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CANADIAN MACHINERY AND MANUFACTURING NEWS

A weekly newspaper covering in a practical manner the mechanical power, foundry and allied fields.
Published by the MacLean Publishing Company, Limited, Toronto, Canada

Vol. XXIII., No. 14. Publication Office: Toronto, April 1, 1920. $3.00 per year Subscription Price

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GEARS

CUT GEARS

We're here to work for you
Write or Wire us

The Hamilton Gear & Machine Co.

Van Horne Street TORONTO

You can't help noticing the good qualities of

Pratt & Whitney Taps

Their free-cutting qualities, their extreme accuracy and their extraordinary ability to outlive others distinguish them.

The con-eccentric relief — a distinctive P & W feature — is the secret of their goodness. One-third of the cutting edge is concentric. The remaining two-thirds has eccentric relief. Taps can be sharpened at the only correct point — on the face of the cutting edge. Sharpening in no way affects their size.

Yes, they cost a little more than some others, but they're well worth the difference. Carried in stock as are all other P & W Small Tools at our sales offices and agencies as listed.

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PRATT & WHITNEY

The BERTRAM Page

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Canadian Machinery and Manufacturing News April 1st, 1920. Vol. 23, No. 14. Published weekly at 143-153 University Ave., Toronto, Canada. Subscription price in Canada $3; United States $3.50. Entered as second-class matter at the Post Office Department Ottawa, Canada. Entered as second-class matter July 1, 1912, at the Post Office at Buffalo, under the Act of March 3rd, 1879.

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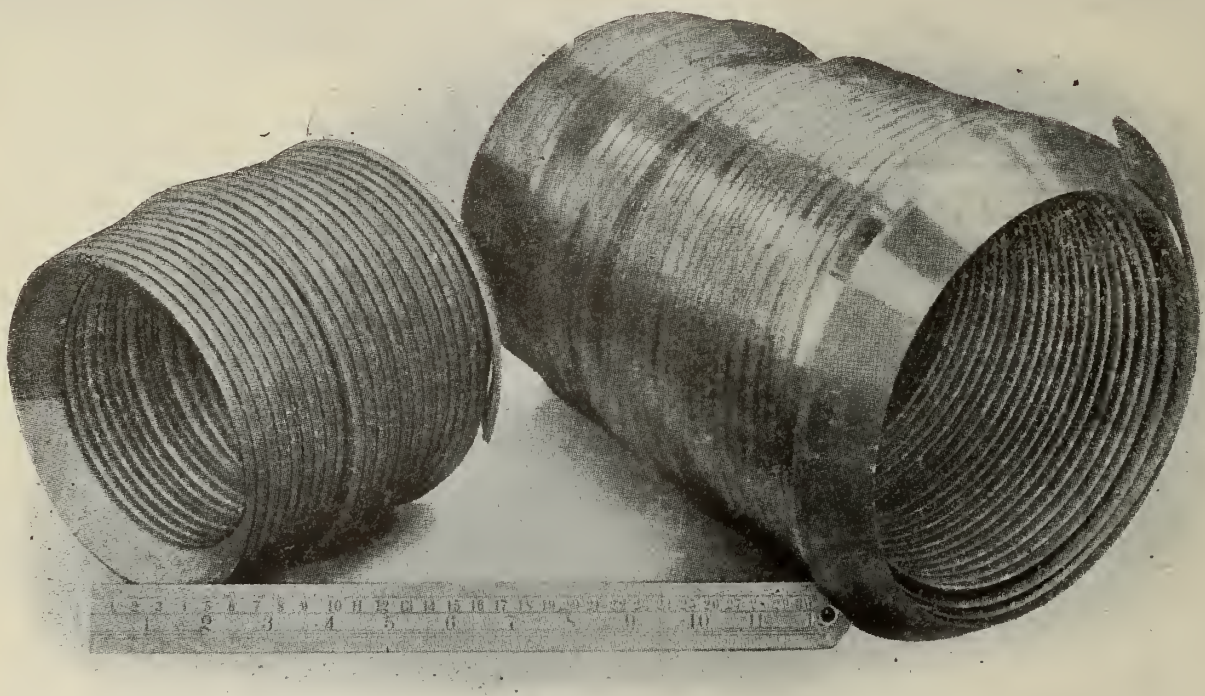
HIGH SPEED STEEL



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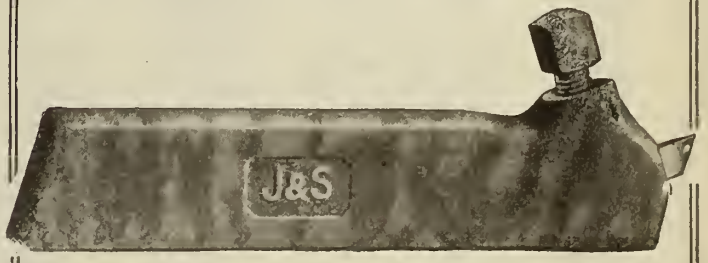
ENGLAND produces "better tools" than any land under the Sun, but she has been slow to advertise the fact. In this new era when every thinking man recognizes the immense advantages of increased business between the Home Country and her great Dominions across the seas, we think it well worth while to draw the attention of tool users to our line of Drop-forged and other Tools for Engineers and Machinists and invite practical comparison with similar tools produced by any other maker.

For this purpose we are opening up an office and stores in Toronto and supplies of these tools (made in our own works in Leicester, England), will shortly be obtainable through the usual dealers.

We shall also endeavour to illustrate from time to time in these columns some of the advantages of British-made **"Better Tools."**



(Catalogues on request)

By courtesy of the publishers of "Canadian Machinery," enquiries may be sent to our representative, Mr. T. E. Hewitt, c/o the MacLean Publishing Co., Ltd., Toronto, until our office address in Toronto is arranged.

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All of these steels are supplied in

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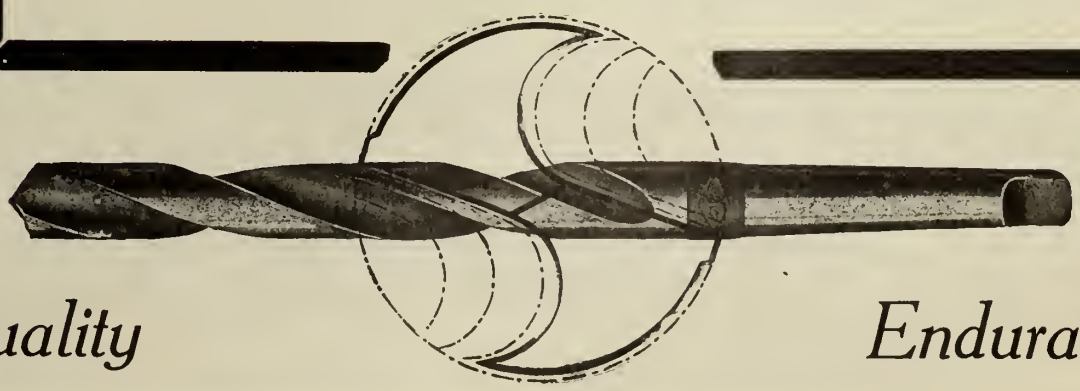

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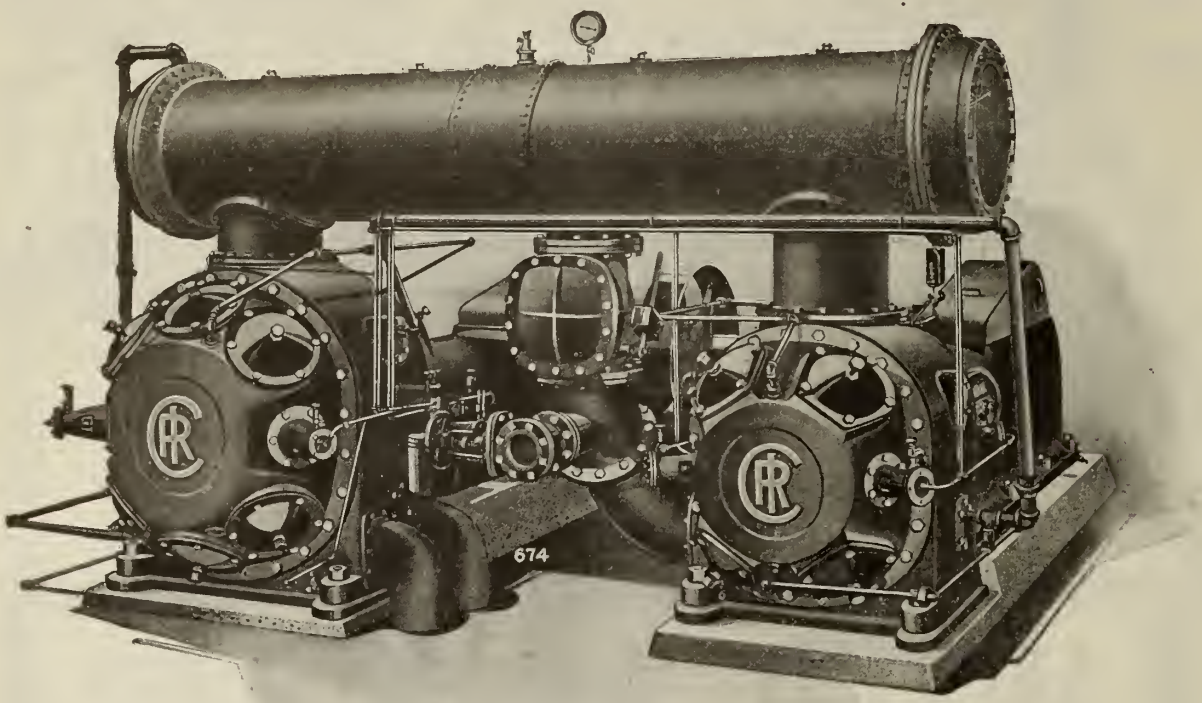
DEPENDABILITY



TO maintain production at its highest point the modern industrial plant must operate each unit of its mechanical equipment without interruptions. For this reason experts are employed to select the type of machinery which will give the most dependable service for the least cost.

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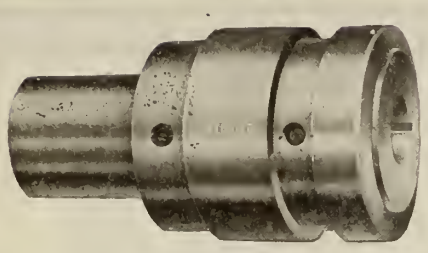

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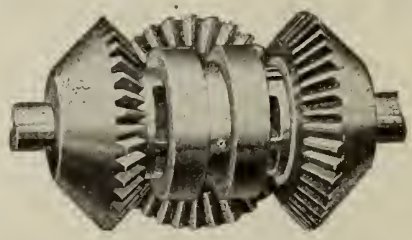
The Johnson Clutch is made in eight sizes, from ½ to 4 H.P. per 100 R.P.M. For overhead transmission it offers a compact clutch of excellent quality, perfectly balanced for any speed. No other type is so readily adaptable to special conditions. The Johnson Clutch in special designs is serving on all types of machinery. Our booklet, "Clutches as Applied to Machine Building," shows many of its possibilities.

Write for our Yellow Catalog.

Better Clutch Service
And More Of It

There is one big reason for the wide adoption of the Johnson Clutch—that is, its record of dependable service. Other features recommend it for many situations. In compactness, simplicity and adaptability it is unequalled. But what appeals to its users more than anything else is its superior durability.



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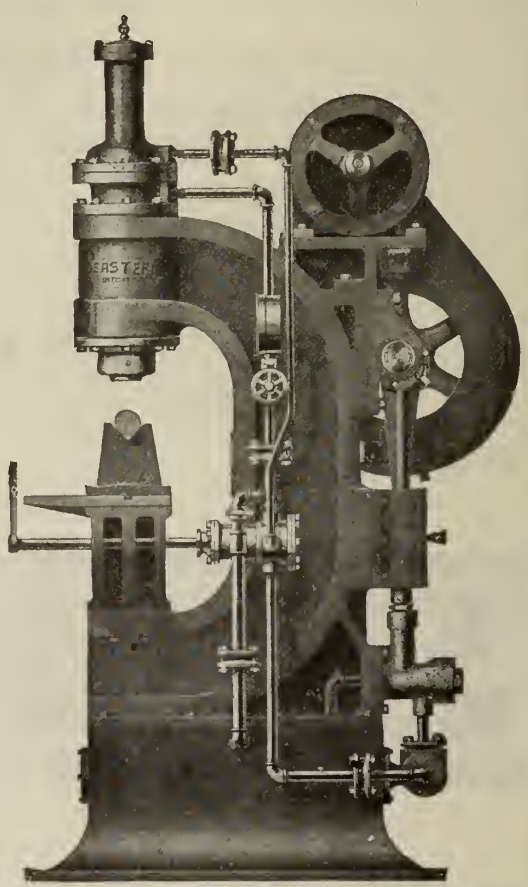

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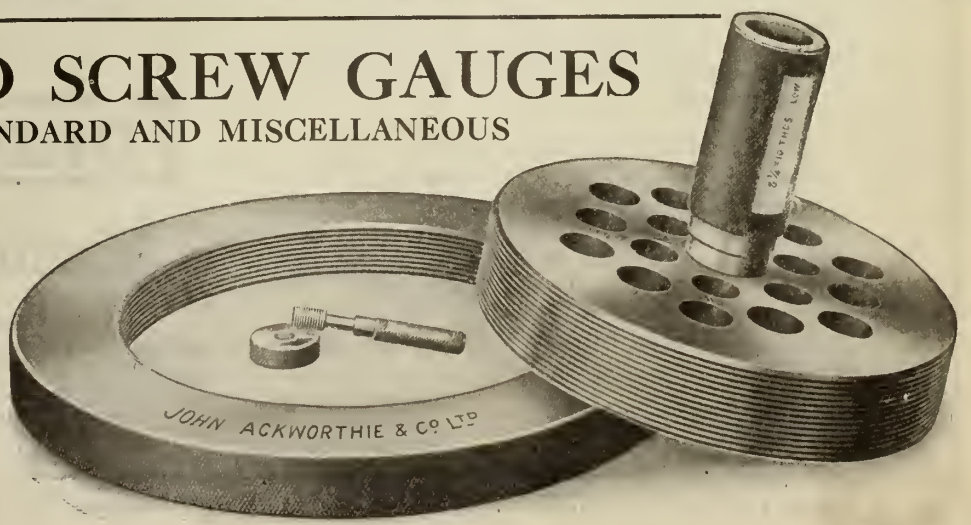

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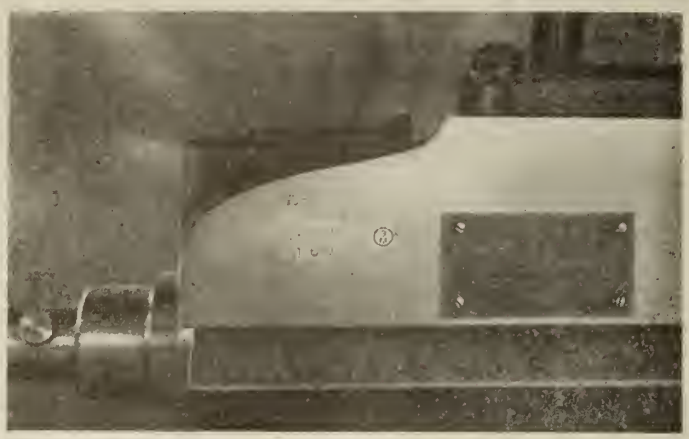

--worth looking for

THIS inconspicuous mark is stamped on the Ford-Smith Miller by the inspector—but only after the machine has successfully passed every one of the exacting tests imposed by an elaborate testing system.

The cut shows one test—for the alignment of the knee. There are many others covering every detail of the construction. Each of these tests is hard. Each is passed only as the result of painstaking care on the part of a skilled mechanic. And these unobtrusive letters cannot appear upon the Ford-Smith Miller until **all** of the tests are passed.

That's why the mark is worth looking for. It's a hallmark of quality. It's your guarantee that the Miller is as accurately and honestly constructed as human hands can make it.

We shall be glad to supply any information on the Ford-Smith Miller.

The FORD-SMITH Machine Co., Ltd.

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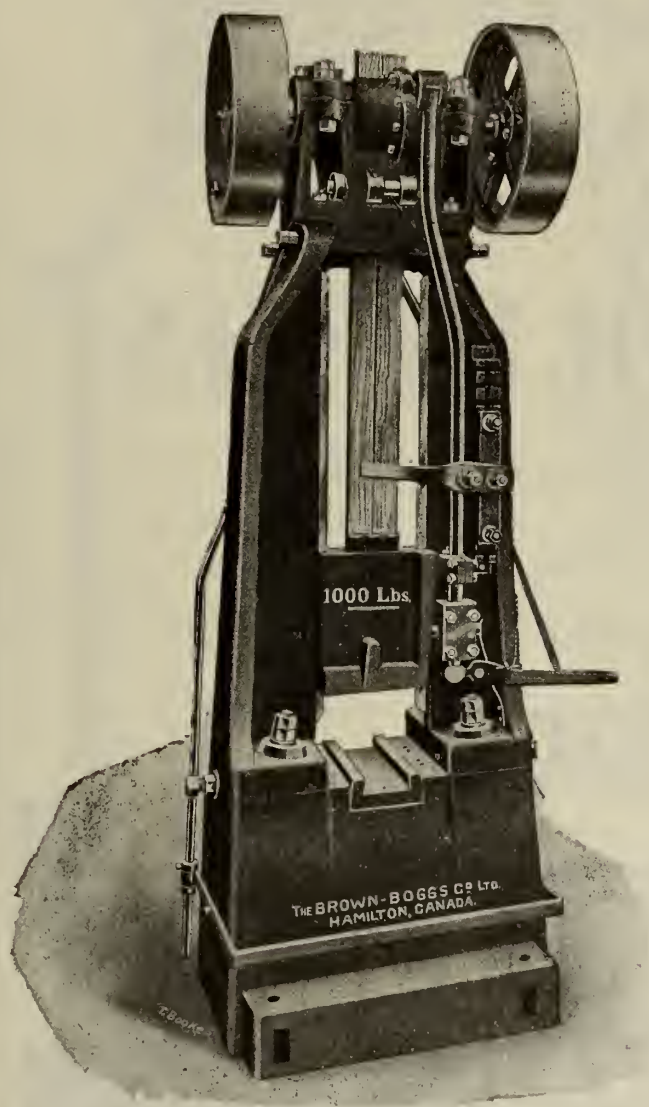
"BB" DROP HAMMERS



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Our latest type of hammers have exclusive features that add greatly to the life of the hammer as well as increasing the production.

The old-fashioned, noisy gears have been eliminated entirely, the hammer being lifted by friction exerted by a powerful eccentric motion under perfect control of the operator at all times.

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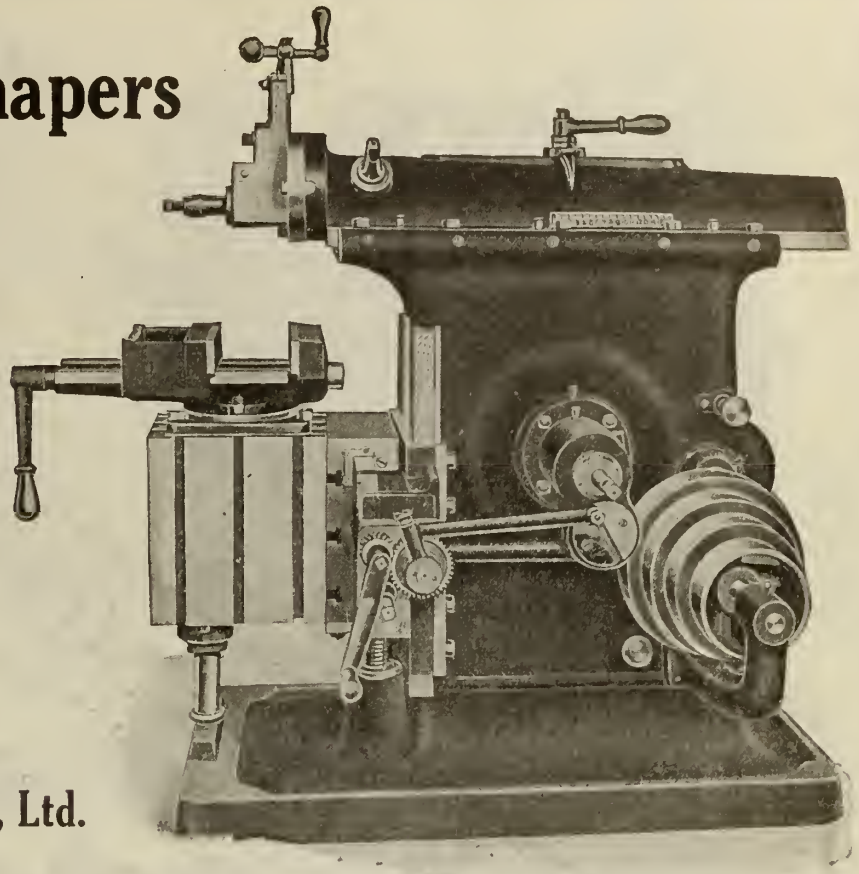
Designed throughout, down to the last detail for strength and durability. Metal is used unsparingly in the section where rigidity is essential.

An unusually useful machine, with a carefully graded range of speeds and a convenience of adjustment and operation which adapt it to a wide variety of work.

We shall be able to describe this interesting tool in detail if you write to us.



Rae Machine Tool Works, Ltd.
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Crucible
AND
Open Hearth Steel
Tool Steel
"ARGO" BRAND *HIGH-SPEED* STEEL

The John Illingworth Steel Co.
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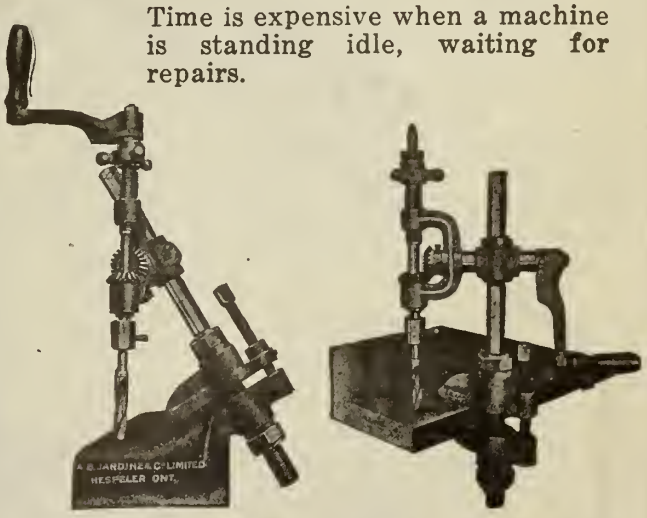
Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.



On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

Weight, 40 lbs. Price, $26.50 net.
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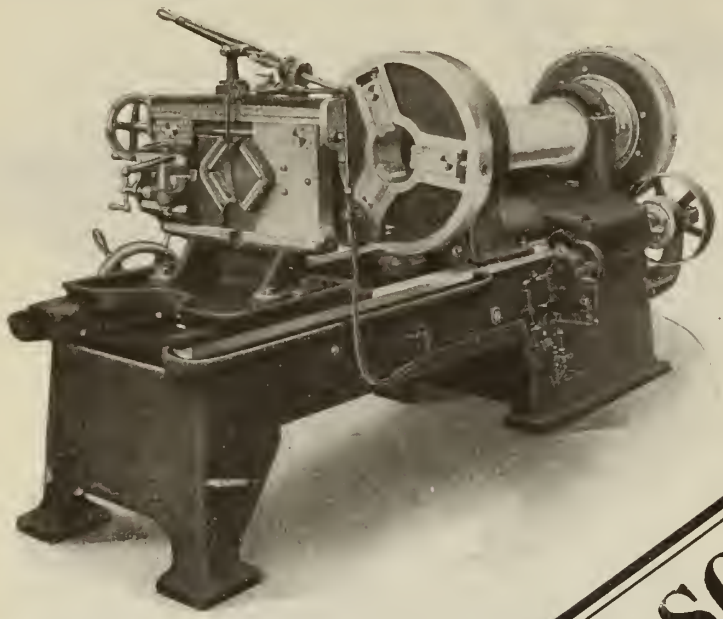

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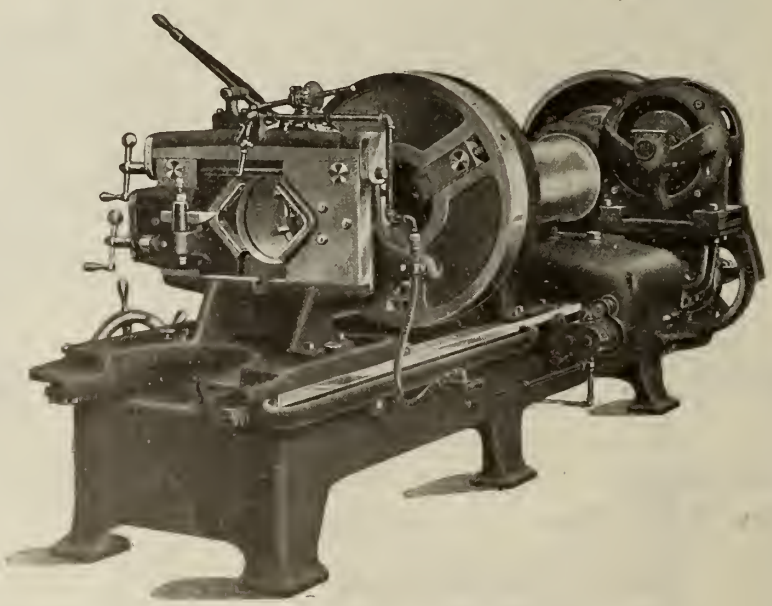

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Write for new
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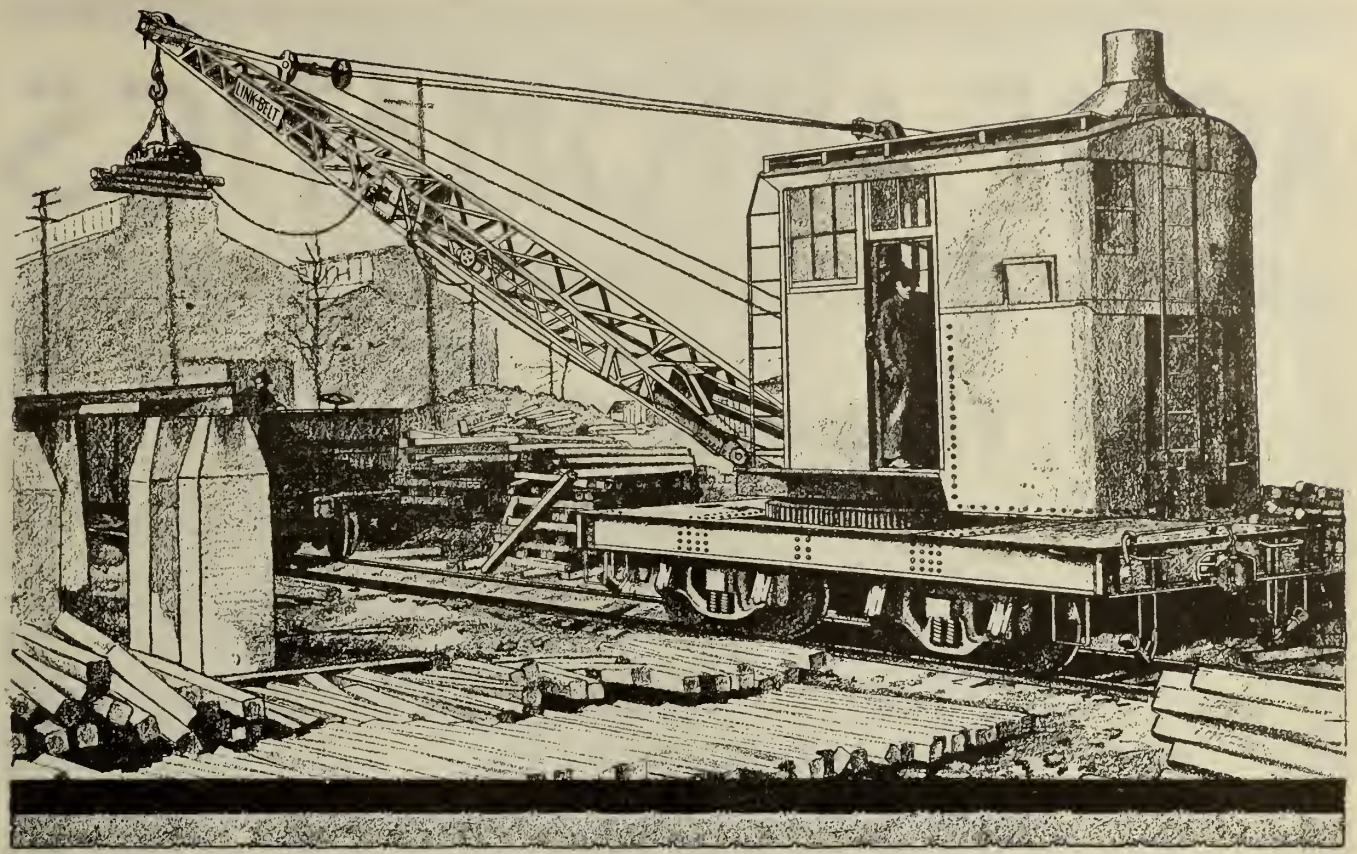

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IT does not pay to employ hand labor today to move any materials that can be handled by machinery. That is one good reason why you should use a Link-Belt Locomotive Crane.

The Link-Belt Locomotive Crane can do the work of from ten to thirty men. It can work long hours and will not go out on strike. It wants work—and lots of it.

It is a modern necessity wherever heavy materials must be handled with ease and dispatch. One man operates it and does practically all the work.

For handling heavy materials; for storing coal; for storing and rehandling anything, or switching cars, the Link-Belt Locomotive Crane is a useful and profitable machine around the yard. When not in use for the specific purposes for which it is purchased you will find there is always some other profitable work for such a machine to do.

And remember this, a Link-Belt Crane will be on the job every day—no layoffs, strikes, or demands for higher wages. Our Crane is "Built for Service", and you can always depend upon it.

Write for a copy of our Book No. 370.

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Locomotive Cranes

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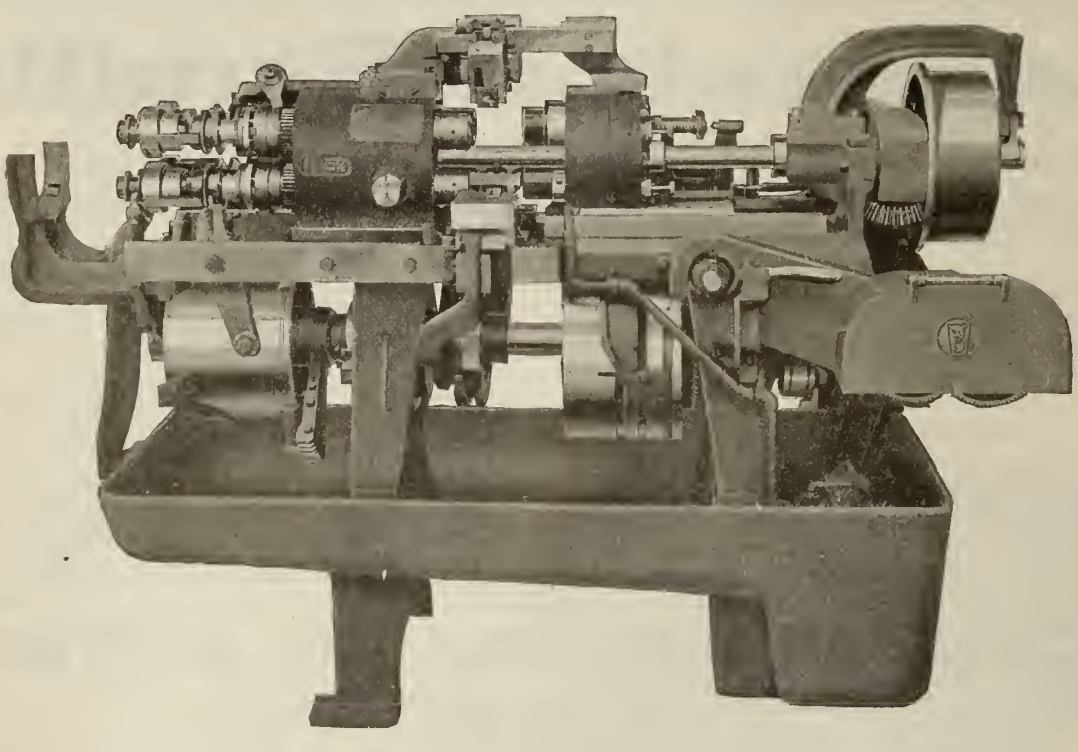
Is There a Question

in your mind as to your methods of screw machine production?

Are you seeking speedier—yet compact—processes of duplicate part manufacture?

We merely suggest innumerable practicabilities afforded in ACME MULTIPLE SPINDLE AUTOMATIC methods.

At least, send for a catalog



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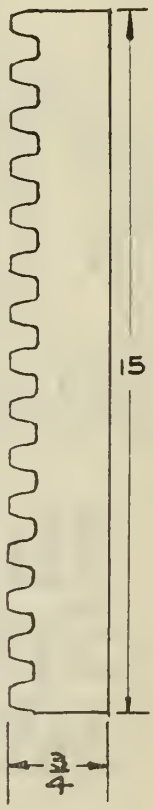

Production Milling

The illustration herewith shows the method employed for cutting of racks on a Potter & Johnston Automatic Milling Machine.

Two pieces are held in each fixture and the operation is carried out as follows:—

Pieces are placed in fixture and the teeth are cut for half the length of the rack, the table then revolves to the loading position and while the cutter is working on the racks just placed in the fixture, the operator is reversing the pieces in the other fixture ready to complete the rack, when the table revolves to its next station.

Compare this with your method.

Canadian Office: POTTER AND JOHNSTON MACHINE CO.

ROELOFSON MACHINE & TOOL CO., LIMITED

Head Office: 1501 Royal Bank Building, Toronto, Canada

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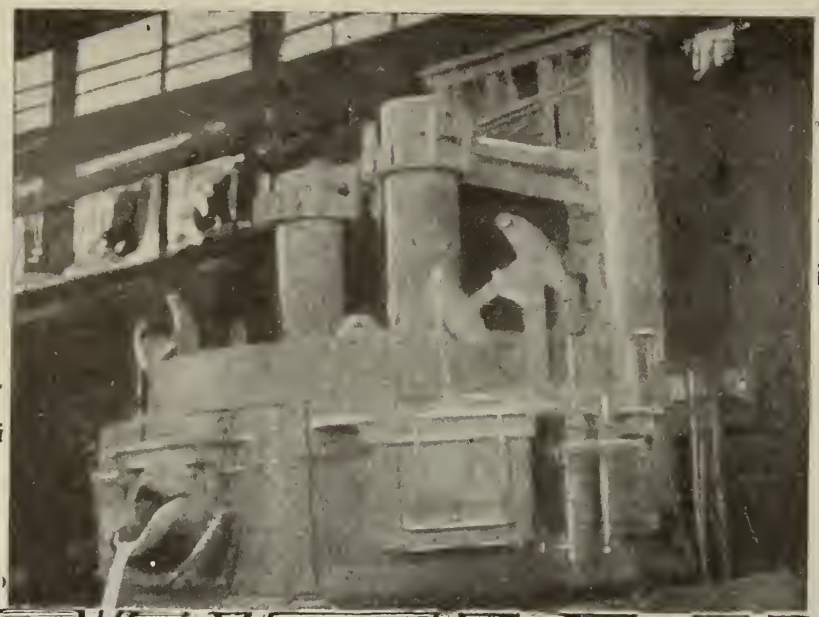

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High Speed Steel

SEVERAL factors combine to make this high-speed steel a triumph of the steel-maker's art; Electric Furnaces — entirely infallible, automatically regulated, delivering the same result time after time.

Uranium — This rare element, cousin to Radium, effects a profound change in the texture and quality of the steel.

Added to these, the constant care and skill of years of steel-making experience make the result of each melt a foregone conclusion.

Latrobe Electric Steel Co.
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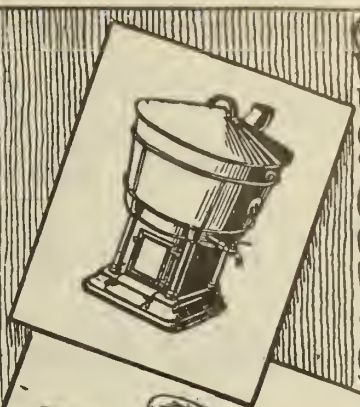

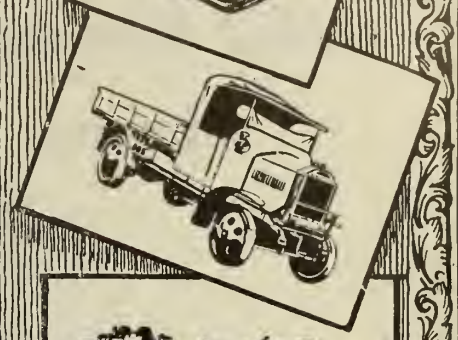

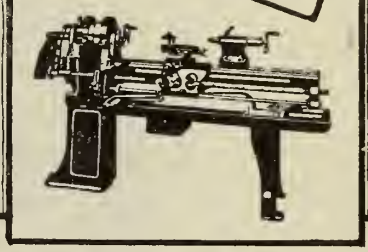

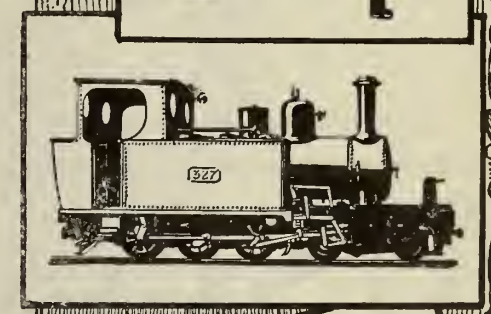

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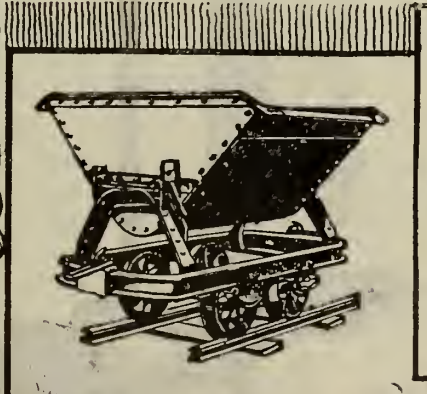

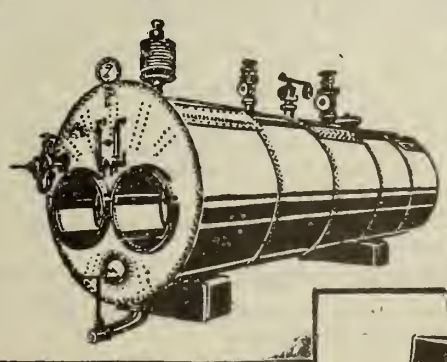

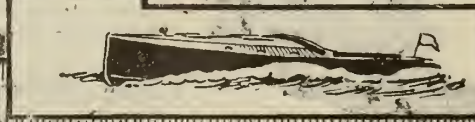

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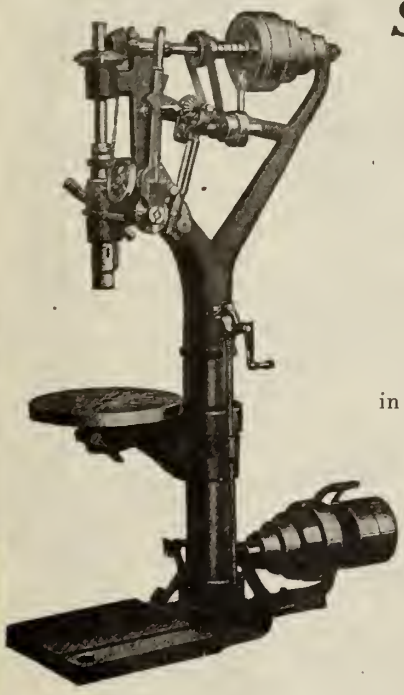
Dominion Foundries and Steel Limited

Hamilton Ontario

Silver Drills



Simplicity, Convenience and Strength mark every feature

—and these factors are essential in a drill intended for economical work, for the speedy production of high grade parts where accuracy and finish are important. Silver Drills rigidly retain their accuracy under the heaviest and fastest work. The result is fewer rejects and broken tools.

—20-in. drills in four styles—plain lever feed, lever and wheel feed, power feed, automatic stop, back gearing. Singly, or in gangs of 2, 3 or 4.

—25-in. drills with eight spindle speeds and six positive geared feeds.

—Compact, Efficient, Economical.

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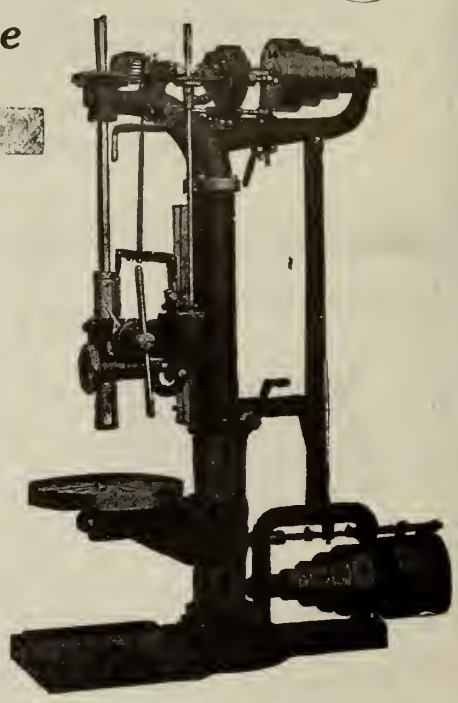

The Silver Mfg. Co.
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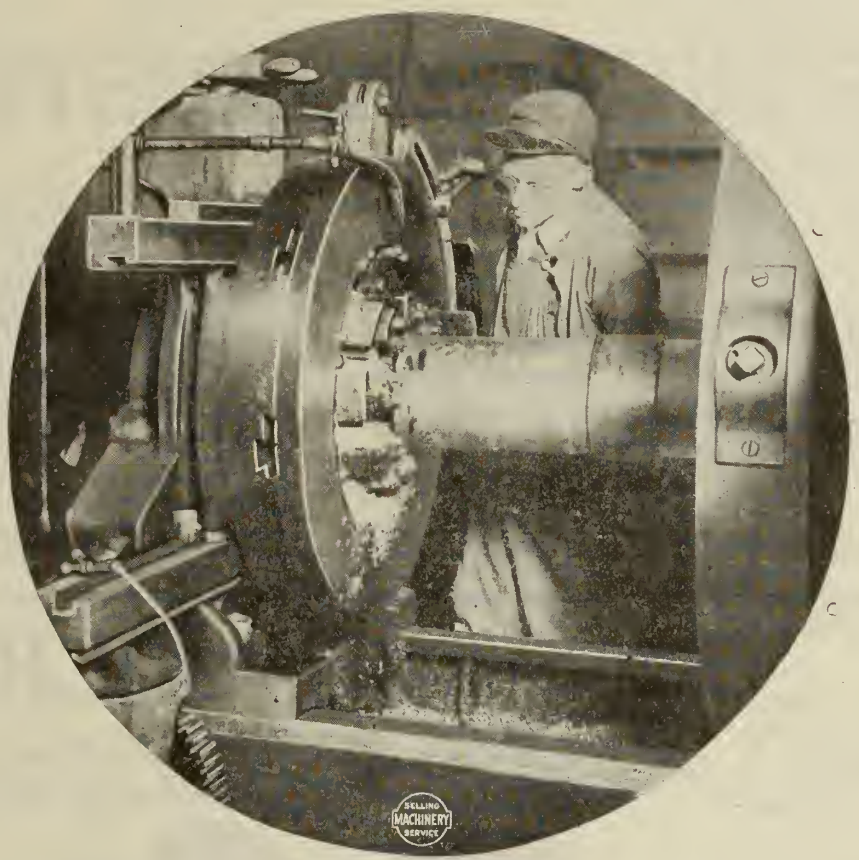
Manufacturers also of the Silver Radials

LANDIS PIPE CHASERS WEAR WELL

THIS JOB PROVES IT



LANDIS PIPE THREADING MACHINES used in this plant thread pipes of all kinds (mostly steel, with a hard, scaly surface) and of all sizes from 8 in. to 16 in. diameter.

¶ A job such as is shown imposes considerable strain on the chasers of the Landis Die Head with which the machine is equipped, yet they stand up in a manner that is truly remarkable.

¶ Frequent changes of size are required — only a moment's work is required to change for different sizes of pipe, due to the fact that the entire range of each head is covered by but one set of chasers. The only operation necessary is to open or close the die head for the desired diameter.

There are no threading problems when equipment is "Landis."
Let us go into the matter further. Write us.

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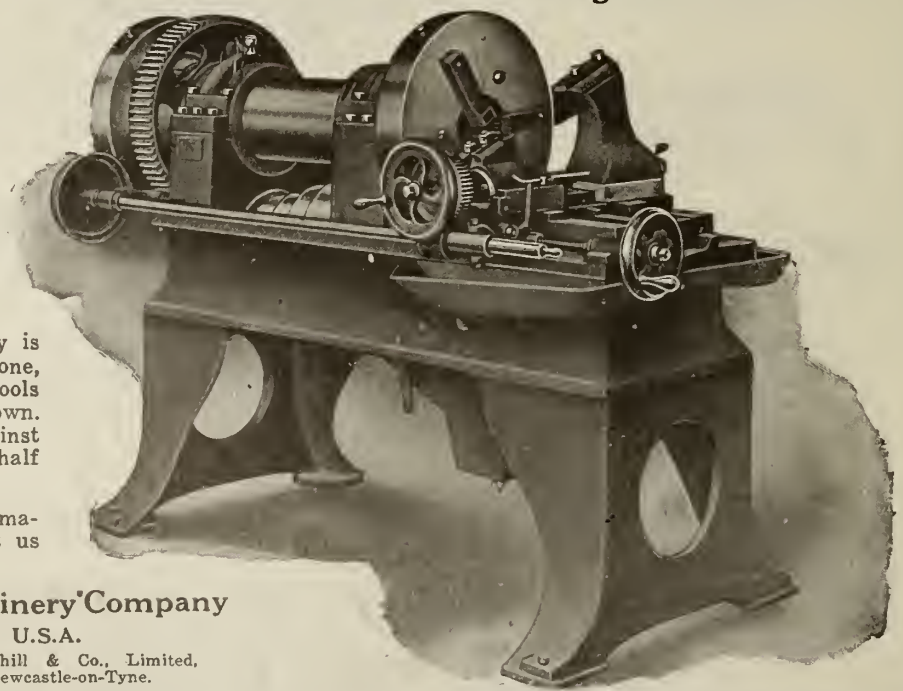

TO say that the Hurlbut, Rogers Cutting-Off and Centering Machine will **double your production** and **cut your costs in half** may seem like a broad claim. But this is just what this machine will do compared with any ordinary machine of its kind.

Hurlbut, Rogers speed and efficiency is easily explained. Instead of only one, it is equipped with two cutting-off tools —one cutting up and the other down. In this way they hold the work against each other and finish a job in just half the time and do twice the work.

You can't afford to be without this machine. It saves real money. Let us tell you more about it. Write!

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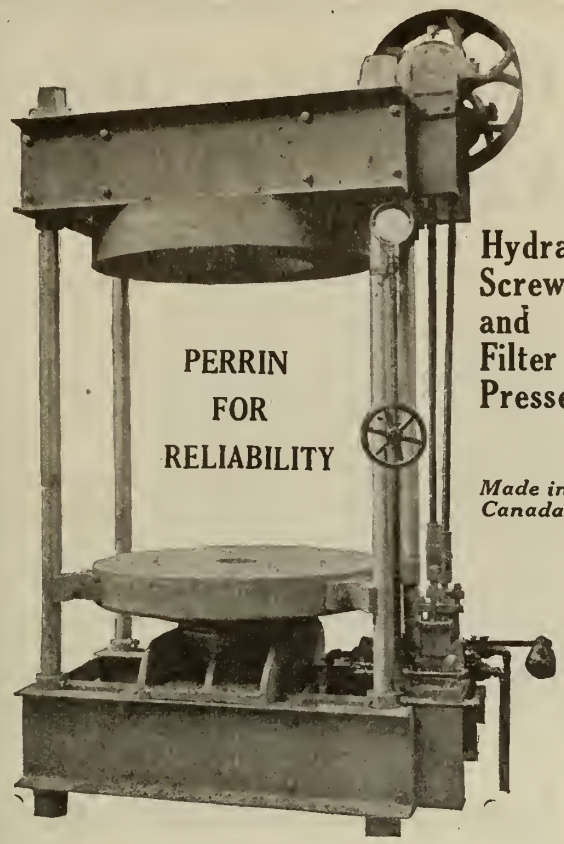

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The Greenfield is equipped with all attachments for the grinding of milling cutters, reamers, taps, lathe centres, etc., and capable of handling all this work with the accuracy and convenience essential in the modern tool room.

The Greenfield is a simple necessity in the tool room for routine grinding work, but has a versatility outside this line that is astonishing. It is truly universal and handles all varieties of cylindrical, internal and surface grinding within its capacity with a consistent accuracy and finish that adapts it to the making of intricate jigs and gauges.

Greenfield Machine Co.
GREENFIELD, MASS., U. S. A.

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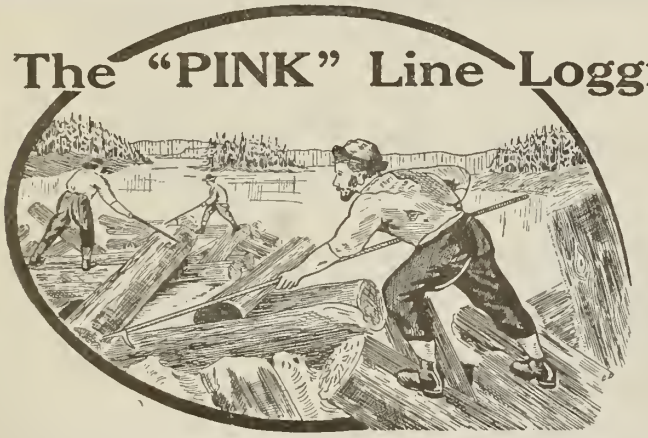

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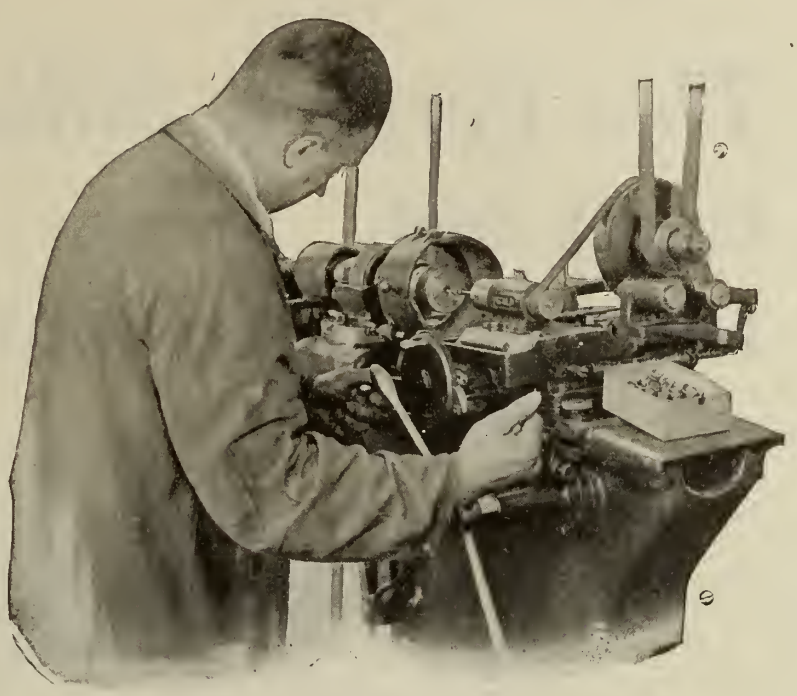

No. 1

The hole in the ball race as shown above was ¾ in. diameter by ½ in. long. It made an ideal job for the Heald Style No. 85, which handles work ¼ in. to 2 in. diameter by 2½ in. long.

Grinding Ball Races

The above photograph shows the Heald No. 85 grinding a small chrome steel ball race. Notice the simplicity of the chucking operation. The ball race was placed in a draw-in collet, the lever thrown to the left, securely holding the work. Removing it was even simpler. The pilot wheel was turned to the right, drawing the wheel from the hole, the work head automatically stopped, water was shut off and by operating the collet lever to the right, the work was released, fairly jumping into the operator's hand.

Other features are a positive stop accurately governing the travel of the table, flexible wheel head idler, automatic wheel guard, water attachments, and simple single countershaft.

May we send you literature on this or our larger internal grinders?

THE HEALD MACHINE CO.

Worcester, Mass.

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Milling Machines
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Die Slotters
Screw Slotters
Tapping Machines
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Gang Drill Presses
4-Head Right Angle Drills
Screw Machines
Cutter Grinders
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Surface Grinders
Duplex Slot Millers
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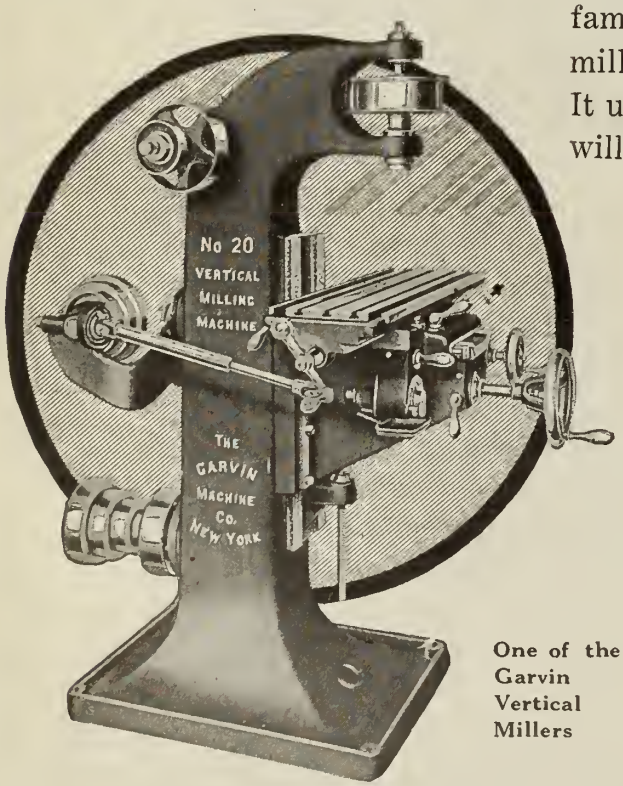
This Vertical Miller turns out finely finished work

It cannot vibrate. Hence, the cutters mill a perfect surface.

A Garvin Vertical Miller has decided advantages for certain kinds of work. Without sacrificing any of the rigidity for which Garvin Horizontal Millers are famous, this machine affords greater convenience for face milling, spotting off bosses, milling out recesses, etc. It uses mostly butt and face mills as this style of cutter will produce a better finish and do it faster than any other. The rotary table makes it an easy matter to finish circular slots and edges and like circular milling work.



One of the Garvin Vertical Millers

If you have work for which a machine of this kind is adapted, you will want to investigate the other desirable features of these machines.

Let the description in the 340-page Garvin catalogue explain why you should be using Garvin Vertical Milling Machines.

The Garvin Machine Company
Spring and Varick Streets
New York, N. Y., U.S.A.

G 27

GARVIN

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If you use Starrett Blades in a Starrett Frame, you're a long way toward economical, easy cutting. The rest depends upon the way you use the saw.

Long, even strokes, not more than 50 to the minute, a little lift on the return stroke, to keep the teeth from dragging and wearing without cutting—and the proper blade for the metal you are cutting—is about all there is to doing good work when you use Starrett Hack Saws.

One of the biggest helps to better hack saw work is the Starrett Hack Saw Chart. Write for a copy and ask for Catalog No. 21"3" also. Both are free.

THE L. S. STARRETT CO.

The World's Greatest Toolmakers
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Starrett Hack Saws

STARRETT HACK SAWS CUT QUICKER LAST LONGER

STARRETT TOOLS

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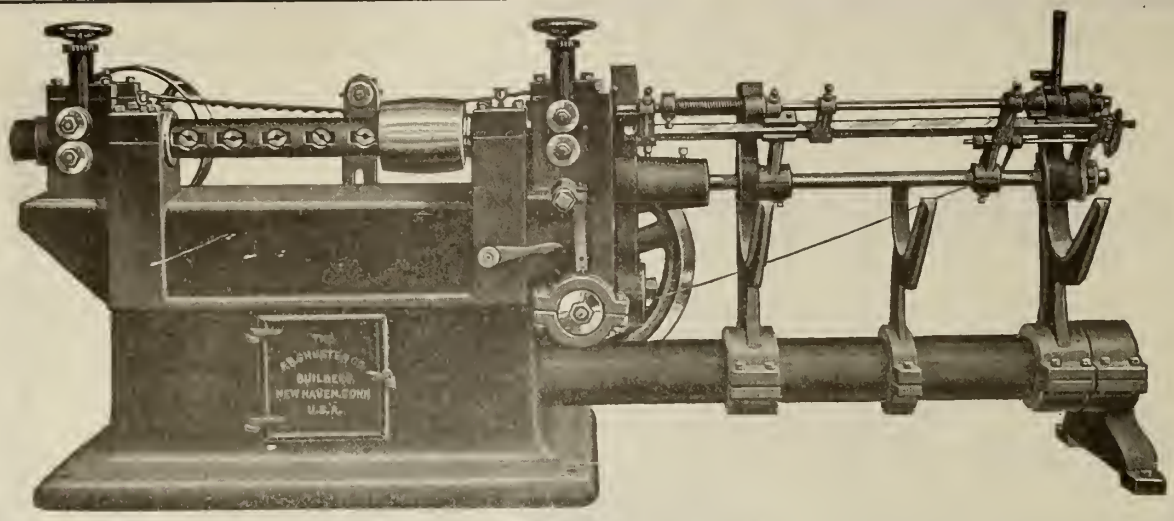

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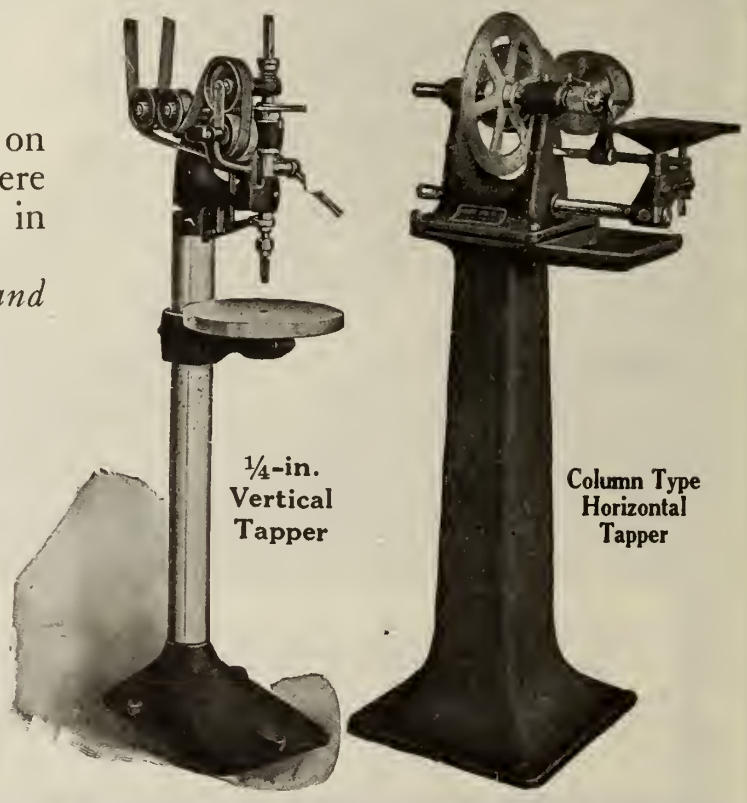

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Column Type Horizontal Tapper

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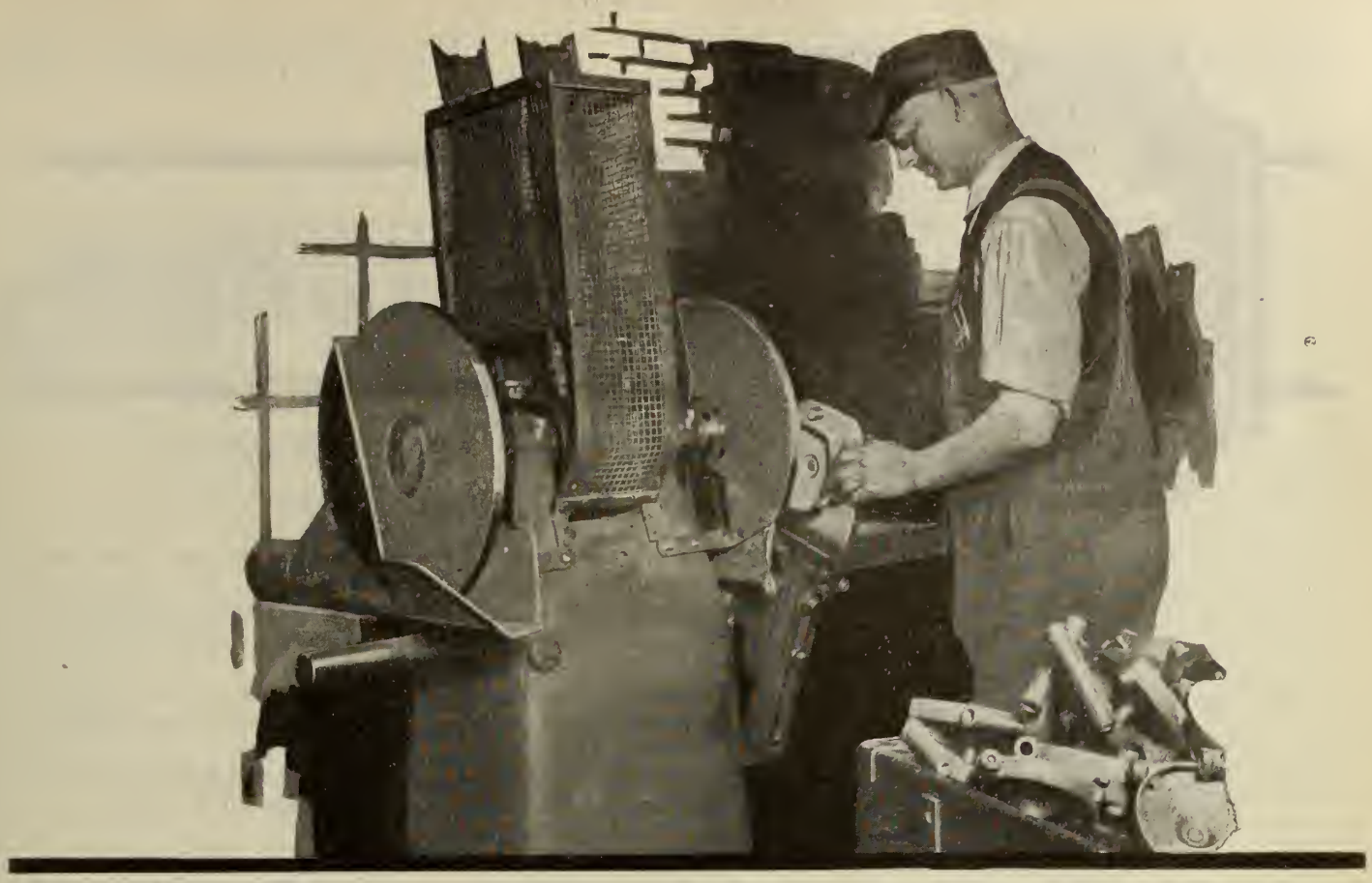

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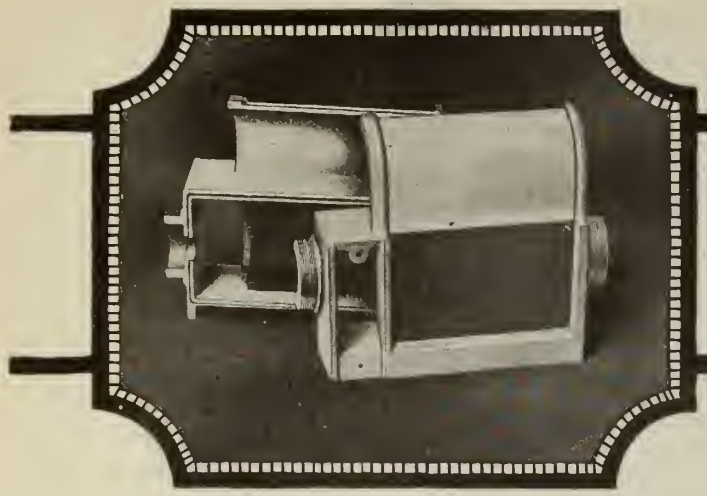

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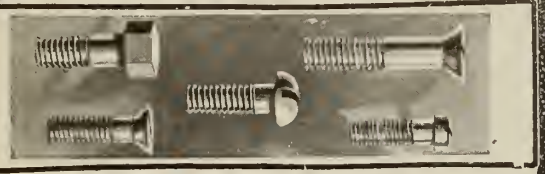

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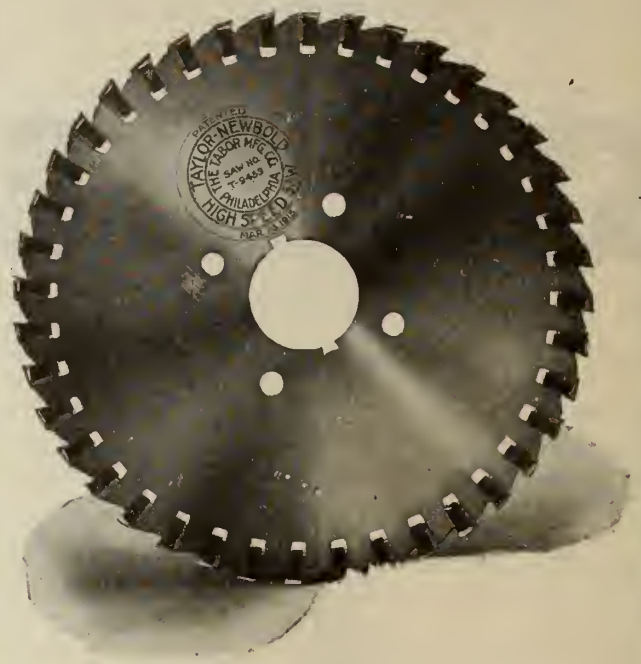

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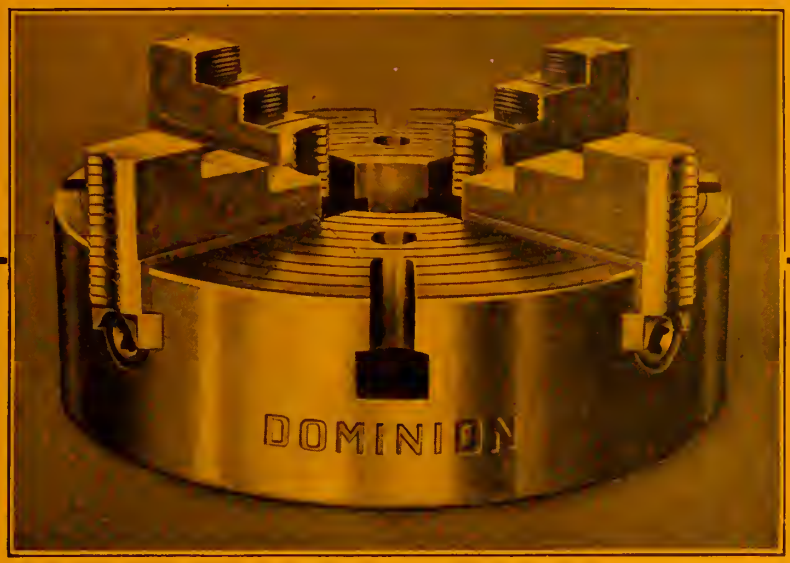

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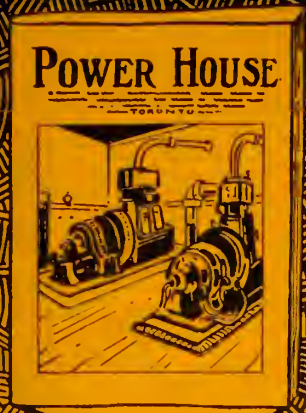

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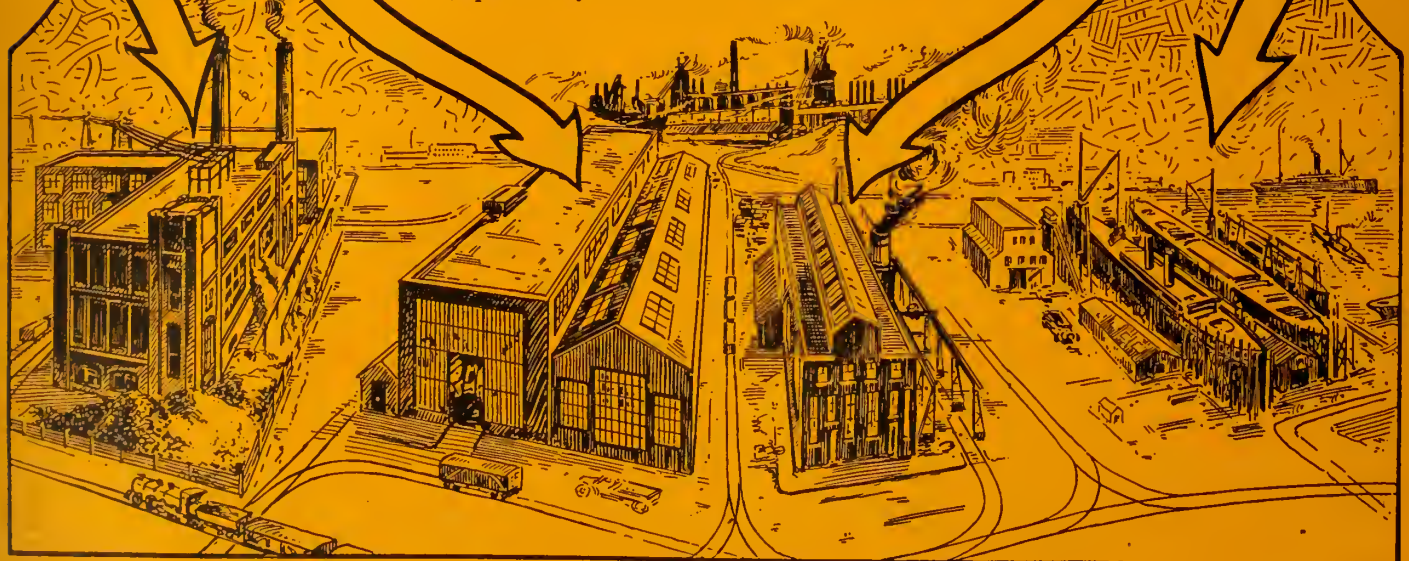

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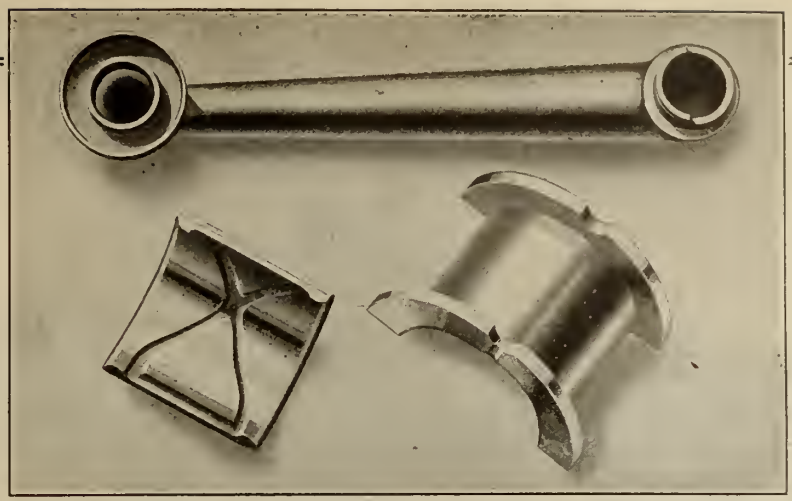

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BEND PIPE COLD

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"Wonder" Pipe and Tube Bending Machines (pat.) electrically operated to bend from 1" to 8".

We also manufacture 10 other sizes

Hand operated to bend from ⅛" to 6".

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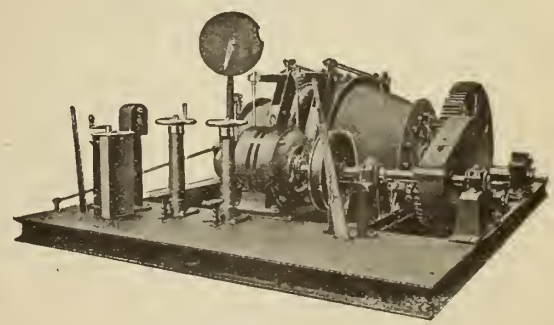

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There is a limit to every man's ability to lift and effectively handle material. And in the case of steel, iron and similar heavy materials this capacity is necessarily small. For work of this kind, many firms have found a Brownhoist locomotive crane to be the cheapest and most reliable kind of handling equipment. A crane similar to the above is a great time and labor saver and, properly equipped, is adaptable to almost every kind of plant or yard where there is handling to be done.

You may feel that this is not the proper crane to fit your needs and this may be so. However, as builders of many kinds of hoisting equipment, from the smallest trolleys to the enormous fast-plant unloaders, we are particularly well fitted to study your handling problem from your viewpoint. We will simply apply our long experience to your new need and then suggest the best equipment for you. If you have any handling requirements or questions, we will gladly talk them over with you.

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Products include

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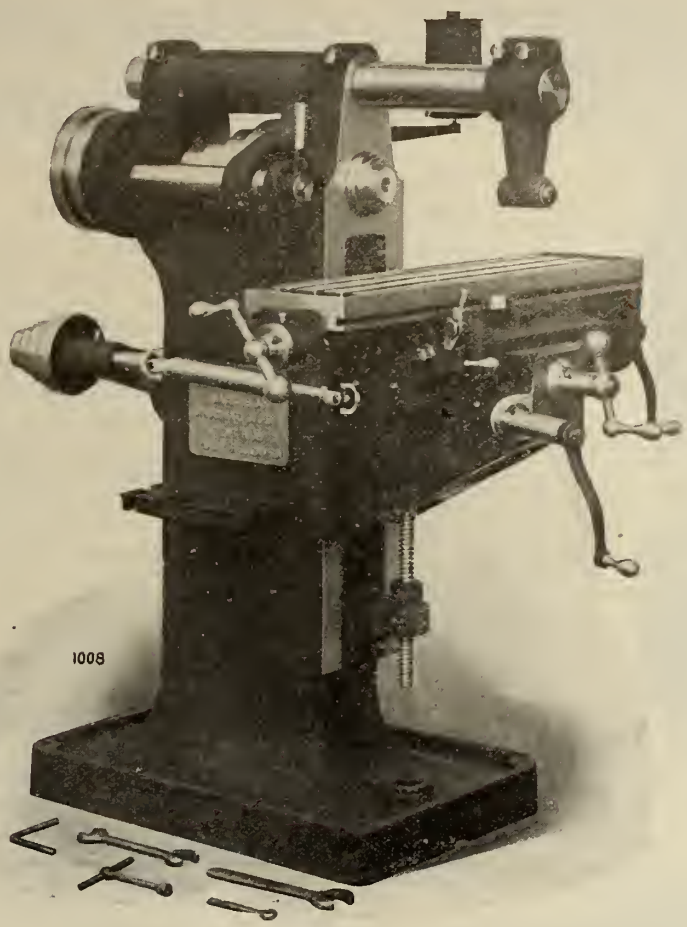

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The same painstaking workmanship
The same complete jigging and tooling
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Screw Feed
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Crank Handles for all movements
Wide speed range—21 to 500 r.p.m.
Power longitudinal feed
Range—18" x 6" x 15"

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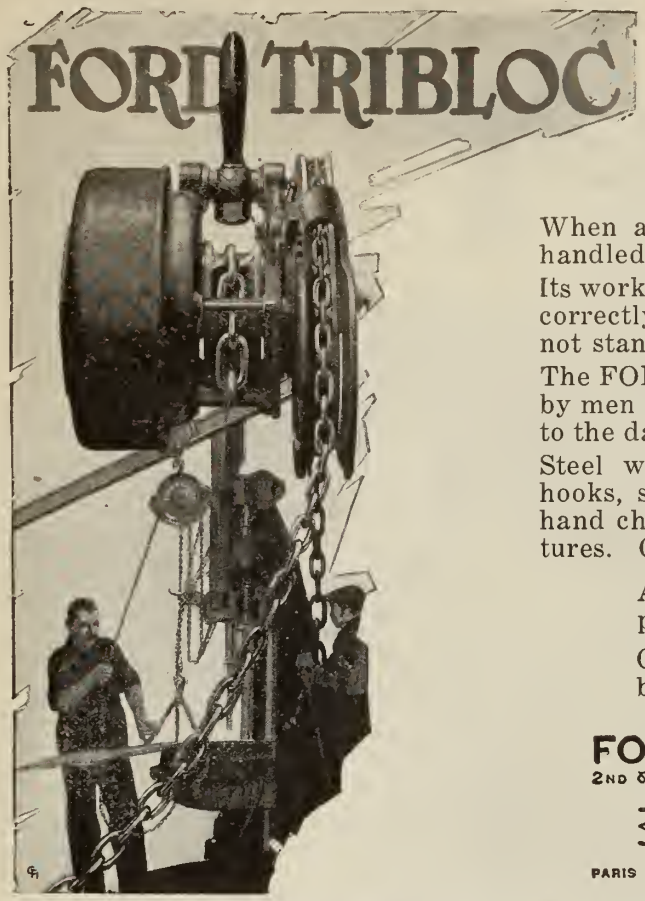

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The FORD TRIBLOC is built for "roughing it." Made by men who know what a hoist must do, it stands up to the daily grind without care or attention.

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A 5-year guarantee **in writing** is **your** protection.

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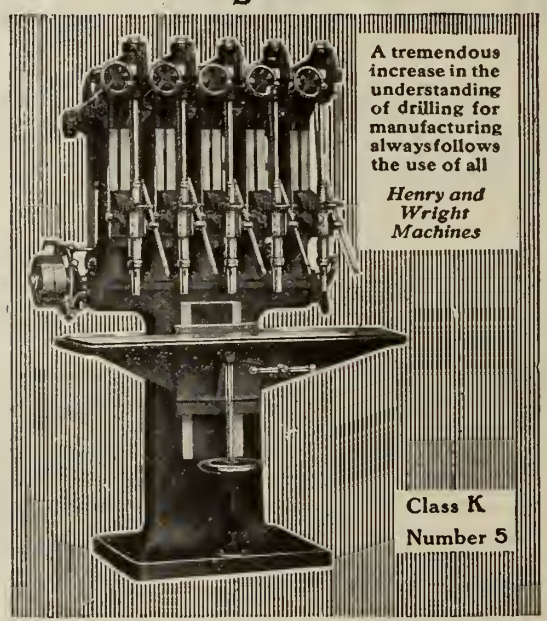
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Fusibility of Alloys

Of the many correlative sides of equal importance to a babbitt metal discussion, it is difficult to fix upon any choice in the order of precedence, but we shall first discuss the fusibility of Alloys.

When the tin supply became scarce, because of the war, the Bureau of Investigation and Research of the War Industries Board, of the United States Government, made inquiries as to the best babbitt formulas containing reduced percentages of tin which could be used as substitutes for Genuine Babbitt, and they specifically asked our opinion concerning a mixture containing 50 per cent. tin.

In response we expressed the opinion that only two babbitt compositions were seriously worth considering—one a strictly tin base (Genuine) babbitt; the other a strictly lead base babbitt containing a comparatively small quantity of tin.

We gave as our reason for this seemingly revolutionary advice the extreme low fusibility of all intermediate grades of babbitts, whatever their composition, which makes them highly susceptible to the influence of frictional or initial heat and limits their usefulness to the nature of conditions under which they are used.

We recommended that tin could best be conserved by confining the use of Genuine Babbitt to thin shell bearings, which, by reason of the loose play and pounding made malleability of prime importance. For all other bearings where the lining was secured by recesses or soldered, or well seated, we recommended a well balanced, properly made lead base metal, maintaining that it would wear longer, run cooler and give the most economical service.

Continued next month.

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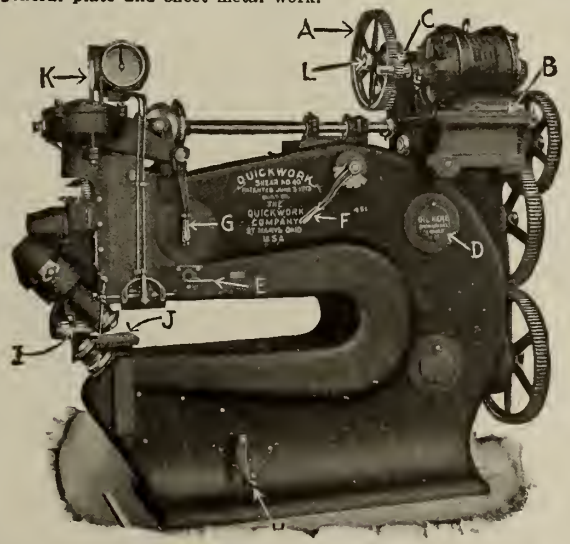

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We can supply forgings of all shapes and sizes made of ordinary or "HARMET" Fluid Compressed Open-Hearth Steel on the Shortest Notice.

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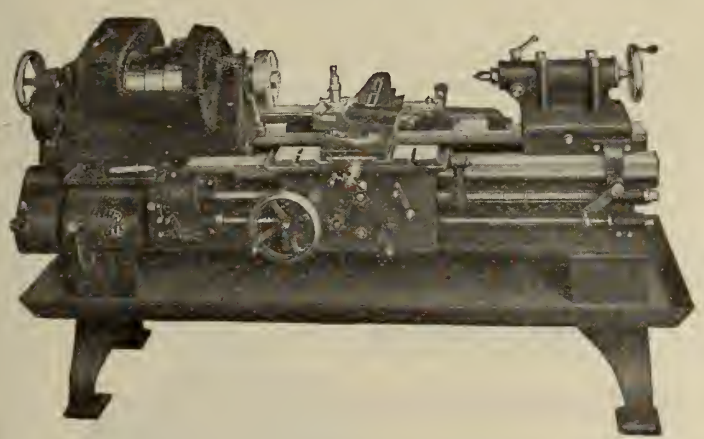

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Because they are constructed "right" of the best material, workmanship and design, and therefore are adaptable to all conditions, whether it be work requiring accuracy to the highest standards or for the heavy duty where power, strength and rigidity are required.

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We know you are interested, so don't put off writing us. Do it to-day. Now!

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BELTING—For power transmission, conveyor, and elevator service. Bucket belts, Vanner belts, belts for brick-making machinery, lumbering, and all exposed or outside work.

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Industry Unites in Endorsing the "Clipper"

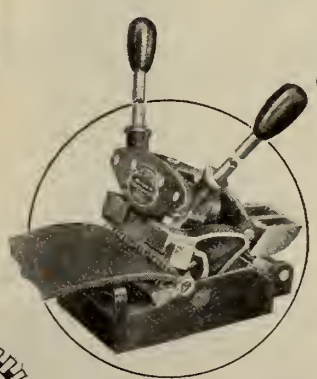
IT HAS taken more than human brawn and thundering machines to attain the staggering production of recent years. Production giants have had to *think* to solve the question of keeping power belts doing continuous duty. They did so by installing "Clipper" Belt Lacing.

The Clipper Belt Lacer
Laces a Belt in Three Minutes

Before the advent of the "Clipper" it took from 15 minutes to half an hour to repair a belt—an unthinkable waste!

More than speed has commended the "Clipper." It makes a hinge-joint that can be depended upon; that is smooth, flush on both sides; that is flexible, hugs the pulley and is safe. That is why Industry has endorsed the "Clipper." The "Clipper" goes to manufacturers for free trial and is perpetually guaranteed.

Sold by mill supply houses everywhere. Correspondence solicited from dealers where we are not now represented.



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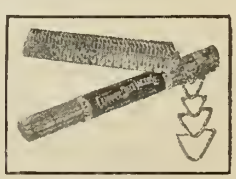
"The Connecting Link
Between Power and Production"



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For chippers, grinders, welders and others.

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One every second is a speed which this Grant Rivet machine will keep up indefinitely, in any degree of tightness or looseness desired. Each rivet is finished with perfectly shaped head, polished and with no hammer marks showing.

We claim this is the only machine manufactured that will accomplish this feat. Our claims are unchallenged. By writing for our catalogues you may obtain full information regarding the ability of this machine.

We are rivet machine specialists. Get in touch with us.

Grant Man'fg. & Machine Company
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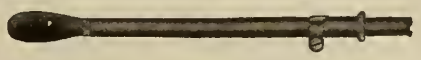
Provide one of these dressers for every wheel in the shop. It's an inexpensive investment which pays well in the efficient grinding by sharp, true wheels. We handle other styles besides the two illustrated, including diamonds.



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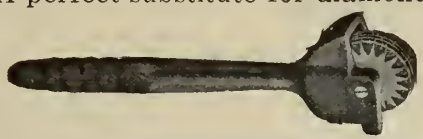
For all ordinary shop wheels.
A perfect substitute for diamond.



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Complete equipment.

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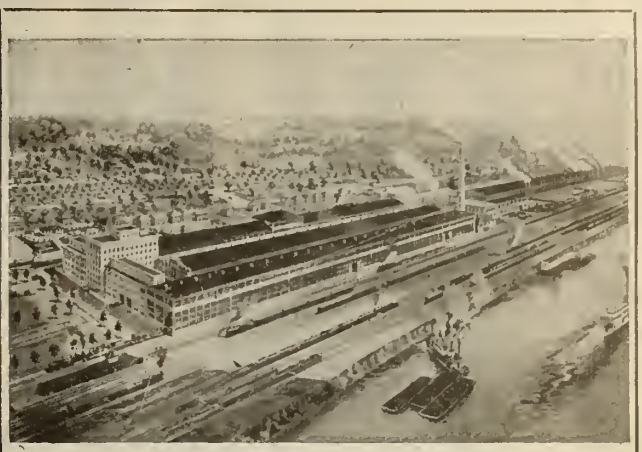

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Built for rapid production on grinding work.

It handles work either singly or in multiples within the capacity of the chuck and not thicker than 6-in., and grinds within quarter thousand in. of manufacturing accuracy.

And it is built to last.

It is provided with exceptionally long bearings throughout, especially in the back column. This prevents the wear, which is very slight, from affecting the accuracy of the grinder. The Back Column is made to swivel four degrees, which allows concave or convex grinding.

Bristol Rotary Surface Grinders are made in several types and sizes and are regularly equipped with 8-in., 12-in., and 16-in. magnetic chucks, either belt or motor driven and for dry or wet grinding.

Our Bulletin describes the many good points fully. Send us your name and address and we'll gladly mail you one.

Grinds within .0004 in. of absolute Accuracy

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SUCCESSORS TO C. G. GARRIGUS MACH. CO.
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Canada's Dependable Machinery and Supply House

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In Toronto alone we possess 75,000 square feet of floor space for the storage of modern machinery. This and the excellence of our buying and selling connections, enables us to handle a contract of any size in the quickest possible time and at most reasonable prices.

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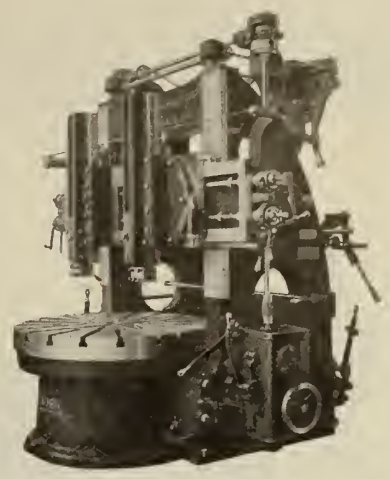

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Made in 5 sizes, from 42 in. to 72 in.

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You are always safe in ordering a Colburn Boring and Turning Mill.

Let us know your requirements.

Prompt service always from Petrie!

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75,000 Square Feet of Floor Space Filled With Up-to-Date Machinery

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1500 GOOD TOOLS

Hack-Saw Blades

GOODELL-PRATT Hack-Saw Blades are made to stand up under severe usage day after day. They are designed to meet actual shop conditions, not freak tests. In the long run they prove the most serviceable and economical.

Goodell-Pratt Hack-Saw Blades do the work they are intended for. If a blade is to saw brass or heavy tubing it is made with that purpose always in mind. There are other blades for every other purpose; for Goodell-Pratt Hack-Saw Blades come in enough different sizes and pitches to allow anyone to select just the right blade for the job.

Just as in every other one of the 1500 Goodell-Pratt Tools, quality is the first consideration. Only the best materials, skilful workmanship and the most approved designing ever enter Goodell-Pratt Tools. Their supremacy is recognized the world over.

Send for a complete pocket catalog of these hack-saw blades and the other 1500 Goodell-Pratt Tools

GOODELL-PRATT COMPANY *Toolsmiths* Greenfield, Mass., U.S.A.

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

"Good workmen know the difference."

This trade-mark is a little thing to look for but a big thing to find.

Fast but Sure!

"'Slow, but sure'—that's our motto, Mason," said Misik. "Our finish is all hand work."

Misik is foreman of the finishing division of the Drawing Instrument department in the Keuffel & Esser Company's factory at Hoboken, N. J., where the world famous K. & E. drawing instruments are made.

Mason, who is a Speed-grits salesman, watched the workmen putting the finish on the fine nickel-silver compasses by hand with strips of emery cloth. Yes, it was slow—and tedious and costly.

"What's wrong with your machines?" he asked finally, pointing to the row of belt-grinders that stood idle along the wall. "Nothing—with the machines," replied Misik. "It's the belts. The 'jump' from the belt-joints in an abrasive belt spoils the finish on our instruments. I've tried a lot of belts but I stick to hand work."

The first thing Mason did when he got back to his office that afternoon (August of last year) was to send Misik several samples of the new Speed-grits Uniflow Belt. Then several days later, he went back to the K. & E. factory. The first thing that greeted his ears as he came up the stairs was the hum of busily whirring belt-grinders.

Misik came forward to meet him. "You win, Mason," he said. "That joint in your new Speed-grits Uniflow Belt does the trick. We are getting our fine finish by machine now, fast—but sure."

"The jump has gone from the belts and the kick has gone from the workmen."

Write today for "The Difference Book." *Address*

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Or send to the Manning Abrasive Company, Troy, New York

Speed-grits

comes in the following varieties:

GARNET PAPER
GARNET CLOTH
GARNET COMBINATION
FLINT PAPER
(*Sandpaper*)
EMERY CLOTH
EMERY PAPER
METALITE CLOTH
HANDY ROLLS
GRINDING DISCS
DURITE CLOTH
DURITE COMBINATION
DURUNDUM PAPER
DURUNDUM CLOTH

Manning
Speed-grits
Reg. U.S. Pat. Off.

Don't say Sandpaper —say Speed-grits

If interested tear out this page and place with letters to be answered

for *HEAT*—
OILGAS Industrial Furnaces

"The only distinct advance in furnace practice since Siemens' time."
Double the capacity of the ordinary furnace with the same oil consumption.
A line of continuous forge furnaces of the highest overall efficiency, reliability, and convenience of operation.
Other furnaces of every description for the application of heat to any industrial process.
Write for your copy of Bulletin Fifty-four.

General Combustion Company of Canada, Limited, 619-623 New Birks Bldg., Montreal

E S&M

ELECTRIC
Steel Castings

High Grade STEEL Castings
Of Every Description

Prompt Deliveries

Send us your drawings for estimates.

THE ELECTRIC STEEL AND METALS COMPANY, LIMITED
WELLAND ONTARIO

ACCURACY

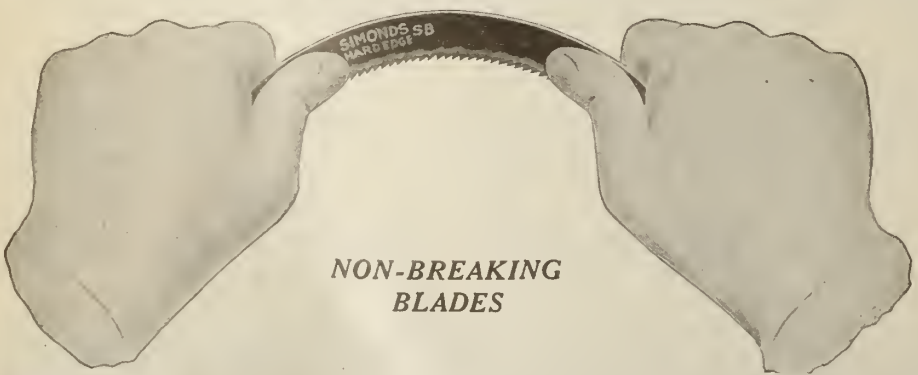
Prompt shipments of all Standard Sizes in
Cap Screws, V or U.S.S.
Cap Screws, S.A.E.
Set Screws, V or U.S.S.
S.F. Hexagon Nuts, V or U.S.S.
S.A.E. Hexagon Nuts, Plain.
S.A.E. Hexagon Nuts, Castellated.
Turned Paper Pins.

Send us your rush orders.

THE GALT MACHINE SCREW CO., LIMITED
GALT, ONTARIO

Eastern Representatives: The Canadian B. K. Morton Company Limited, 49 Common St., Montreal, Que.

SIMONDS HACK SAWS
CUT CUTTING COST



NON-BREAKING BLADES

For Machine or Hand Use
Any Size or Length

Simonds Canada Saw Co. LIMITED
MONTREAL
St. John Vancouver

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

Automatic Furnace Heating Shafts

UNIFORM HEATING AND COOLING

One is at the start and the other at the finish of the heat-treatment operation. **Both are essential** to a uniformly heat-treated product.

Automatic Furnaces, by heating and cooling each piece to the same temperature, for the same length of time and in the same manner, **insure uniformity of finished product.**

Increase in production and **decrease in fuel and labor** are among the other advantages of Automatic Furnaces.

We have a variety in type and size of Automatic Furnaces, for different heat-treating requirements.

Write for Bulletin 217-T

Can. Rep. R. J. McLean
604 Southam Bldg., Montreal, P.Q.

W. S. ROCKWELL CO. INDUSTRIAL FURNACES NEW YORK

HUNT

Industrial Electric Trucks
For
Rapid Inter-Factory Transportation

Consult us for circulars and engineering advice

A complete line of Trucks, Tractors, Crane Trucks and Trailers for all conditions of operation.

Chas. E. Goad Engineering Co.
Limited
105 Bond St. - TORONTO

"Firth quality means first quality"

Firth's

Speedicut High Speed Steel
Extra Cast Steel
Best Cast Sheet Steel
Nickel Chrome Steel

Superior steels of the highest quality, each a leader in its class.

Immediate shipments from stock.

Thos. Firth & Sons Limited

Montreal
449 St. Paul St. W.

Toronto
79 W. Adelaide St.

John J. Coleman - *Canadian Manager*

Damaged Material—and Handling Methods

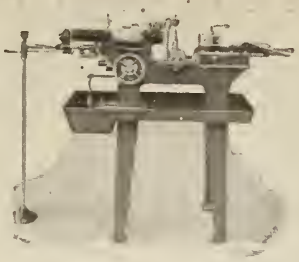
If you'll trace that spoiled part right back to the place where it was damaged, it's ten to one you'll find that the injury occurred while it was being piled onto the floor—thrown from one truck to another, or from the floor to the truck. The chances of injury to fine material vary directly with the amount of handling it receives, and when you're trying to keep up production with every man working at top notch your material is going to be handled pretty roughly.

THE HOLYOKE TRANSFER SYSTEM

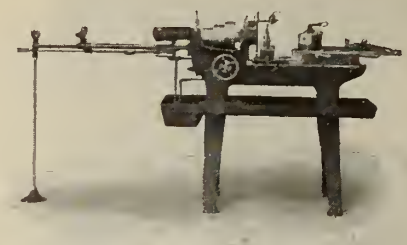
eliminates all this handling. Just build platforms with the superstructure that is required to handle your material safely—boxes, racks, or shelving; and set them beside the machines. When the platform is filled, the truckman comes along with the Holyoke and carries it away—to storage or to the next machine. There is no need to handle the material until it is taken out at the next machine. With the Holyoke, every platform is a truck, and platforms are cheap. The possibilities of damage from handling are reduced to a minimum.

Write for our booklet on "Inside Transportation." It explains how the Holyoke system permits you to install a more economical trucking system AT LOWER INITIAL COST.

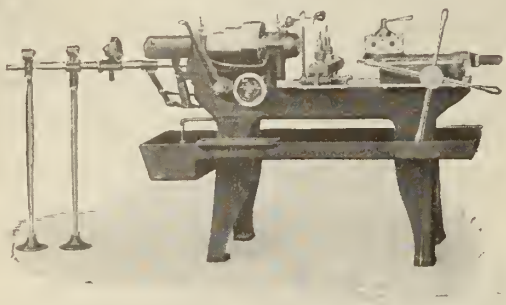
Holyoke Truck Company
119 Race Street **Holyoke, Mass., U.S.A.**



No. 0. P.H. SCREW MACHINE

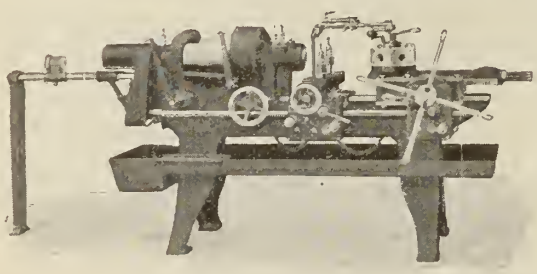


No. 1. P.H. SCREW MACHINE

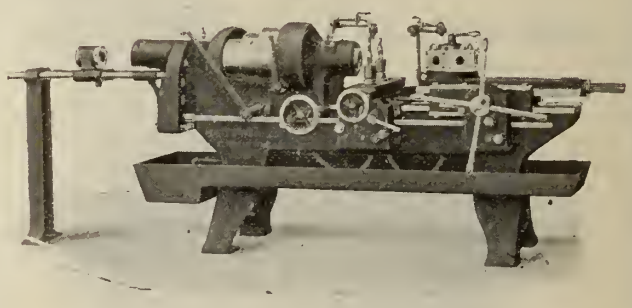


No. 3. P.H. SCREW MACHINE

No. 3. F.H. SCREW MACHINE



No. 5. F.H. SCREW MACHINE



No. 7. F.H. SCREW MACHINE

DESIGN OF CUT-OFF UNIT

The fourth of a Series of Advertisements describing the Foster New Line of Hand Screw Machines.

One of the important points of design in the new line of hand screw machines, a point that brings out into clear light the care and study given to every feature involved, is the hand longitudinal feed screw located between the ways. This eliminates all cocking action in the cross slide carriage, enables same to operate with greater ease and makes possible a closer adjustment for obtaining of accurate shoulder lengths of the work. As simple as this point is its importance can readily be grasped by any one upon a minute's consideration.

The hand longitudinal feed screw when located on the side of the bed, as found in other screw machines, will necessarily tilt the cut-off carriage. The additional friction and undue wear created hereby is a cause of irritation and inaccuracies and also shortens the useful life of the entire machine.

The large diameter graduated dial inside of the hand wheel and the observation stops mounted on same is a great convenience for the rapid and accurate setting of the cut-off.

Our circulars describe fully our entire line of machines. If you have not written for these circulars yet, do so to-day.

FOSTER MACHINE CO., ELKHART, IND.

ARMCO IRON WELDING RODS

AMERICAN ARMCO INGOT IRON

General View of Ports

Interior of Furnace Before Laying Brick

Interior of Furnace After Laying Brick

Water-Cooled Ports for Open Hearth Furnaces Welded with Armco Iron Welding Rods

The water-cooled ports illustrated were manufactured by Blaw-Knox Company, Pittsburgh. The ports mounted in furnaces as shown are subjected to a temperature of 3000° F. on one side and the temperature of water at approximately 60° F. on the other side. All welds made with ARMCO IRON Welding Rods.

ARMCO IRON Welding Rods are furnished for both electric arc welding and oxy-acetylene welding. They are the purest commercial iron in the world—99.84 per cent. pure iron content (minimum) guaranteed. They flow freely, weld evenly, and lend themselves perfectly to finishing operations. Ask our nearest branch office for addresses of ARMCO distributors in your locality.

PAGE STEEL & WIRE CO.

Established 1883 as Page Woven Wire Fence Co.

STEEL AND WIRE PAGE QUALITY PRODUCTS

Makers of ARMCO IRON Welding Rods and Electrical Wire; Wire Mill Products, Plain and Galvanized; Wire of Special Analysis; Wire Fencing for all Purposes; Factory Gates; Ornamental Iron Fence; Machine Guards; Tool and Stock Room Partitions; Architectural Iron.

Plants: Monessen, Pa., and Adrian, Mich.

SALES OFFICES: 30 CHURCH STREET, NEW YORK

CHICAGO: 29 South La Salle Street. DETROIT: Book Building

SAN FRANCISCO: American Rolling Mill Company of California.

CANADIAN DISTRIBUTORS: Taylor & Arnold, Ltd., Montreal, Toronto, Winnipeg.

65

DOMINION BRIDGE COMPANY LIMITED

MONTREAL, QUE.

STRUCTURAL STEEL

FOR

Bridges Buildings Tank Work

Transmission Towers Penstocks

ALSO

Electric Hand Power Travelling Cranes

Steam Turbines

Main Office and Works: LACHINE, QUE.

Phone - Westmount 6800

BRANCH PLANTS: TORONTO OTTAWA WINNIPEG

DOMINION ENGINEERING AND MACHINERY COMPANY, LIMITED

MONTREAL - QUE.

Pulp and Paper Making Machinery

Fourdrinier and Cylinder Paper Machines

Pulp Drying Machines

Barking Drums, Sulphite, Sulphate, Paper, Screens,

Granite Rolls, Millspaugh Patent Suction Couch and Press Rolls

WORKS: LACHINE, QUE. PHONE WESTMOUNT 6800

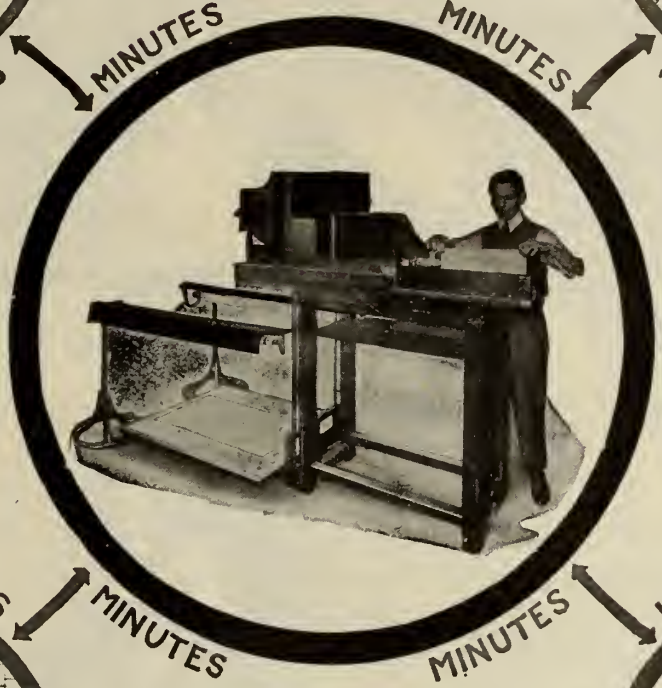
Photographic Copying with the PHOTOSTAT
(TRADE MARK REGISTERED)

How Long Does It Take You—

To Copy Catalog Pages

letters, reports, charts, etc., takes hours of a stenographer's time. The results cannot be exact duplicates and there are frequent errors.

The PHOTOSTAT produces an exact duplicate, without errors, in a few minutes, at a cost of a few cents.



A PHOTOSTAT IN OPERATION

To Make Advertising Layouts

By hand for six or a dozen publications requires hours of work by an expensive man.

The PHOTOSTAT quickly duplicates the original layout at the required size and as many times as desired at a cost of a few cents apiece.

The PHOTOSTAT Makes No Mistakes

Cuts Dollars to Cents and Hours to Minutes

To Duplicate Blueprints

Tracing them in the drafting room takes hours — sometimes days—of a highly paid man's time, always with a chance of errors.

The PHOTOSTAT accomplishes the same result in a few minutes at a cost of a few cents and without errors.

To Make Drawings of Small Machine Parts

in the drafting room, costs many dollars and takes hours or days of time.

A PHOTOSTAT copy of a small machine part accomplishes the same result and is made in a few minutes at a cost of a few cents.

Manufactured by the Eastman Kodak Company exclusively for

COMMERCIAL CAMERA COMPANY
ROCHESTER, N.Y.

CHICAGO NEW YORK CITY PHILADELPHIA PROVIDENCE SAN FRANCISCO WASHINGTON

AGENCIES:

Alfred Herbert, Ltd., Coventry, England.
Societe Anonyme Alfred Herbert, Paris, France.
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Societe Anonyme Belge Alfred Herbert, Brussels, Belgium.
Graham Bros., Stockholm, Sweden.
Dodwell & Co., Ltd., Buenos Aires, Argentine Republic.

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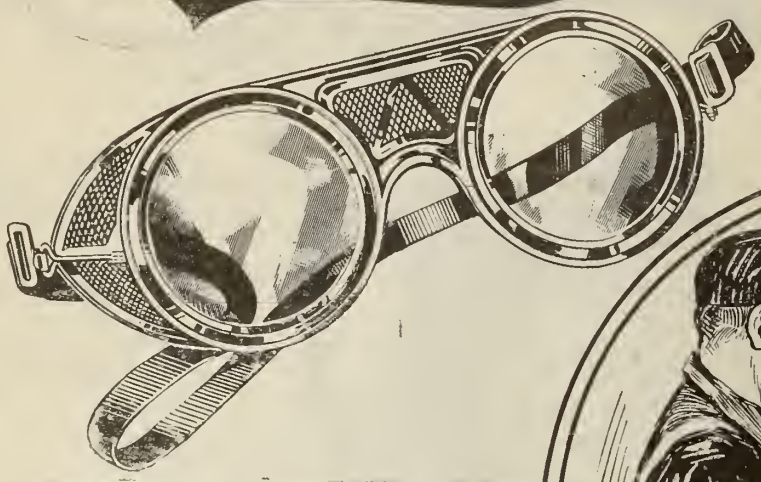
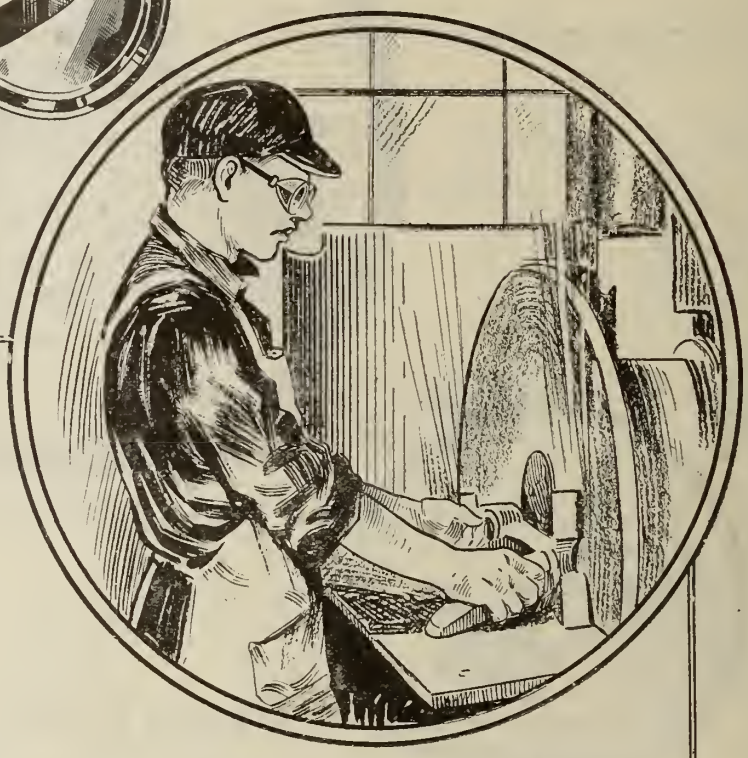
For the Eye-Hazardous Job

STOCO SAFETY GOGGLES

"CELOGLAS"
SHATTER-PROOF LENS





For the Stoco Safety Goggle is strictly an industrial protection glass, the result of applying 37 years of experience in building optical ware for use under every conceivable condition to the particular problem of producing a glass that would protect the eyes completely, would be sturdy enough to stand up under the roughest kind of handling and yet comfortable enough so that workers would not object to wearing it.

While that was no mean problem, the large and steadily growing list of Stoco Safety Goggle users shows how well we solved it.

Price (f.o.b. Geneva, N.Y., U.S.A.)

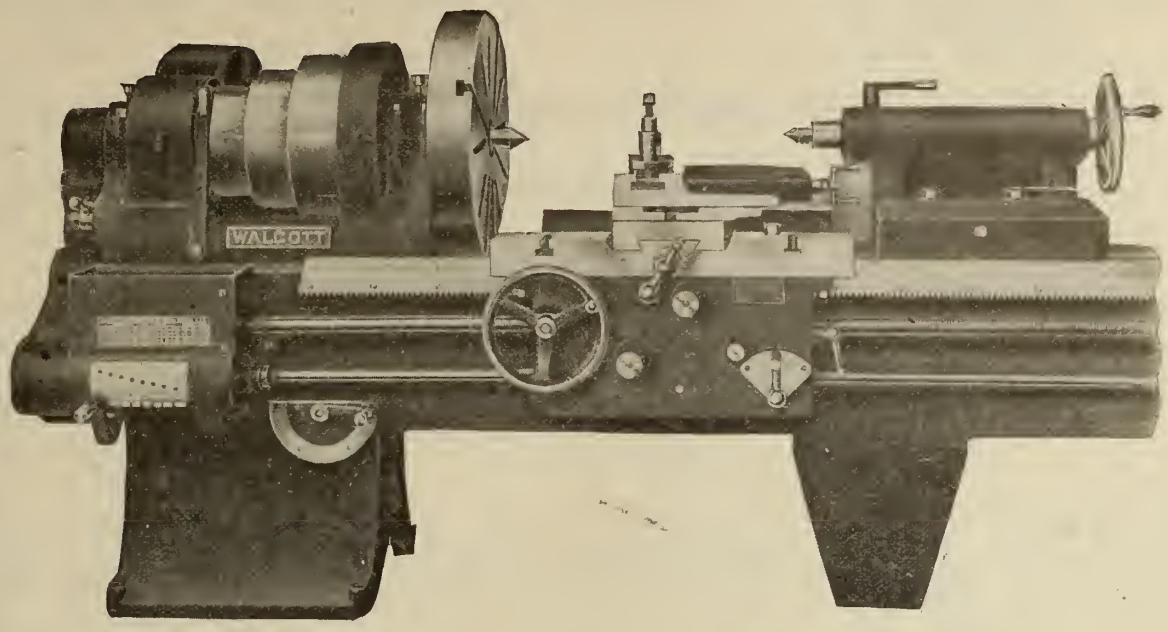
With Celoglas Shatter-proof Lenses, $115.00 per hundred.

With extra heavy optical glass lenses, $90.00 per hundred. Black elastic headbands or easy cable temples at same price.

Attractive discounts for quantity orders.

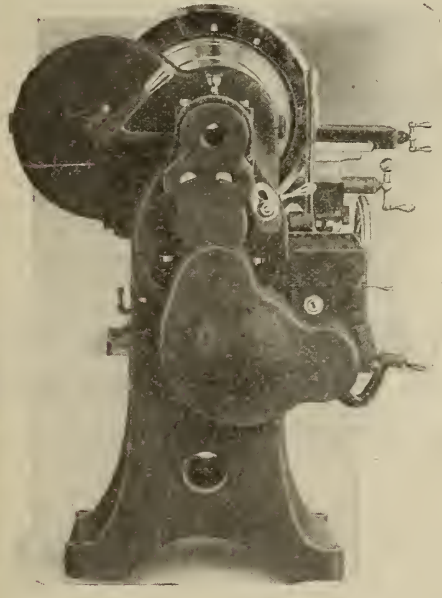
NOTE.—A sample *Stoco* Safety Goggle will be sent interested responsible people without charge on receipt of request on firm letterhead.

STANDARD OPTICAL CO.
GENEVA, N.Y. U.S.A.



Walcott Lathes——Time Tested

It did not take 38 years to establish a reputation, but you can benefit by that experience.



YOU can subject this 26" Engine Lathe to any test and at the outcome you will find that 38 years of lathe building have enabled us to present a machine that answers the most rigid requirements.

Reinforced and strengthened at the points of stress, this machine includes such features as: double apron plate, drop forged gear in apron, rigid compound rest, back gear arm reinforced by one-piece gear guard and headstock, not a single tooth exposed, feed gears run in oil, large frontway on bed, and quick change gear box. The lead screw and feed rod are separate.

Made in 14", 16", 18", 20" and 29" sizes.

Our experience and co-operation are entirely at your disposal. Write us.

WALCOTT LATHE COMPANY

135 Calhoun St. *Established 1881* **Jackson, Mich.**

Canadian Agents: The Canadian Fairbanks-Morse Co., Ltd., Montreal, Toronto, Ottawa, St. John, N.B., Winnipeg, Calgary, Saskatoon, Vancouver, Victoria, F. H. Andrews & Son, Quebec, Que.

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OUTLINE OF JORDAN PUMP

SPECIFIED

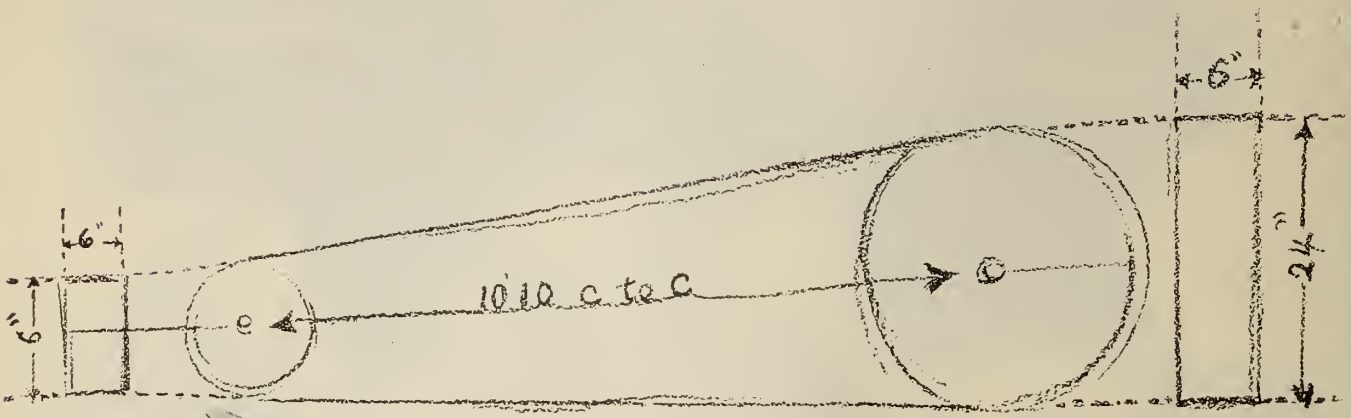
GOODYEAR EXTRA POWER

6" x 5 PLY 25'6"

PULLEY FACES 8"

R.P.M. DRIVING PULLEY 500

H.P. 10



A Goodyear Belting man will survey your plant with no obligation to you.

GOODYEAR

MADE IN CANADA

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

Where Belts Meet Dampness!

Goodyear Extra Power Belt Delivers Power and Lasts

Damp or wet belts usually slip more easily than dry belts.

Water and moisture form a thin film between pulley and belt.

Here "Extra Power" Belting especially displays its advantages.

Where there is water, moisture or steam — around the beaters in paper mills, for instance—Goodyear Extra Power delivers the power load just as under more favorable conditions.

Because Goodyear Belting has a rough friction surface which bites through the film of water and clings to the pulley, costly slipping is overcome.

Moisture rots belts, if it gets into them.

Goodyear Extra Power is rubber-sealed against moisture.

Not just enclosed in a rubber envelope.

The high-grade rubber in Extra Power is forced through and through the fabric, surrounding and protecting every strand, making the belt practically a solid unit.

That Goodyear Extra Power Belting is just as efficient and just as economical in damp or wet places as in other transmission uses, is proved by these satisfied users:

> The Provincial Paper Mills of Thorold got 16 months' service from Goodyear Extra Power on a Jordan Pump where they had been getting about one month's service. They also say — "In the room where our beaters are located, the air is constantly damp. Here we have found extra power so superior that we use it exclusively."

Some other firms who will be glad to tell you of the satisfactory service of Goodyear Extra Power under damp conditions are:

Mittagami Pulp & Poper Co., Smooth Rock Falls, Ont.
Port Arthur Pulp & Paper Co., Port Arthur, Ont.
North West Laundry Co., Winnipeg, Man.
Dominion Pulp Co., Chatham, N.B.
Bathurst Lumber Co., Bathurst, N. B.
Gloucester Lumbering & Trading Co., Bathurst, N.B.

If you use belting, it will pay you to hear about the Goodyear way of supplying it. It will cost you nothing to have a Goodyear man call and show you how to overcome your problems. Phone, wire or write the nearest branch.

The Goodyear Tire & Rubber Co. of Canada, Limited

BRANCHES:—Halifax, St. John, Quebec, Montreal' Ottawa, Toronto, Hamilton, London, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Vancouver. Service stocks in smaller cities.

EXTRA POWER BELT

If interested tear out this page and place with letters to be answered

MILWAUKEE MILLING MACHINES

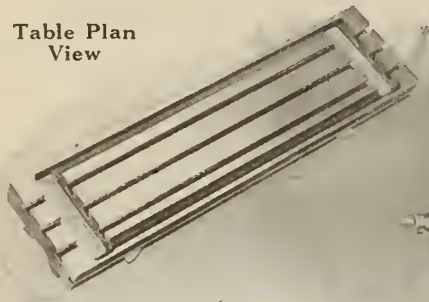


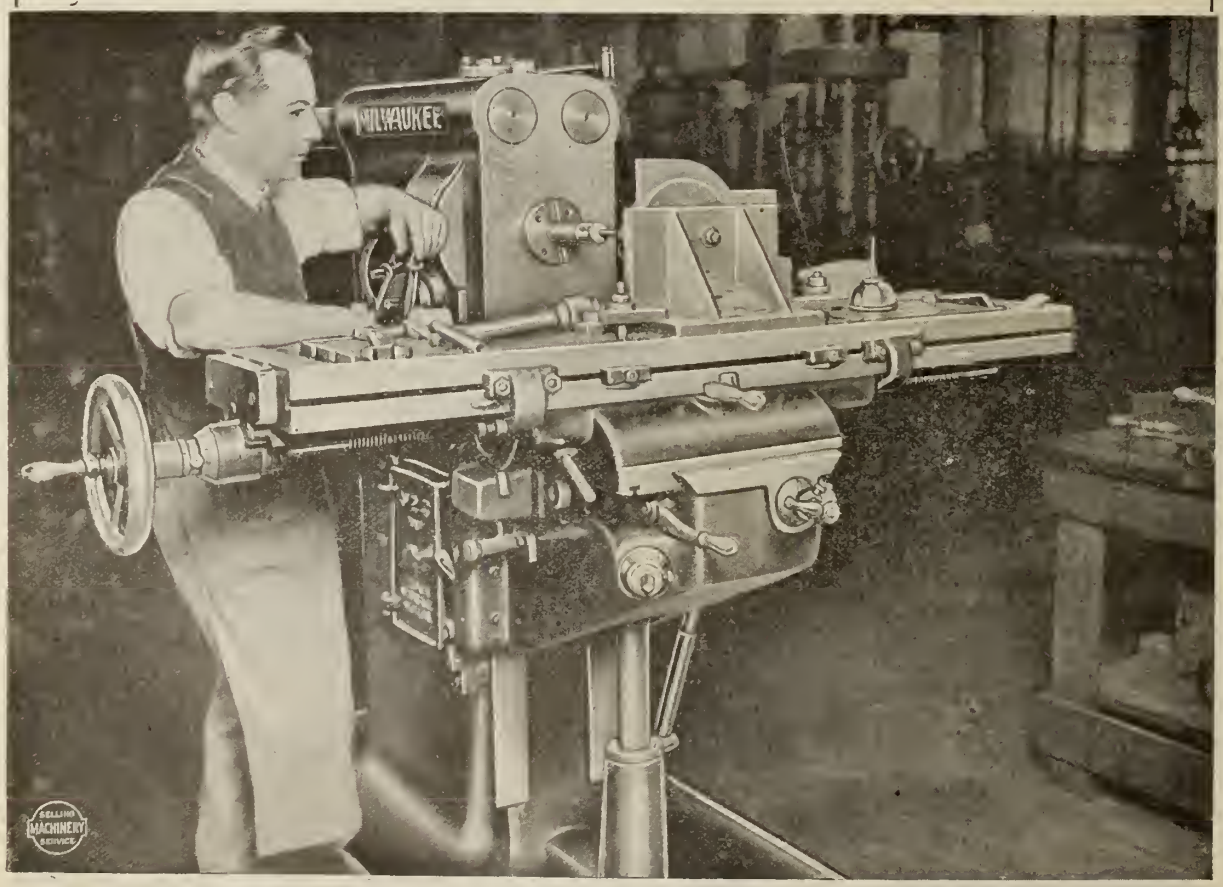
Table Plan View

Knee and Saddle Plan View

THE TABLE

The semi-steel table of Milwaukee Milling Machines is not cored but is left solid and finished all over, eliminating the possibility of distortion which would be caused if scale were left on the bottom. The bearing of the table is at the top of the saddle rather than at the bottom of the dovetail, securing larger bearing surfaces at a greater distance apart. It is of a generous width that does not crowd the operator in making an intricate set-up; has deep slots to take heavy clamping strains, and a completely screened drainage system to handle the cutter lubricant. Work can be turned out more rapidly and with less physical effort.

The table is only one of the numerous meritorious features of Milwaukee Milling Machines. Our catalog gives them all. Write for a copy, to-day.



KEARNEY & TRECKER CO. MILWAUKEE, WIS. U.S.A.

Some industries may be operated profitably *anywhere.*

OTHERS — and these are the greater number—are so controlled by the conflicting demands of labor, transportation, raw materials, power, etc., that their geographic location is of the utmost importance. For each industry there is possibly only one location which will allow it to meet competition profitably.

St. Johns possesses such unusual advantages of great economic importance that it should always be included in investigations preparatory to the location of a new industry.

The Secretary of the City Council will be pleased to answer any enquiry on St. Johns, and will supply complete and accurate information on any phase of the industrial situation as it affects the city.

—Seven railroads, including Canada's great transcontinental lines.

—Finest ocean shipping facilities.

—Canal connections with New York, the Eastern States, and the Great Lakes.

—Cheapest labor market in Canada.

—Plentiful supply of skilled and unskilled labor.

—Cheap and abundant electric power.

—Cheap coal and lower freight rates.

—Desirable factory sites with all public conveniences immediately available.

—Extraordinary inducements to new industries.

For Detailed Information, write

The Secretary, City Council

St. Johns, Quebec, Can.

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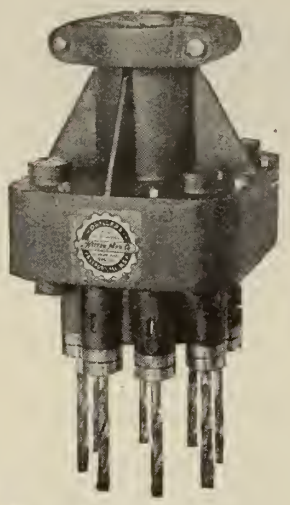
2 Minutes or 20?

This Is The Vital Question



Do you drill ten holes in the time it takes for one? The Hoefer Auxiliary Head equips any driller so as to accomplish this big saving in time. It speeds up production in drilling tremendously. Not only do you save the drilling time, but also the time now lost in shifting the jigs and raising and lowering the spindle for the extra holes.

Hoefer Auxiliary Heads are made in any multiple, arranged in any manner, from 2 up. They are made by expert tool makers and unqualifiedly guaranteed to handle accurately the work for which they are designed.

Investigate now—every day you use a single drill where the multiple may be used you are paying for an auxiliary head through increased costs, but not securing its benefits.

Write for catalog. Send a blueprint of some of your work for estimate of time and cost.

THE HŒFER Mfg. Co., Freeport, Ill.

621 Washington Blvd., Phone Haymarket 2408, Chicago, Illinois; 1113 Citizens' Bldg., Phone Main 795, Cleveland, Ohio; 217 Stanwix St., Phone Court 1911 or 1912, Pittsburgh, Pa.; 602 Kerr Building, Phone Cherry 2884, Detroit, Mich.; 30 Church Street, Phone Cortland 1615, New York City; Badger-Packard Mchy. Co., Milwaukee, Wisconsin; National Supply Co., Toledo, Ohio; John M. Howett, 18 W. Second St., Dayton, Ohio; 881 Ellicott Sq., Phone Seneca 2033, Buffalo, N.Y.

The Canadian Fairbanks-Morse Co., Limited

"Canada's Departmental House For Mechanical Goods"

Halifax St. John Quebec Montreal Ottawa Toronto Hamilton Windsor Winnipeg Saskatoon Calgary Vancouver Victoria

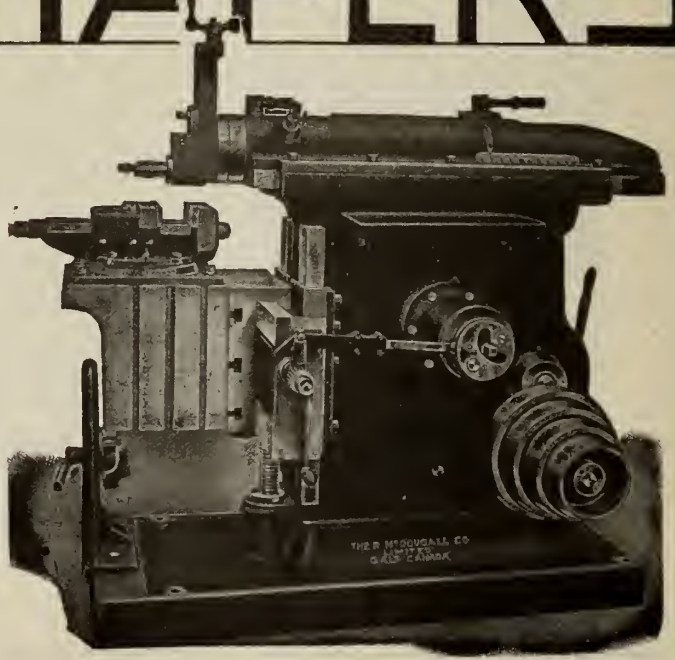
McDougall SHAPERS

Rigidity Plus

Simple Design and Convenience of Adjustments

give operator every facility for ease of operation and Accuracy in Production

Our circulars, containing complete specifications and descriptions, are ready. Write us for one.



The R. McDougall Co., Limited

GALT, ONTARIO

THE CANADIAN FAIRBANKS-MORSE CO., LIMITED
Sales Agents

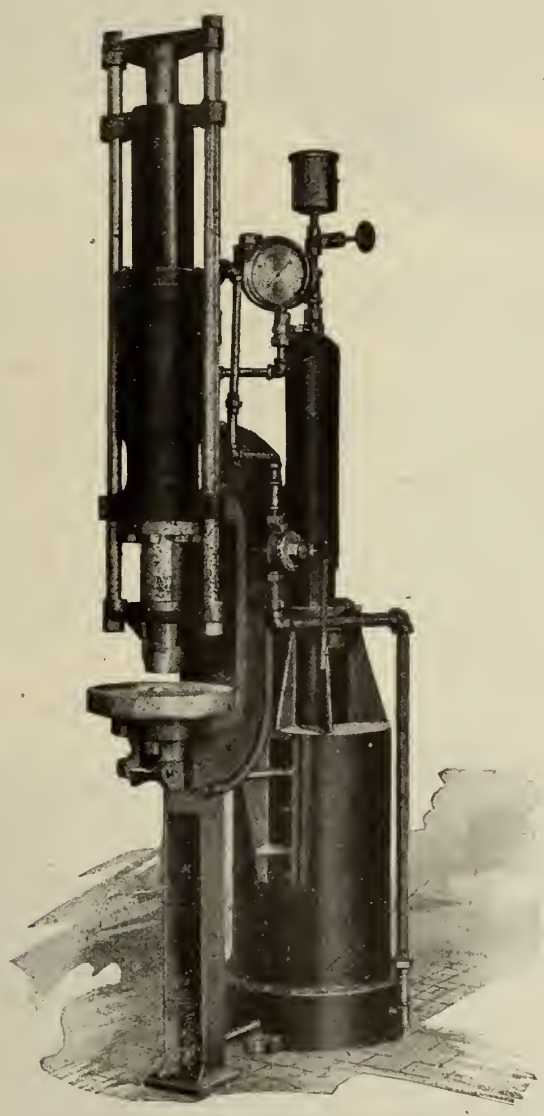
If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

ORIGINALITY

is Characteristic Always of

"METALWOOD"

DESIGNS and DEVELOPMENTS



The "Metalwood" line of these Quick Operating Hydro-Pneumatic Presses comprises a variety of styles, types and sizes.

By performance through a period of years, these presses have established themselves in a wide range of industries as standard tools for light straightening, broaching, forcing and assembly operations.

The "R-149" style press of 20-ton capacity shown here is described in our bulletin B-47.

METALWOOD MANUFACTURING CO.

High Speed Hydraulic and Hydro-Pneumatic Machinery

DETROIT, MICHIGAN

EXCLUSIVE SALES REPRESENTATIVES:

Canadian Fairbanks-Morse Co., Ltd., Montreal and Toronto; R. E. Ellis Engineering Co., 621 Washington Blvd., Chicago; Fairbanks-Morse & Co., Inc., 30 Church St., New York City; Sherritt & Stoer Co., Inc., Finance Bldg., Philadelphia, Pa.

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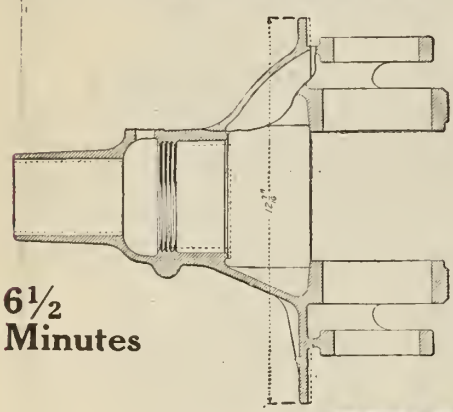
GIS

Differential Carrier of Malleable Iron

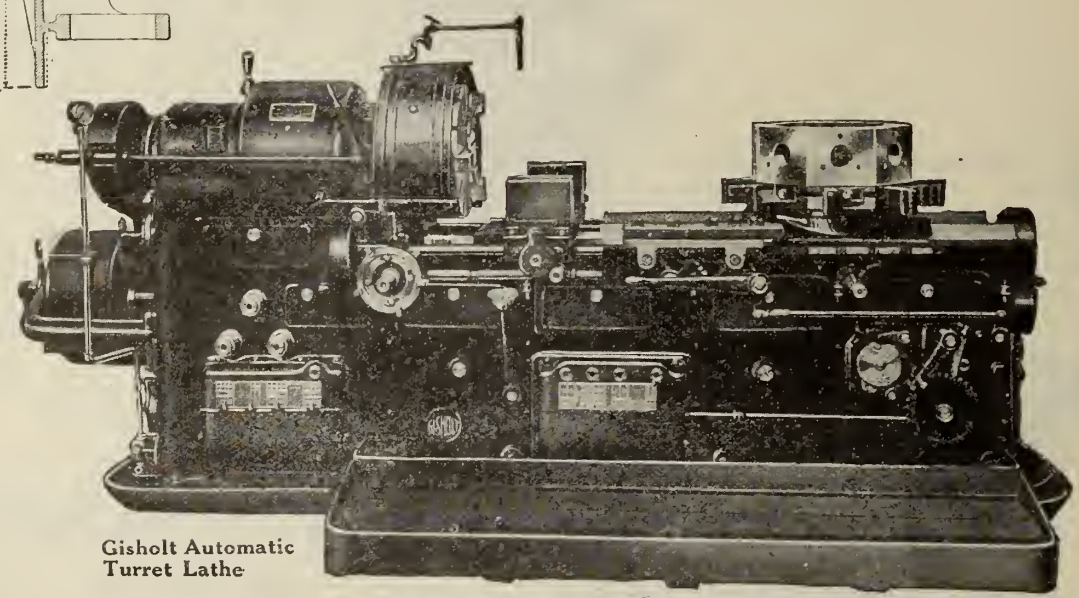


6½ Minutes

This is a typical Gisholt Automatic piece, finished in typical Gisholt time.

Note the amount of work performed in the time named.

Compare this production with your own on all your chucking work and let us tell you how this machine will help you increase your production and reduce your costs.



Gisholt Automatic Turret Lathe

GISHOLT MACHINE COMPANY, 1201 EAST

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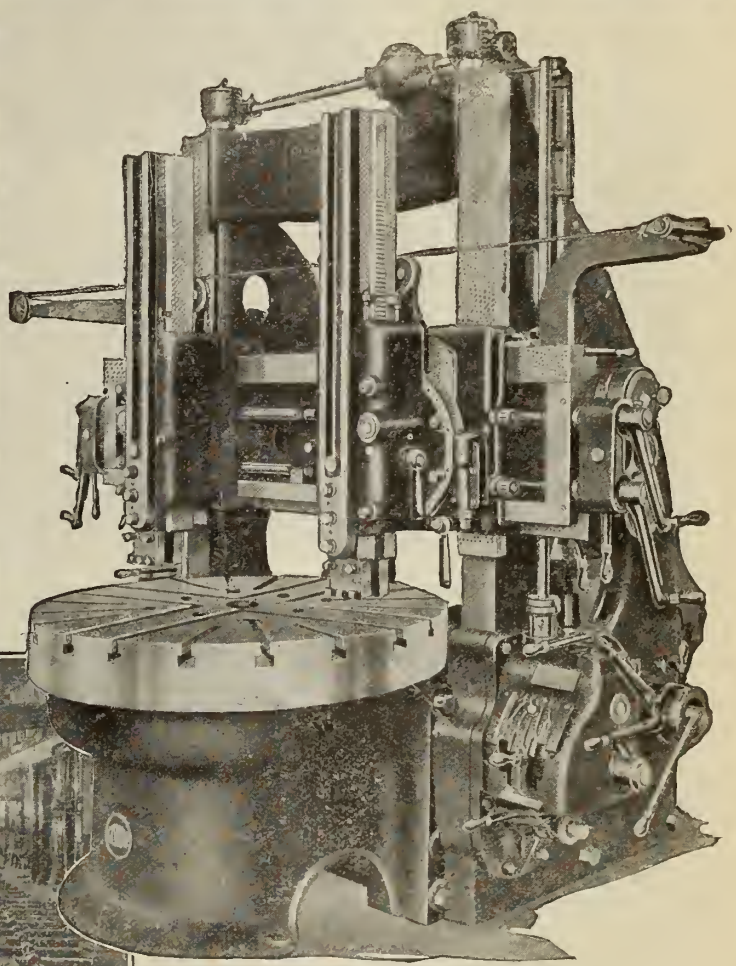

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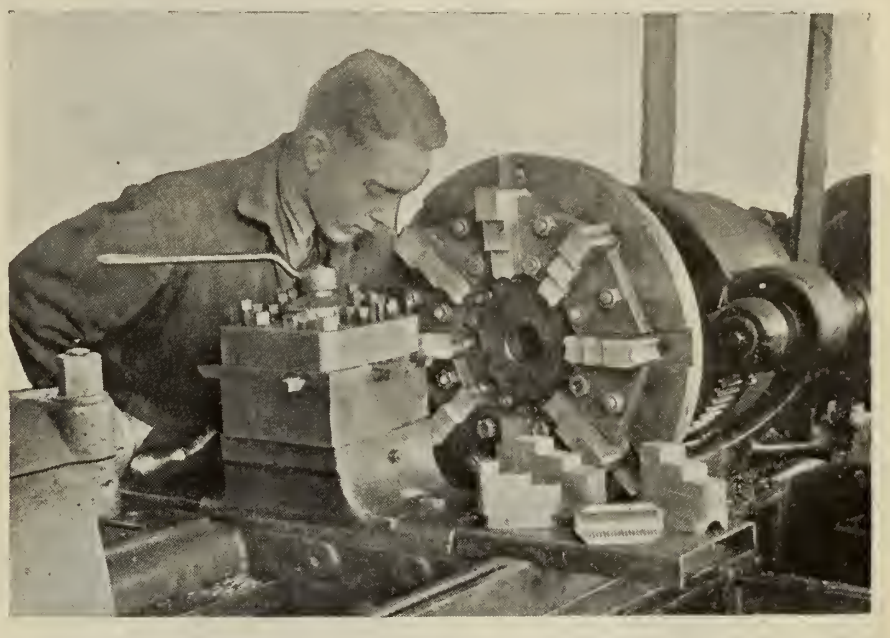
CANADIAN MACHINERY
AND
MANUFACTURING NEWS

Vol. XXIII, No. 12. April 1, 1920

The Evolution of the Dominion Chuck

—By J. H. MOORE



READERS of CANADIAN MACHINERY will no doubt recall two articles published last year on the making of 5 in. naval gun mounts at the plant of the Dominion Steel Products Co., Ltd., Brantford, Ont. In these articles we not only commented on the intricacy of the work being accomplished but also upon the close limits to which the gun mounts were held.

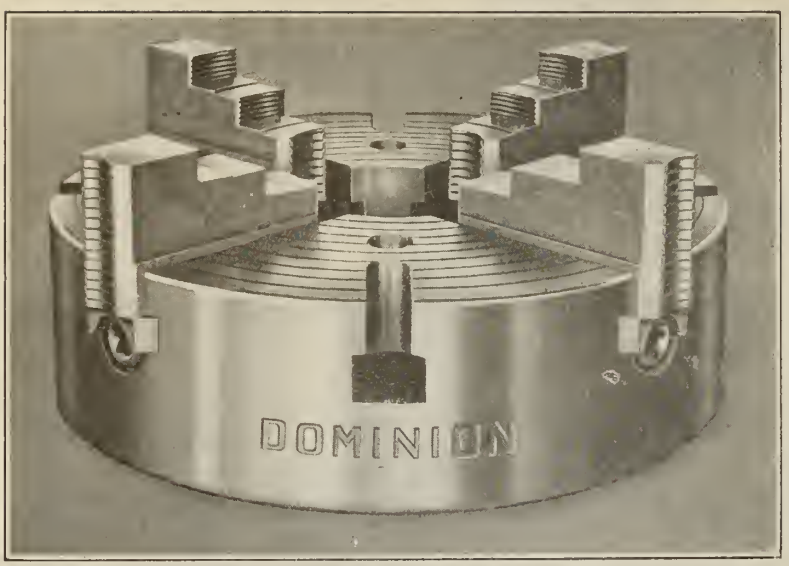
It may seem strange that we should direct attention to an incident which is now a thing of the past, but we do so in order to illustrate the benefit and experience derived by this firm from the working on such a war-time product.

It may be surprising to know that these gun mounts were held to 1-10,000 limits. This gives a fair idea of the wonderful accuracy necessary on the work, but when we state that the company also turned out torpedo destroyer shafting for the United States Government, and enough propeller shafting in 1918 for 980,000 shipping tonnage, one can realize the magnitude of their task. All this work necessitated the use of a great number of chucks. But experience proved that at the most inopportune time these chucks would break, or crack, rendering them useless, causing considerable and costly delay in production. As Mr. Fischer, the sales manager, put it: "We were heartily sick of the complete performance, and solemnly vowed that we would build a chuck strong enough to stand the wear and tear of our business. We designed such a chuck, not with the sole idea of placing it upon the market, but because necessity once more proved herself to be the mother of invention. We had contracted to turn out shafts with no interruptions, and to do this we had to use chucks capable of standing the hard and steady usage we were giving them. Thus we decided to build our own."

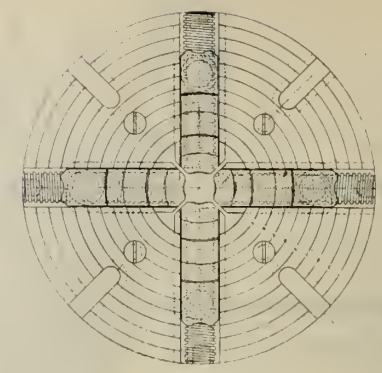
The method used by this concern in the designing of the chuck is well worthy of note. They announced to the employees their determination to make chucks for their own use capable of standing the strain, and asked for suggestions. Of course when experienced operators are asked to give the benefit of their experince in a regular manner such as this, they feel it a privilege to do so. The result was, that many helpful suggestions were made and adopted. The metallurgist came forth flat-footed and stated what, in his opinion, was the correct properties of the metals best suited for such a chuck, and these were also acted upon. Last but not least the engineering staff got busy, with the result that between the employer, the metallurgist, and the designers, they turned out a chuck that stood the strain. All this did not come as easy as it looks on paper, but there was great satisfaction at the finish in knowing they had accomplished their purpose.

Then the war came to its dramatic close and the urgent need of gun mounts was over for the time being. The next problem was to start a peace-time industry, yet make that industry the turning out of some product that would fill a long-felt want. They decided to keep on with their large work on the marine steel shafting, and added to this line considerable work on rubber mill rolls, rolling mill equipment, and so forth, but in addition to these lines they decided to give the trade the benefit of their experience and place on the market their proven chuck, which was to be known by the name of "Dominion" 4 jaw independent chuck.

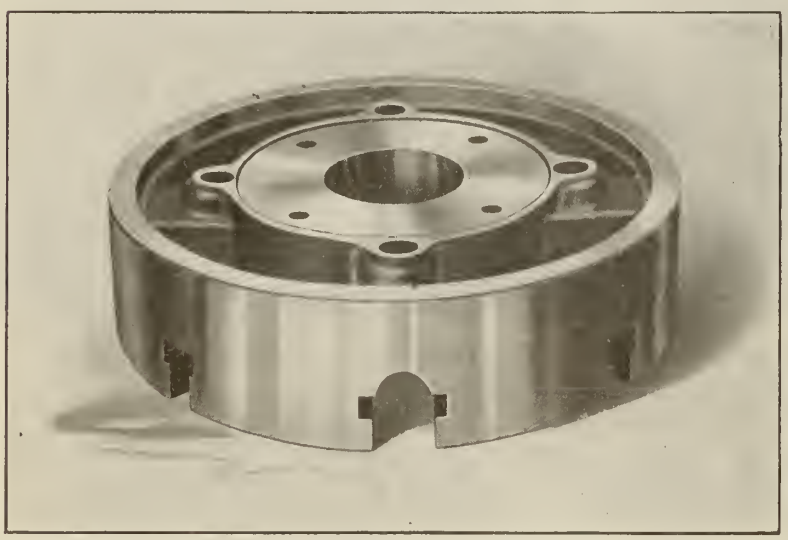
People are too apt to take a chuck for granted. As one machinist hesitatingly remarked on being asked what a chuck was, "Why—a chuck—a chuck is something that holds a piece of work you want to machine, or turn. Oh, anybody knows what a chuck is!" Strange to state very few people realize the importance of a chuck. In all his description of a chuck this machinist omitted to emphasize the necessity of accuracy. A chuck could hold a product and yet not be a good chuck. To belong to the A1 class it must have several features. First and most important of all, it must be accurate. A chuck that is not absolutely correct is worse than useless. Then it must be of strong and rigid construction, heavy enough to withstand unlooked for strains. Last, but as im-



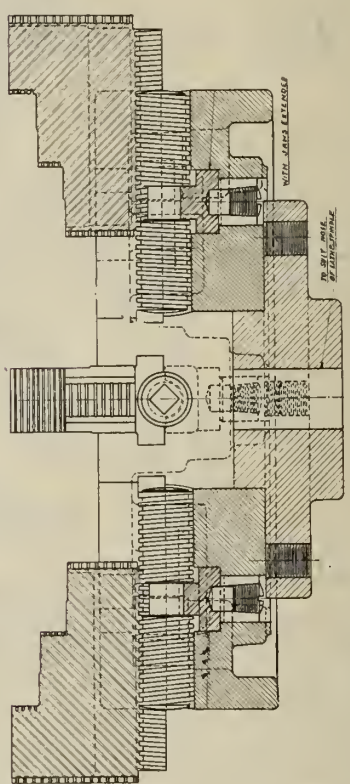
GENERAL VIEW OF THE CHUCK.



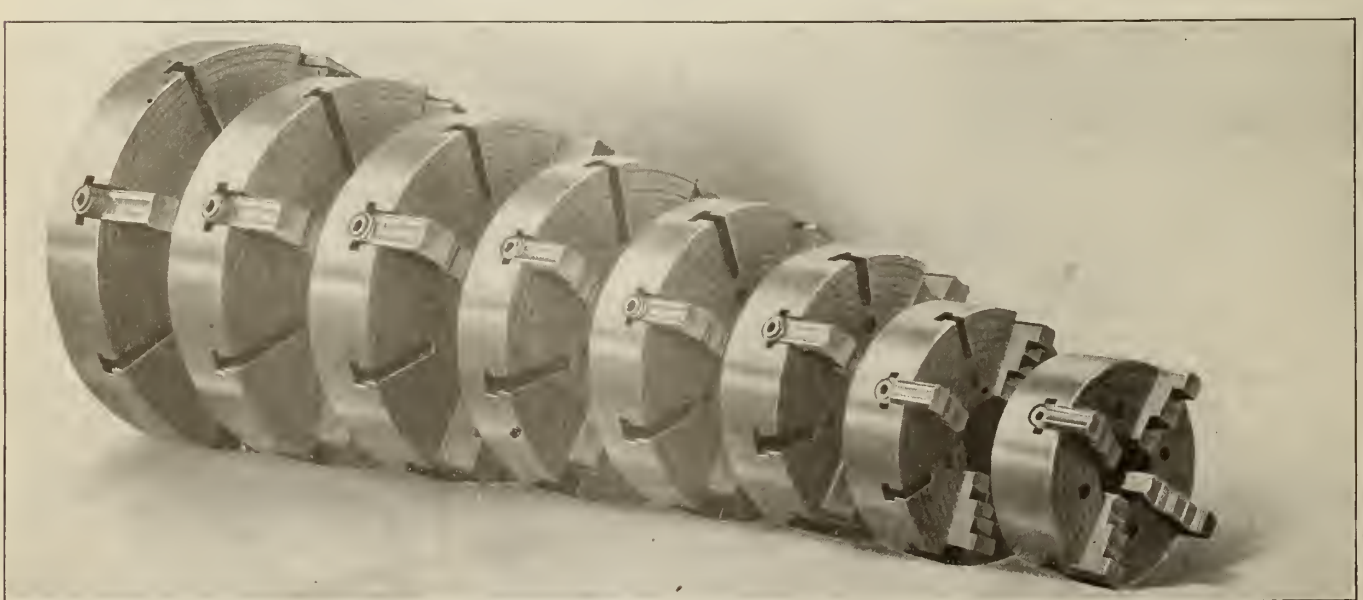
DIRECT FRONT VIEW OF CHUCK.



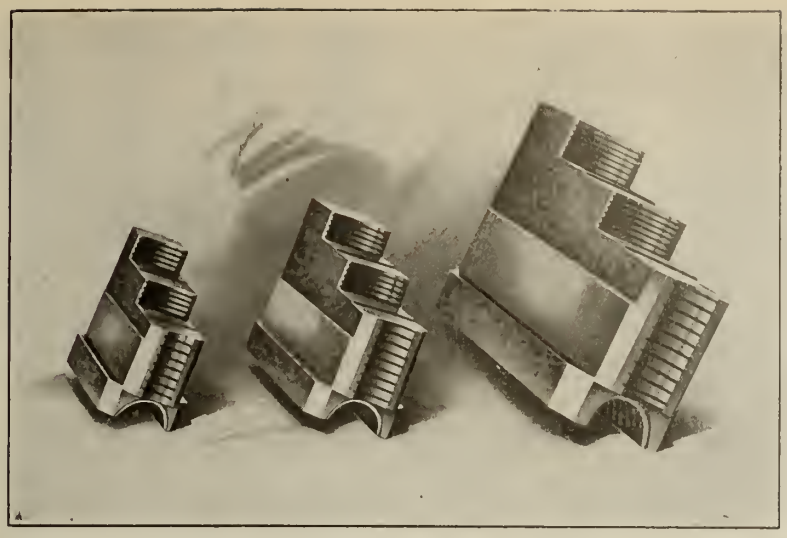
THE BODY OF CHUCK LOOKING FROM THE BACK



SECTIONAL VIEW OF THE CHUCK.



GROUP OF CHUCKS FROM 10" TO 24" SIZE.



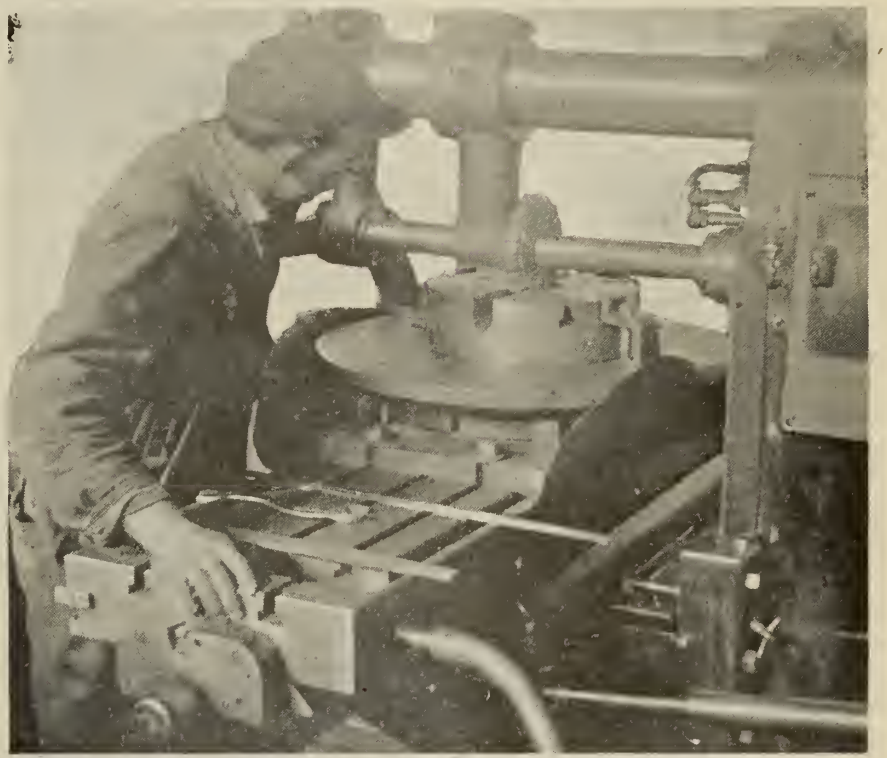
COMPARATIVE VIEW OF VARIOUS SIZED JAWS.

portant as any—it should be made in such a manner that its parts are interchangeable. This, unfortunately, is a feature often overlooked or passed up as an unnecessary precaution.

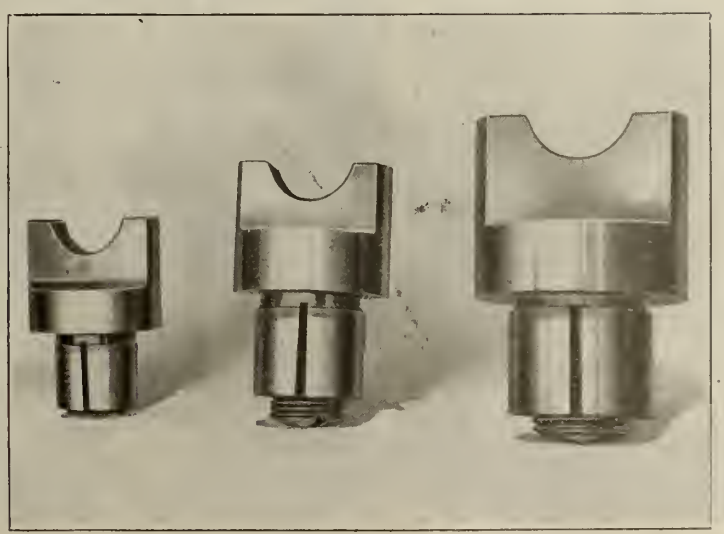
Having decided to manufacture chucks for sale as well as for their own use, the next step was to make sure that all the features of their already tested chuck went into their standard lines. Now came the point of deciding the sizes to be made, and once more they drew from their personal experience. Having used all sizes from 10 in. up to 24 in. themselves they decided to place a similar range of sizes on the market. They also made up their mind to play safe regarding strength, with the result that they decided to divide their chucks into three groups as follows: First, the 10 in. and 12 in. size; second, the 14 in., 16 in., and 18 in. size; third, the 20 in., 22 in., and 24 in. size. This meant that the proportions of the jaws and screws on each of these groups would be so designed that they would be heavy enough for the largest size in the group.

For example, the 10 in. chuck jaws and thrust blocks are the same size as those on the 12 in. chuck. The chuck screws on the 10 in. size are also the same size as the 12 in. chuck, the only difference being that of length. The chuck jaws of a 10 in. chuck could be taken out of that size and used in a 12 in. size, or vice versa. The same conditions hold good in all three groups, so that the 20 in. size chuck actually has jaws, thrust blocks, and screws, capable of standing the class of work performed on the 24 in. size.

It will be seen from this description that the feature of absolute interchangeability has also been embodied, for otherwise it would be impossible to substitute jaws from one size chuck to another. This decision to have all parts interchangeable meant large expenditure on the part of the firm, but as they themselves put it, "We have proved the feature of interchangeability to be well worth while and worth the added cost in jigs, fixtures, gauges and other equipment." The writer personally saw these fixtures, gauges, etc., and could not help but notice that considerable money had been spent in the perfection of their product.



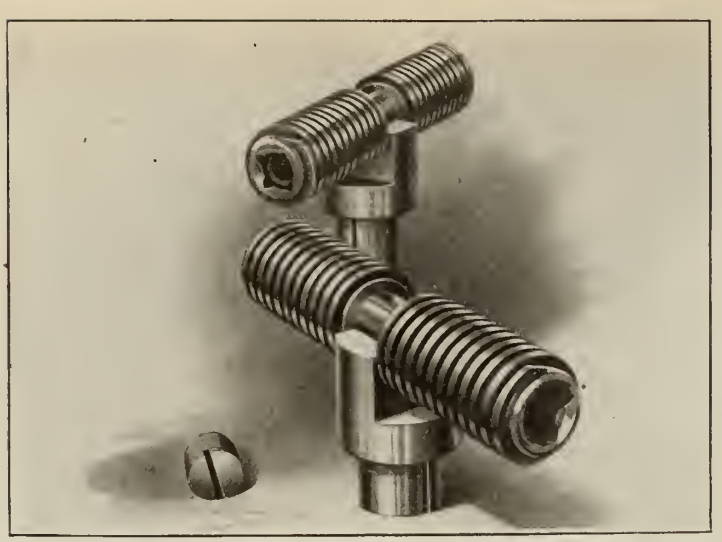
MILLING THE CHUCK BODY FOR JAWS.



VIEW SHOWING HE THRUST BLOCKS, WITH EXPANDING STEM.

Types of Chucks Made

Before going into the actual manufacture, it might be best to mention that both grey iron and steel bodied chucks are made. While each are equally capable of performing their respective duties, it goes without saying that the steel chuck is superior. The day of the steel bodied chuck is here to stay. As every machinist of experience knows, the introduction of high-speed steel into the machine industry made many changes. Machine tools were practically redesigned to withstand the extra speed and strain, so that it was only natural that the steel bodied chuck followed. Unfortunately, however, there is still existent that type of individual who cannot see further than the initial cost of either a machine tool or chuck. They cannot



VIEW SHOWING THRUST BLOCKS AND SCREWS. NOTE THE REVERSIBLE FEATURE OF THESE SCREWS.

seem to grasp that a slightly greater expenditure at the start means a greater production, and of course larger profit in the long run. Fortunately this type is dying out, and manufacturers in general are alive to the advantages of the steel chuck for heavy strains. As we remarked at the start, however, this concern turns out both styles, grey iron and steel.

They mould their own castings, and in every case only first-class castings are allowed to pass. A blow hole is never tolerated, and any flaw in the metal sends the casting to the scrap heap. To illustrate the general design of the chuck we show several views, and call attention first to the picture illustrating the body of the chuck itself. It will be noted that it has both broad and deep T-slots, and is provided with a good thick section between the face of the chuck and the bearing surface of the Tee. It is this feature of design that allows it to stand up under increased stress. The other views illustrated will be taken up in due sequence, but having commenced at the body, let us follow it through the process of manufacture.

The Body

The first operation on this portion is that of rough-turning the outside diameter. It is now turned around and rough-turned down the back, also recessed to suit the face-plate. The next step is to finish turn the points just mentioned.

The third operation consists of drilling the holes for the face-plate, this work being accomplished in a special jig for the purpose. The face of the chuck is next finish-turned, also the outside diameter.

The fifth operation is an exceedingly important one, and we have illustrated it in picture form. This operation consists of rough and finish milling the jaw channels, also the milling of key slot. A special indexing fixture is used on the millers, which is so arranged that it locks itself every 80 degrees. Referring to the photograph, we notice that the form cutter is just about to pass through the second portion of its cut. By milling in the manner shown they are absolutely certain that every jaw will be at right angles to each other, for a sliding key locks itself into a slot on the circular table of the milling fixture every 90 degrees. This fixture, of course, as can be readily understood, swivels from the centre.

After passing through this operation the body goes to be broached. It might be well to explain that in the previous milling operation the jaw channels were not finished to size, but to wthin five-thousandths of the proper dimensions. It is this five-thousandths that the broaching operation removes.

We illustrate this broaching operation, and in the photograph will be noticed several other broaches used on the various-sized chucks. Briefly, two broaches are used on each size chuck, the first broaches the width of the channel, also the T-slot bearing surfaces, while the second broach is so arranged that guide portions fit the parts already broached, while a circular broach finishes out the chuck screw semi-circular guide

After this has been completed the body passes on to the drill press and is drilled for the thrust blocks. This operation is also accomplished by means of a special jig.

Taking it for granted that the other portions of the chuck are completed, the next operation is that of assembling, but before going to this step suppose we consider the different operations on the making of the jaws.

Chuck Jaws

As can be readily understood, these jaws, to be efficient, must be made of good material. This is something which this firm can safely crow over, for all jaws are drop forgings of a special grade of steel, made to their own specifications.

The first operation performed is that of milling the bottom, after which the jaws are turned on their side, placed in a special holding fixture, and milled by a three-step cutter. As soon as one side is milled they are turned over and the other side likewise treated. A feature of the fixture used, and in fact all their milling fixtures, is that everything is governed by the T-slots in the miller table, so that the fixture, jaws, etc., cannot help but be in line.

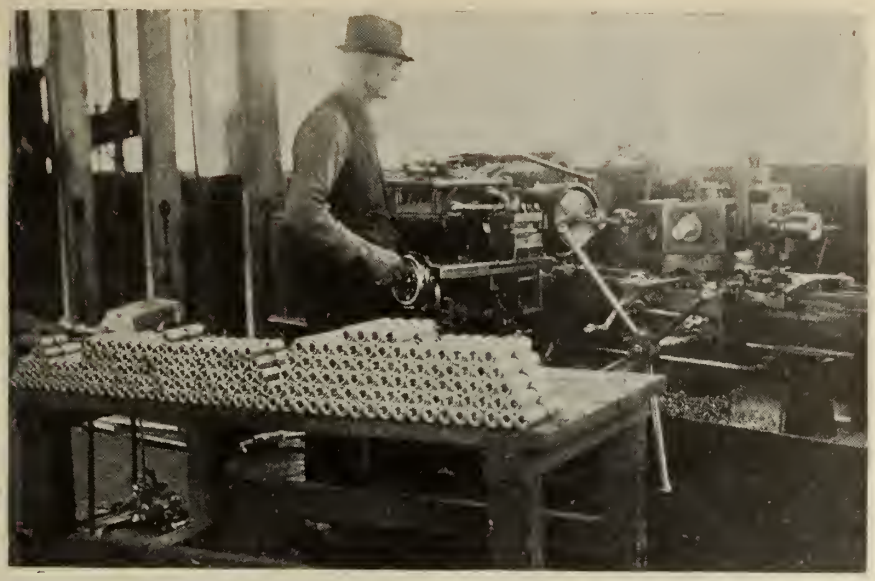
The third operation consists of milling both ends of jaws at the same time. This necessitates a special form cutter which not only mills the form at both ends, but the bevelled portion as well.

The next and fourth operation is shown in picture form. This illustrates the milling of the groove in which the thread is cut at a later operation. The type of fixture can be clearly noted, and both a roughing and finishing cut is made to ensure accuracy.

The fifth operation is that of milling the undercut, or clearance space at both ends of the jaw. The serrations are then cut at the end of jaw, after which, by means of a special hob (guided in a fixture for the purpose), the threads are hobbed to suit the chuck screw.

The turning of the jaws is next in sequence, and five tools are used at one time for this operation. The tools are arranged in multiple form, and so spaced

BROACHING THE JAW SLIDES ON CHUCK.



TURNING THE CHUCK SCREWS. NOTE THE SQUARE HOLE ATTACHMENT IN PLACE.

that they cut the various steps necessary in the jaws. A special turning fixture is used which holds eight jaws at once, the work being tightened by the clamps as shown on the photograph illustrating this operation.

All burrs, sharp corners, etc., are now removed, in other words, each jaw is gone over separately and touched up to ensure that no corners or objectionable burrs remain. The next step is that of hardening, and the jaws are bone-hardened to a depth of 1-16th of an inch. Before proceeding with the last operation, which also enters the assembly stage, we will consider the work entailed in the manufacture of the thrust blocks.

The Thrust Blocks

It is a recognized fact that the thrust block of a chuck is a part which must be carefully watched in order to secure accuracy. Special jigs have been designed to guarantee this point, and following is the sequence of operations:

The blocks are first turned on their outside diameters. They are next drilled and tapped to receive the tapered headless set-screws, which expand the stem when required. The ends are now faced, the sides straddle milled to definite size, after which two blocks are placed at a time in a special jib and the semi-circular hole which receives the chuck screw is drilled. The slots for expansion are next cut into the stem of the block.

They are now ground on their outside diameters, and on their two sides, which have previously been straddle milled, after which they are bone hardened. This completes the operations on this portion of the chuck.

The Chuck Screws

We will next consider the chuck screws. These parts are practically finished on the automatic lathe, the first operation being the rough-turning to within 1-32 in. of size as regards outside diameter. The clearance for thrust block is also roughed out at this operation. The square hole in each end of the screw is also drilled in this set up by means of the now well-known square hole attachment. Instead of the attachment being placed vertically, as in a drill press, it is placed horizontally as shown in the photograph.

The screws are now finish turned on special square centres, a mark being made on each screw to show how it was placed on the centres in order to ensure their being placed in similar position when being threaded. This threading operation is next in sequence. The screws are then finished to meet exact width as far as the centre portion is concerned, that is where the thrust blocks fit into.

A commendable feature on these screws is the fact that they are reversible. For example, suppose the square hole in one end of the screw becomes damaged and unfit for use. One need not worry, for all they need do is to reverse the screw and use the hole at the other end. This is one case where interchangeability cannot help but shine. The screws are absolutely similar on both sides of the thrust block, otherwise they could not be used in the manner described.

After the finishing operation to suit thrust blocks, all burrs are removed. The screws are next hardened and polished. This, of course, is the final operation.

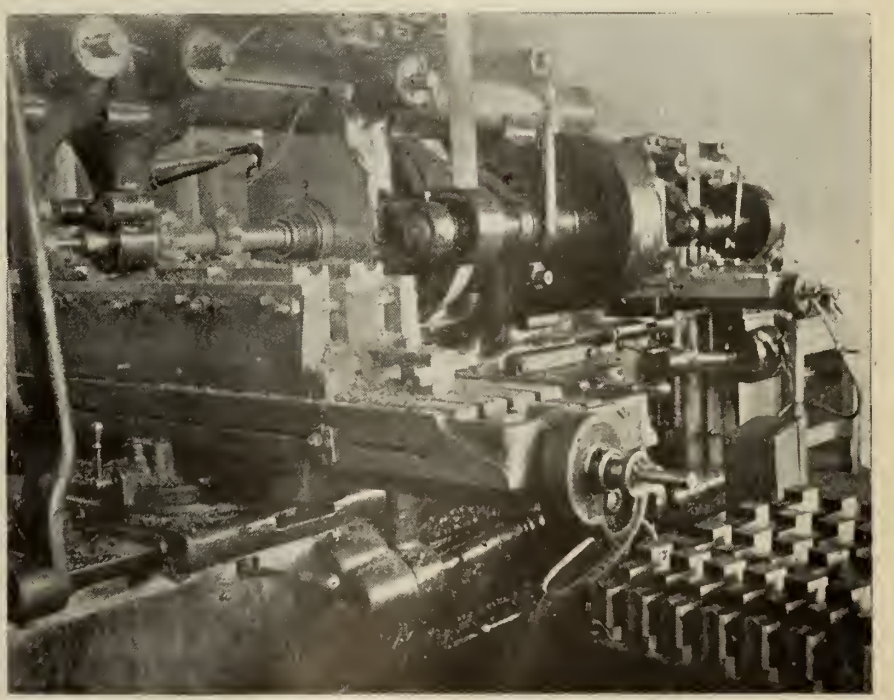
The two remaining parts, namely, the wrench and the headless taper set-screw for expanding the stem on the thrust blocks, are straight machine work, so no detailed comment is made. Having covered the main details of construction, let us proceed to the final assembly and inspection.

As shown in the illustration this assembling takes place on long benches. The chucks move up from one workman to another by steady stages. Each worker has his set task, with the result that by the time the chuck reaches the other end of the bench it is assembled, inspected, and ready to pack for shipment. The last worker on the bench packs the chucks in their cases, stencils the boxes, and piles them up on the truck, which later takes them to the warehouse.

It will be noted throughout the article that every step in the progress of manufacture has been carefully weighed in order to eliminate lost motion. The experience gained on their gun mount work stood them in good stead in the manufacture of this chuck, for having once mastered the matter of proper routing and working to close tolerances, a firm never lets go, for they realize its many advantages. This we can safely say without taking away any credit from the executive staff of the concern mentioned, that the high point in efficiency reached by them has been indirectly obtained by former war-time experience.

A notable feature in connection with this chuck is that the company issue with every chuck a one year guarantee, part of which reads as follows:

"We could make our chucks cost less



MILLING THE CHUCK JAWS IN GAUGES. NOTE TYPE OF FIXTURE USED.

if we chose to be indifferent as to quality. This, however, we will not do. We have set ourselves a high standard and are determined to live up to that standard. We believe, judging by our own experience, that there is a big and growing demand for chucks of superior design and quality such as we offer. Consequently we fully guarantee every chuck we sell. This guarantee applies both to material and workmanship. Any part of any of our chucks that is found to be defective within one year after purchase will be instantly and cheerfully replaced without charge."

Need we say more? When a firm speaks so convincingly and confidently regarding their product, it is a sure sign that both the material and accuracy of workmanship is embodied therein. The various illustrations accompanying this article give better details of the chuck's general design than text matter could ever accomplish, so we leave the reader to study the improvements embodied in this Canadian made product.

VIEW SHOWING A PORTION OF ASSEMBLING DEPARTMENT.

Pyrometers and Steel-Treaters*

By T. G. SELLECK

All modern steel treaters appreciate the value of thermo-electric pyrometers as a means of determining high temperatures, and they are in use so generally that it is a rare experience to find a steel treating plant that is not so equipped. The value of pyrometers depends, however, entirely upon the intelligence displayed in their use and the care with which they are kept standardized and calibrated. In the hands of ignorant operators they are as likely to lose their value as a full-jewcled solid gold watch would be in the hands of a chimpanzee, and to become an expensive nuisance rather than a valuable help. Yet it is not uncommon to find them being used by men that call themselves steel treaters, but who have no knowledge of the principles of construction and operation of pyrometers or of the care required to keep them in working order.

The fault lies, of course, with the employer. No employee should be trusted to use a pyrometer until he has been given some information concerning its construction, its principle of operation, and its delicacy of adjustment, as well as its limitations of accuracy; and unless he has the mental capacity to grasp these things the instrument might better be kept away from him.

The full value of a pyrometer is obtained only in the hands of an operator whose knowledge of steel treating includes a conception of temperature as indicated by color tints. This is essential because the pyrometer gives the temperature of only a small area within the furnace and the true temperature of a heating chamber can be judged only by comparing that area with the remainder of the chamber on the basis of the colors shown. It is not unusual to find men using pyrometers to whom "heat by color" means nothing.

To such men the pyrometer is a sort of wonder-instrument that tells the whole story of temperature and don't even have to be wound up. Here is a case in point

Not long ago I was called to a certain plant where some case-hardening had been done that was not satisfactory, and the owners wished to know the cause of their trouble. The parts carbonized were discs about four inches in diameter and ¼ in. thick. Upon examining them I found that they had been carbonized entirely through and were badly fused on the edges. The operator that had done the work informed me he had carried a temperature of 1600° for 5½ hours.

I asked if he was sure of his temperature, and he said yes, because his "byrometer" registered just 1600°.

I suggested that there must be something wrong with his "byrometer," since it would be impossible to fuse 20-point carbon steel at 1600° Fahr., and quite as impossible to carbonize the pieces to the saturation point in that period of time at such a temperature, to which he replied: "Well, maybe it does need fixing, but I have used it several years, and ain't had no trouble before."

I prevailed upon him to have his outfit checked, and learned later that the temperature carried was high enough to fuse a hole through the top of the plate steel box used to pack the parts, and also that, while the instrument was in good condition, the thermo-couple had been broken near the hot junction and that the elements had been twisted together and used without being welded.

In such a case, which is not unusual, the man is in as great need of being checked and calibrated as the instrument, and a superintendent who would trust results in a steel treating department to a man so lacking in the simpler essentials of steel treating, namely, common sense and watchfulness, should also be sent out to be "fixed."

In another plant where trouble develcped, conditions of another nature were found. Here the men on the job were "highly intelligent." The works manager was a college graduate, well versed in metallurgy, and his steel treater a man of more than ordinary intelligence and some years of experience. The cause of complaint was a lack of uniformity of hardness after parts had been carbonized and heat treated. That is, there was a variation of 10 points scleroscope when the parts had been given uniform heat treatment, where the allowable variation was only three points (from 77 to 80). Investigating their methods of carbonizing, it was a wonder that the variations did not exceed 10 points. The carbonizing boxes were packed in the regular way, placed in a cold furnace, and the temperature raised as rapidly as possible to 1800°. The thermo-couple, unprotected, was placed in the furnace through a top-vent about the centre of the heating chamber. The furnace temperature was maintained at 1800° for three or four hours, the fire shut off, and the boxes allowed to cool with the furnace. With technical knowledge and years of experience in the work, these men use the pyrometer with but little more judgment than the poor ignorant fellow whose "byrometer" had been such a faithful friend to him for so many years that he had no idea the little matter of a broken couple could make any difference.

In one spot of the furnace they probably had 1800°, and that was the very hottest spot in the furnace, while other parts of the heating chamber probably varied in temperature much more than the product varied in scleroscope hardness. Working within narrow limits of hardness and tempting fate with reckless heating, indicates the need of "calibration to the job" for even intelligent experienced men

*Abstract from "Journal" of the American Steel Treaters' Society.

The Work of the British Trade Commission

Seeking to Promote Trade Within the Empire—How Canadian Firms Can be Helped by This Organization—Analyzing Marketing Chances is a Very Helpful Service to British Firms

"ONE of the outstanding features of the commercial and industrial situation is the tendency of the various units of the British Empire to trade one with the other," said Mr. F. W. Field, British Trade Commissioner in Ontario, in an interview with CANADIAN MACHINERY. "This is a most interesting development, and if the policy is given the support and encouragement it deserves the volume of trade within the British Empire will grow to considerable proportions. In Canada the business community are not entirely familiar with the raw materials, semi-manufactured and manufactured products which can be secured in other parts of the Empire. While the desire is naturally first to purchase in Canada, it is equally the wish to purchase whatever possible in the United Kingdom and the British Empire generally.

"Manufacturers and traders in the United Kingdom are turning the channel of their purchases of raw materials and some manufactured articles from foreign countries, to Canada and the other Dominions. During the past year, this country has benefited by several such arrangements. The work of trading within the Empire is being encouraged by the British Government's trade commissioner service, in connection with which have been opened more than a dozen offices in the Dominions and in India. The Canadian Government trade commissioner service is also extending to various parts of the Empire. We appear to be on the eve of an important development of trading within the Empire, a development fraught with immense possibilities.

"The British Government trade commissioner service in Canada comprises three offices, one each at Montreal, Toronto, and Winnipeg. An office may be opened at Vancouver in the near future. A British Government trade commissioner stationed in any Dominion or colony, and responsible for a particular area, has to make himself fully conversant with:

1. The business houses trading in this area, as well as the local manufacturing and public bodies.

2. The quantity and value that the country purchases of any articles which the British manufacturer and merchant can supply.

3. The tariff and customs regulations for goods entering the country.

4. The foreign goods competing with British, their method of sale, their character and price.

5. Freights and charges and the comparative rates between British ports and foreign ports serving his area.

"All these categories of information are essential to any British exporting house, and an important function of a trade commissioner is to obtain precise details with regard to them. For instance, take category (1); these concerns consist, as they do in Great Britain, of:

(a) Importing merchants — generally wholesalers, though in some instances they are retailers.

(b) Local manufacturers who are importing machinery, material or equipment.

(c) Local agents who import buying for their own account, some with an exclusive right to serve a particular market as well as agents acting on commission.

(d) The big railway corporations, municipalities and public works, as well as agents acting on commission.

(e) Mining companies carrying on mining and other similar operations, who are also large buyers; and

(f) Shipping companies, telegraph companies and wireless companies, who are also considerable importers from time to time.

"The trade commissioner works in close touch with the Government of the territory to which he is attached, and with resources at his disposal he is able to obtain considerable information about all classes of importers.

How It Works Both Ways

"Every exporter wants to know the extent to which an Empire market purchases goods which the United Kingdom can supply. In order to furnish an answer the commissioner must analyze the figures of trade so that articles may be eliminated in which business would be highly improbable. The local market has to be scrutinized from two points of view:

1. What manufactured articles the British manufacturer can supply.

2. What entrepot trade can be done by British merchants in articles such as plumbago, spices, rubber, tea, coffee, sugar, etc.

"While the primary duty of the British trade commissioners is to ascertain what opportunities exist, and by what means these opportunities can be best utilized for extending in their area the trade of the United Kingdom, and of those other parts of the Empire which desire to utilize the service, the British Government has instructed the trade commissioners to regard it as their general duty to endeavor to promote the trade of the British Empire as a whole within the area to which they are appointed.

"Many organizations are working with a view to closer Anglo-Canadian trade relations. In addition to the Canadian trade commissioners in the United Kingdom there is the Canadian Trade Mission. The Federation of British Industries, representing approximately 19,000 United Kingdom firms, has effected an arrangement with the Canadian Manufacturers' Association for the interchange of views and information. The British Agents' Association with offices at Montreal has for eighteen years been doing good work on behalf of British trade in Canada. During the past year the Canadian Association of British Manufacturers and their representatives was formed with the assistance of the British Trade Commissioners in Canada. This association, with branches at Toronto and Montreal, represents a large number of United Kingdom firms trading in Canada and has done effective work even in the early stages of its career.

"The Canadian Government has accepted the offer of the Imperial Government and will utilize the service of the British trade commissioners at points where there is not a Canadian Government trade commissioner. The Government of India have expressed a desire to avail themselves of the services of the British Trade Commissioner Service in Canada as well as in other parts of the British Empire. Further, the trade commissioners will be willing to assist importers seeking sources of supply of raw materials, etc., within the Empire.

"The Trade Commissioner Service in the Dominion can only justify itself in proportion to the extent to which it is used by those interested in the development of trade between the United Kingdom, Canada, and other parts of the British Empire."

IT WAS A GOOD NAME AT THAT

In an Irish city a zealous policeman caught a cab driver in the act of reckless driving. When he had brought the man to a stop the officer asked:

"What's your name?"

"Ye' bethher try and find out." was the peevish response.

"Sure an' I will," said the officer as he went round to the side of the cab where, according to the Irish regulations the name should have been painted. The letters had, however, been rubbed off.

"Oh, ho!" cried the policeman. "Now we'll git yourself in worst than iver. Your name seems to be oblitherated."

"Tis not so!" shouted the driver indignantly. "Tis O'Sullivan."

It is hardly believable that it costs $2,000,000 annually to remove the snow from the streets of New York, also that millionaires are nearly three times as numerous in the United States to-day as they were in 1914.

Canadians Looking for Export Business

Several Points That Should be Remembered in Connection With Forwarding Goods—Much Business in Hand Makes it Harder for Canadian Firms to Make Bid for Export

THE work of rounding up Canadian manufacturers who are going to be represented at the Canadian Industries Exhibition, London, Eng., June 3 to 17, is meeting with considerable success. Mr. O. C. Pease is Canadian representative of the exhibition, and has visited nearly all the industrial centres.

Some of the Canadian industrial concerns find it hard to consider an exporting propaganda. They have so much business in sight that it is impossible for them to keep pace with their delivery schedule. Others, though, are looking forward to the time when the order of things may be reversed, and when they may be more keen on booking business than they are at present.

Mr Pease has issued the following instructions to the Canadian exhibitor in regard to sending his goods to London. There is considerable material in the letter that it would be well for Canadians contemplating export to put away for reference. It is necessary that the customs details should be adhered to very closely if there is to be as little delay as possible in getting the material over. The instructions are as follows:

Insurance

Shippers should specify what clauses they require in insurance, whether marine, F. P. A. (free against partial loss, a cheaper rate), or F. P. A. 3 per cent. package or shipment.

Forwarding

Owing to the formalities of export shipping, it is to be understood by shippers that a contract number for space, and a permit number for transportation, have to be obtained from steamship and railway companies, and which should be shown upon all shipping papers. This information will be obtained by Morison, Pollexfen & Blair, and forwarded to each shipper for guidance.

The company of Morison, Pollexfen & Blair, has been chosen by the Canadian Manufacturers' Association and the exhibition management to take care of all shipments placed in their charge by intending exhibitors. The Morison Company is one of the best of the English forwarding houses, has been established in the United Kingdom for over sixty years, and is thoroughly well represented in Canada.

In brief, the Merison Company will collect all material and assemble it at the Port of Montreal. The company will then remark all packages and crates and arrange for the shipment of all material in one consignment. This one consignment will be shipped to the Morison Company at the Royal Agricultural Hall, Islington, London, Eng. The goods will arrive at the point of destination on or about the 24th of May. For the information of shippers who are handling their own consignments, I may say that the hall will be open to receive shipments on and after May 20th.

Your company's representative in England will thus be able to proceed direct to the representative of Morison, Pollexfen & Blair at the hall, and on payment of all shipping charges and transportation costs, etc., will be able to obtain a release of your exhibition material and proceed at once upon the arrangement of your space contracted for.

Exhibitors who intend to place their shipments in bulk consignment must advise Morison, Pollexfen & Blair just as quickly as possible, so that the latter may make full arrangements regarding ocean space. A knowledge of the weights, measurements, etc., of shipments is of course absolutely necessary.

The Morison Company of Montreal and Teronto offers every facility they have to inexperienced shippers, and I suggest to the latter that they utilize the services of the forwarding agents to the fullest possible extent.

Yours very truly,
O. C. PEASE,
Sole Canadian Representative.

Instructions Re Shipment of Exhibition Material

If you have not already advised me regarding the value, weight and cubic capacity of your intended shipment, kindly send this information at once to Morison, Pollexfen & Blair of Canada, Ltd., 308 St. Nicholas Building, Montreal, P.Q. Shippers in Ontario and the West should send this information to Morison, Pollexfen & Blair Toronto office, 301 Tyrrell Building, 95 King Street East, which office will look after all details and supply all necessary information to Western shippers.

Canadian Consignment

All exhibition consignments must be forwarded to Morison, Pollexfen & Blair, 308 St. Nicholas Building, Montreal, P.Q., timed to arrive at that point not later than May 3. Responsibility in this matter rests entirely upon the individual shipper. Information and assistance in this respect may be obtained, however, from either the Toronto or Montreal offices of Morison, Pollexfen & Blair.

Crating and Marking

All exhibition material must be carefully and strongly crated. Each case should be marked addressed to Morison, Pollexfen & Blair, Montreal. Each case should bear the following marks:

Distinguishing shipping mark (if I were shipping, for instance, I would mark each case O. C. P. No. 1, 2 and 3, etc.).

Gross and net weight of each case.

Dimensions of case.

Shipper's name.

This information should be shown on at least two sides and one end of each case.

Invoices

Invoices in duplicate should be sent to Morison, Pollexfen & Blair, Montreal, showing the net value of contents of whole shipment—this for insurance and statistical purposes.

Charges

All inland freight charges must be prepaid by the shippers, including handling charges, cartage, deck dues and wharfage.

If you wish to forward "Ocean Charges Collect," please notify Morison, Pollexfen & Blair. The forwarding company can arrange this and collect from your representative at the Royal Agricultural Hall.

It is to be pointed out that the prepaying of ocean charges is to the advantage of the shipper owing to the exchange situation.

Up to this date the following is a complete list of the Canadian exhibitors:

The Bell Piano & Organ Co., Ltd., Guelph, Ont.

Chase Tractor Corporation Ltd., Toronto.

Hill, Seddon & Co., Toronto.

Sales Limited, Toronto.

White Swan Spices & Cereals, Ltd., Toronto.

H. Levy & Sons, Ltd., Montreal.

The Basque Chemical Co., Toronto.

Non-Such Mfg. Co., Toronto.

Satinette Products Mfg. Co., Toronto.

Normandy Tire & Rubber Co., Toronto.

Smalls, Ltd., Montreal.

J. B. Heeble & Sons, Ltd., Toronto.

Megantic Broom Mfg. Co., Lake Megantic, Que.

Meakins & Sons, Ltd., Hamilton.

Stratford Mfg. Co., Ltd., Stratford.

Schultz Bros., Co., Brantford.

Canadian Veneering Co., Actonvale.

Springer Lock Mfg. Co., Belleville.

Gavenite Products, Ltd., Toronto.

Canadian Woodenware Co., St. Thomas.

Kindel Bed Co., Ltd., Stratford.

McLagan Furniture Co., Ltd., Stratford.

C. A. Dunham Co., Ltd., Toronto.

Willard's Chocolates, Ltd., Toronto.

Canadian Polishes, Ltd., Hamilton.

Dominion Machinery Co., Toronto.

Staunton's, Ltd., Toronto.

Maxwells, Ltd., St. Marys.

Quebec Graphite Co., Ltd., Ottawa.

C. H. Peters' Sons, Ltd., St. John, N.B.

The Breithaupt Leather Co., Ltd., Kitchener.

Acadia Gas Engines, Ltd., Bridgewater, N.S.

Canada Cycle & Motor Co., Ltd., Toronto.
Deloro Smelting & Refining Co., Ltd., Deloro.
The Cowan Co., Ltd., Toronto.
A. Ramsay & Son Co., Montreal.
Canadian Biscuit & Confectionery Export Co., Ltd., Toronto.
The Export Association of Canada, Ltd., Montreal.
Canadian Bronze Powder Works, Ltd., Montreal.
The Whitman & Barnes Mfg. Co., St. Catharines.
The Williams Piano Co., Ltd., Oshawa.
The Steel Co. of Canada, Ltd., Hamilton.
Simmons, Ltd., Montreal.
Spramotor Co., London.
Imperial Varnish & Color Co., Ltd., Toronto.
J. H. Connor & Son, Ltd., Ottawa.
Tetreault Shoe Co., Ltd., Montreal.
Wettlaufer Bros., Ltd., Toronto.
The Maple Tree Producers' Association, Ltd., Montreal.
Nova Scotia Steel & Coal Co., Ltd., New Glasgow, N.S.
C. O. Clark & Bro., Montreal.
C. J. Bodley Co., Ltd., Toronto.
The McCormick Mfg. Co., London.
Robertson Bros., Ltd., Toronto.
The Martin-Orme Piano Co., Ltd., Ottawa.
The McClary Mfg. Co., Ltd., London.
William Neilson, Ltd., Toronto.
Sherlock-Manning Piano Co., Ltd., London.
Ottawa Paint Works, Ltd., Ottawa.
The Goodyear Tire & Rubber Co., Ltd., Toronto.
The Kitchener Export Association, Kitchener.
Sheet Metal Products Co., Ltd., Toronto.
E. T. Wright & Co., Hamilton.
Massey-Harris Co., Torento.
International Harvester Co., Ltd., Hamilton.
C. P. R. and C. P. O. S., London, England.
Canadian Government Merchant Marine.
Reg. N. Boxer Co., Ltd., Toronto.
Shawinigan Paper Co., Ltd., Montreal.

EFFECT OF HYDROGEN ON IRON AND STEEL

German technologists have continued their researches since the armistice, one of these being the effect of various gases on iron and steel. The results suggest, says the London "Ironmonger," that if the gases could be conveniently and safely applied, some of them, and particularly hydrogen, might be employed with advantage in certain metallurgical operations, as in the cementation process of making steel and in refining and hardening. The use of hydrogen with iron at high temperatures, however, unfortunately is difficult and dangerous, apart altogether from its high cost, and it is not likely therefore that it will be used for any of these purposes on any commercial scale, though it may continue to be used for research. When that gas is forced through molten iron it is found that any non-metals present such as arsenic, carbon, phosphorus, silicon, sulphur or oxygen are converted into gaseous hydrides while the hydride itself in any particular case may be split up again and the nascent hydrogen set free, under which conditions it will reduce any silica present in the metal, even at so low a temperature as 1,292 deg. Fahr., the gaseous silicon hydride resulting.

From the practical point of view the most interesting of the results of this particular research lies in the revelation that a malleable iron may be made directly by means of oxygen and hydrogen, not only from molten iron but from solid pig. The inert character of nitrogen is confirmed by this research, that gas having no effect on the non-metals in iron, either in the solid or liquid state, notwithstanding the view very generally held that the carbon in iron will diminish if the metal be heated in an atmosphere of nitrogen, the real explanation of this diminution being the action of small portions of oxygen retained in the vessel with the nitrogen.

CARE AND STUDY NECESSARY TO DEVELOPING TRADE WITH CHINA NOW

TRADE COMMISSIONER ROSS, writing in the Bulletin, has the following reference to Canada getting trade with China:

Methods Necessary to Study

Assuming that we are really seriously desirous of developing trade with China, there are several points that are very necessary to understand and certain methods which must be followed. As it is now, Canadian manufacturers in many instances demand that business be brought to their doors; factory prices are asked and letters of credit demanded. In export trade such rules are very stringent, but would not be so bad if our prices were lower than those of other countries, but unfortunately such is not the case, but rather the reverse. Shipping and routes must be better understood by our people than at present, and at least quotations must be made f. o. b. Vancouver. Certain manufacturers in Eastern Canada have written that this cannot be done; it would seem that it should be the business of boards of trade to see that it can be done. It is very remarkable that exporters of Great Britain and the United States are able to quote c. i. f. rate Shanghai, and that Canadian manufacturers cannot quote f. o. b. Vancouver. Who is likely to get the business under such conditions? In respect to payments, letters of credit will not be given by certain firms; it is therefore necessary that a shipper should know his customer; much business is lost by this hard and fast rule of demanding letters of credit in every case. Many shipments of goods from Europe and America are consigned on time payment; this is not difficult when the shipper knows the character and standing of his customers.

In conclusion, unless more of our people will go to the trouble and expense of visiting this market and make a greater effort than they have hitherto done, our trade with China is not likely to greatly expand. Probably the greatest need of all, however, is that some Canadian commercial concerns should establish themselves in Shanghai, with branches in certain of the outports. At present Canadian goods have no distinct recognition in this market; the market is so vast and foreign goods so plentiful that the small quantity coming from Canada is never observed. There are no special advantages or preferences to be obtained by any country here; all are upon the same footing and receive the same privileges. The market is keenly competitive and every nation is represented. Nevertheless Canada enjoys some distinct advantages in the way of direct steamship connection, and if the right methods are followed should be able to hold its own among the others and to obtain a fair share of the developing trade of this great country.

The following "don'ts" from "Belting" should interest the mechanic in general:

"Don't attempt to stop a machine by grabbing the belt.

"Don't throw, by hand, a belt with which you are not familiar.

"Don't lean the end of a ladder against a moving shaft; rest the end on the stringer.

"Don't place a ladder between two shafts to adjust a belt; place it on the outer sides.

"Don't put on a belt without stopping the machinery, or at least reducing the speed one-half.

"Don't, when splicing a belt, leave ragged ends or projections that might catch in someone's clothing.

"Don't, when throwing off belts, allow two belts to occupy the same space between two pulleys on the driving shaft.

"Don't try to release an overhead belt that is caught and begins to wind around the shaft; get away from it and have the power shut off immediately.

"Don't leave any tools on the stringers overhead after having tightened the clutch fingers or parts of a countershaft, as the vibration will cause them to fall.

"Don't use a short pole when replacing an overhead belt upon a pulley that is in motion; use a pole nearly equal to the distance from the pulley to the floor."

Animal and vegetable oils both oxidize or gum on exposure to the air. Spread thinly over inflammable material, they will create spontaneous combustion. Linseed oil is an excellent example of gumming oil—highly desirable for paint but not for lubricating purposes. All seed oils have this common characteristic in greater or lesser degree.

The Electrolytic Production of Oxygen

This Paper Was Read Before the British Acetylene and Welding Association and Should Prove of Interest to Readers in General. Cost Items Are Left in Original State for the Sake of Comparison

By G. I. STANFIELD

THE subject of our paper is one which calls for a good deal of care, both in its preparation and perusal, as, owing to the enormous progress made in the oxy-acetylene welding and kindred industries, we have now come to a stage where the question of a cheap and certain supply of oxygen is of vital necessity to economical and efficient application of these processes.

It is somewhat difficult in a paper of this description to avoid the use of formulae, but, as far as possible, we will leave the more technical items aside altogether. These have not much bearing from the point of view of general interest, and, consequently, are only of importance to the individuals more concerned in the manufacture and installation of gas-producing plants.

As you know, oxygen may be produced from different substances, and the whole history in detail of the various methods of production, together with the successive steps leading up to our present-day output, is a most interesting study.

Oxygen gas is produced in three different ways, namely:—

i. By the chemical process.
ii. By the liquid air process.
iii. By electrolysis of water.

Chemical Process

In the chemical process, a mixture of manganese dioxide is mixed with other chemicals to form a slow-burning compound, and when this is ignited in a hermetically-sealed container, built to withstand high pressure, a fairly pure supply of oxygen is the result. The chief drawback to this method is the high cost of production, which precludes the application in a general way; but in special cases this type of oxygen generator is a valuable asset, and particularly in certain inaccessible parts of South America and Africa, where cylinders of gas are not readily obtainable, has extended the useful sphere of oxy-acetylene welding to a remarkable degree.

Liquid Air Process

The second means of production, namely, the liquid air method, is responsible for the major portion of our oxygen at the present day, and the manner in which the supply factories have been erected and maintained in close proximity to the main manufacturing centres is undoubtedly one main cause of the wide-spread usage of oxy-acetylene welding, etc.

The history of the liquid air plant is very interesting, indeed, and the story of the early pioneer research and later developments read almost like romance. Briefly, the discovery was due largely to one of the early physicists, who argued that as water by decrease of temperature is transformed to a solid, and by application of heat becomes a gas, that the converse law should apply to gases.

Pursuing this line of thought, careful experiments were made with chlorine, which is one of our most readily liquefied gases, the result proving to its delighted discoverer that his theory was correct.

For many years a number of the gases, including hydrogen and oxygen, defied all attempts at liquefaction, and were classified as permanent gases which could not be reduced to any other form. Improved apparatus utilized in the research, however, proved a great help, and step by step the definite goal of our present output of oxygen was achieved. Many set-backs, due to seemingly impossible barriers were encountered, but gradually, one by one, these were broken down.

Liquid air contains, approximately, 20 per cent. of oxygen and 80 per cent. of nitrogen, and other rare gases. The boiling point of liquid oxygen, being somewhat lower than that of liquid nitrogen, provides a means of separating the latter gas, leaving almost pure oxygen.

Electrolytic Process

This brief outline now brings us up to the main point of our paper, namely, the production of oxygen by electrolysis. The development of the electrolytic process has been carried out on the continent of Europe and in America to a greater extent than here. In all probability, the two factors causing this being the cheaper cost of electricity and the larger use of oxygen and hydrogen, the former in oxy-acetylene welding, and both in combination in oxy-hydrogen cutting, whilst the hydrogen alone has been largely used in treatment of fats in soap making and similar industries.

As early as the year 1800, it was discovered that in discharging a Voltaic pile through water, an evolution of gases took place at the electrodes, one electrode evidently producing twice as much gas as the other. Not much notice was taken of this at the moment, until someone analyzed the gases produced, with the result that water was found to be composed of H_2O; or two volumes of hydrogen to one of oxygen. No further notice was taken until about 80 years later, when D'Arsonval, requiring pure oxygen for certain research work, made a small and crude but efficient plant for the production of this gas. The commercial production of oxygen and hydrogen by this process was, however, not proceeded with for many years.

Meantime, a number of facts and details were established in connection with the electrolysis of water, one of which being the fact that a voltage of 1.7 (in round figures) was necessary to effect the decomposition. It follows from this that, in order to be successful, economical and efficient, any method of electrolysis must be as near the theoretical figure as possible, and many of our present-day plants have succeeded in producing the gases very economically indeed.

Another interesting item, worthy of note, is that 100 cubic feet of oxygen weigh 8.926 lbs., whilst 200 cubic feet of hydrogen weigh 1.118 lbs.; thus, one gallon of distilled water approximately produces 100 cubic feet of oxygen and 200 cubic feet of hydrogen.

A further point of great importance was brought to light as a result of experiment, namely, the fact that pure water is a non-conductor of electricity. It, therefore, becomes necessary to overcome this point, which can be done by adding acid to the water. The disadvantage of acid in attacking the electrodes forms a very serious impediment, however, and eventually alkaline solutions, which are comparatively harmless, unless containing chlorine, became generally used. The principal solutions are caustic potash, caustic soda, carbonate of potash and carbonate of soda.

Caustic potash forms an ideal solution in every way, especially for types of generators employing asbestos mesh screens, as these are not affected by the potash. The high price of the potash and difficulty in obtaining same in large quantities, however, forms a serious drawback to its employment on a large scale.

Caustic soda, on the other hand, is much cheaper, and is readily obtained in an almost pure state. It forms an ideal conductor of low specific resistance, approximately equal to caustic potash, but may rapidly destroy the asbestos screen, and cannot usually be utilized in connection with the plants requiring these diaphragms. From a handling point of view, it is terrible, as, used at a strength of about 30 deg. Beaume (or equal to a specific gravity of 1.27), it burns holes in one's clothes and boots to an alarming extent, and is particularly painful if in contact with the skin.

Great care is required in the mixing of the solution, therefore, and rubber gloves and boots are necessary to protect one somewhat against its ravages.

Pearl ash, or carbonate of potash, and carbonate of soda are frequently used, but are of a higher specific resistance than caustic soda and caustic potash, thus a large percentage of the voltage employed is wasted in overcom-

ing the resistance, thereby detracting somewhat from the efficiency of the apparatus.

Various theories were formed as to the actual operations taking place during electrolysis, but it is now generally agreed that actual liberation takes place only on the face of the electrodes, whilst both gases follow the natural law of electro-magnetics.

Oxygen, being a negative gas, is always attracted and liberated at the positive pole or anode, whilst hydrogen, being electro positive, is liberated at the negative pole of the battery (or kathode).

Production of the gases is, in every way, a simple and natural function; the great difficulty encountered lies in keeping two gases, which have a natural affinity for each other, apart and distinct. Sometimes they contrive to unite, despite all efforts to separate them.

The different plants which have been constructed from time to time, therefore, pretty much resemble one another, so far as the electrodes are concerned, differing only in minor details. The principal feature of each type of plant, however, is the system of keeping the gases apart after separation, and we will take three or four outstanding types of plants as examples.

In all modern plants where cast-iron electrodes are utilized, it is the practice to have these made of a close-grained cast iron, carefully cleaned and nickel-plated, in order to prevent oxidation.

Perhaps the earliest successful commercial plants employed were those of Garuti, Siemen and Schuckert, whose plants all had one feature in common—namely, a diaphragm of conductive material. A description of the construction of the first-named will, perhaps, suffice as example of the type which, however, differ considerably in detail. The Garuti plant consists of a series of inverted cells built with open ends. These are entirely immersed in the electrolyte. The electrodes are mounted each in its own cell, or gas bell, perhaps, would be the better term, and the whole so arranged that the gas from one set of cells producing hydrogen are led into a collecting chamber, the oxygen being treated similarly.

No doubt the most familiar type of plant at the present time is that which employs a diaphragm of finely-woven asbestos stretched between the electrodes. This material, when immersed in the electrolyte, forms a very efficient gas screen, permitting the electrical current to pass freely from one electrode to another through the solution held in the pores of the asbestos diaphragm. This diaphragm, however, is practically impervious to gas, and, consequently, the gases are not liable to mix. In this type of plant we may classify the Oerlikon and Integral Oxygen Co.'s apparatus.

The Geeraerd System is on differing lines, as it is claimed to dispense altogether with a diaphragm, and to separate the gas by mechanical methods.

Oerlikon Plant

The apparatus manufactured by Messrs. The Oerlikon Co., consists of a series of electrodes, each separated and insulated from its neighbor by a diaphragm of woven asbestos, which is furnished with a specially-prepared rubber border. The electrodes are approximately square, and, as will be seen from the illustration, are furnished with grooves vertically arranged up the plate. A gas channel is provided at each of the upper corners, and these are so arranged that each channel is connected by means of a small passage to one side of the plate.

Referring to the illustration of the complete battery, it is clear that the plates are mounted after the manner of a filter press, the electrodes and diaphragms being placed alternatively. The reason for the rubber border on the diaphragm now becomes clear, as this fitting on the machined face of the electrode provides a water-tight joint.

The whole of the plates are screwed up in the press, the projecting arms on each side resting on insulated tubes through which passes the main staybolts. The only path open to the current, therefore, is through the electrolyte and electrode faces. The gas from each side of the electrode is passed into its respective channel, and oxygen and hydrogen channels each form practically one continuous tube.

The large separation pots are in communication with the main channels, and to there the gases pass, becoming separated from the solution, which returns to the cell, maintaining the working level of liquid. It must be noted that the only material used in this and other electrolytic apparatus is pure distilled water, which has to be added from time to time, in order to compensate for the gas generated.

The soda in solution does not require replenishing, save only at very long intervals.

The Integral Oxygen Co.'s Plant

The latest apparatus placed on the market by the Integral Oxygen Co. is a very sound mechanically-arranged plant. One of the good features of this apparatus is that each cell is entirely separate, only being in electrical contact with its neighbor. A reference to the illustration, showing the cell with part of one electrode broken away, gives a very clear idea of its construction. The main casting consists of what might be termed a frame section, in the centre of which is stretched the asbestos diaphragm. The diaphragm is held in position by means of a plate screwed to the main body. Each of the door plates forms an electrode, which is insulated from the main casting, to which it is bolted, by means of a special joint on the face, bushed bolt holes and insulating washers.

The faces of these plates are arranged with small pyramid-shaped projections, which give a very largely-increased electrode surface. The plate forming the anode or positive plate at which the oxygen is liberated, is heavily nickel plated to resist attack by the oxygen gas.

A very ingenious feature is provided in the glass bells at the upper part of the cell, into two of which the hydrogen and oxygen gas, respectively, is led. The gases pass through a swan-necked pipe to below the water level in the glass bells, and thus the gas, bubbling through the water, gives at all times a ready and visible indication of the working of the plant.

The third gas bell is for the purpose of a water-feed indicator, and distilled water is allowed to drip into this at a rate corresponding to the outflow of gas. In event of any mishap taking place, any of the cells may be taken out, without any loss of time, and the battery again put into operation by substituting copper connections in place of the faulty cell.

Geeraerd System

A somewhat novel plant was invented in the year 1916 by Monsieur Geeraerd, a Belgian engineer, and, generally speaking, has opened up a new system of gas production. Hitherto, all the plants which we have reviewed have had some form of diaphragm interposed between the electrodes; but in this plant such diaphragm is entirely done away with, and the gas separated on what is claimed to be an entirely mechanical principle. Each cell consists of a frame-like section, the electrodes being in the centre. Two gas channels, of course, are provided, each of which leads, by means of a duct, to opposite sides of the plate. The interior of the cell is fitted with a large number of glass vanes, which are held in position by ebonite grooved blocks lying at each end within the surface of the outer flange, and retained by a fin projecting on the casting. Both sides of the plate are mounted alike in this respect, and each cell is separated from its neighbor by a rubber joint which projects downwords into the cell for a space of about four inches, at the outer extremity between the faces, acting both as an insulator and a water-tight joint. The cells are in communication with each other at the bottom through a series of holes, which permit a level of electrolyte to be constant throughout the battery. In order to appreciate the principle upon which this plant works, it is necessary to imagine a single cell with the glass vanes in position, and filled with the electrolyte to the top. As current is passed through and decomposition takes place on the face of the electrodes, the gases are liberated in the form of small bubbles, and naturally rise to the top of the cell. One would think that the fact of the hydrogen being liberated on the one side of the cell and the oxygen being liberated on the other side of the same cell that a mixture of the gases would take place. This, however, does

caught by a glass vane and is rejected and deflected towards the electrode at which it was formed. The upward movement of the gases to the top of the cell causes a circulatory movement in the electrolyte, which has a tendency to accelerate the passage of the gas up the plate.

A small battery of twenty cells is shown also, complete with the gas separator pots and filling funnel mounted in position, though in practice it is usual to have the gas off-takes in the centre of the battery instead of one end. The purpose fulfilled by the projecting rubber screen at the top of the cell is to prevent the gases mixing.

Installation Points

The modern plant may be taken altogether as a perfectly safe apparatus to instal. No doubt the fact of the dangerous qualities of the gases may, hitherto, have deterred some firms from installing the plant.

There is, however, no more risk in connection with oxygen and hydrogen than with our own domestic supply of town gas. Of course, when people begin to look for a gas leak with a candle, and find it, there is apt to be some little consternation. It is not fair, however, to blame the gas supply for that.

Certain precautions should be taken, at all times, and these are:—

1. The generating station should be well lighted, both by sufficient windows and well-arranged electric lighting for night use.

2. A constant room temperature should be maintained, as this both saves current which has to be utilized in warming up the plant to a working temperature and does away with risk of freezing in winter.

3. Good ventilation should be provided in both generating house, compressing rooms and filling station, and, if possible, separate filling stations for each gas should be provided, unless the filling station is of ample size. On the Continent, certain regulations compel a wall, about six feet high, between compressing and filling stations where, in the latter, motor-driven compressors are used.

4. A log sheet should be provided and kept regularly at stated intervals, whilst the gas analysis should be carefully taken and noted. (The analysis is quite simple, by the way.) The advantage of keeping these records is apparent, as the performance of the plant can be carefully watched, and if the plant shows a high internal resistance, the electrolyte might be strengthened if weak, or cleaned out if necessary.

5. Hydraulic seals should be installed between the plant and gas-holder.

6. It is usually better and safer to have an oxygen purifier inserted between the plant and gas-holder, consisting of a mass of platinized asbestos heated by a platinum spiral connected in shunt with two or three cells of the battery. The current employed to keep this working is very minute, and it is impossible for an igniting mixture of oxygen and hydrogen to pass this and accumulate in the gas-holder. Should there be a small percentage of hydrogen mixed with the oxygen, the purifier will consume the hydrogen, causing a recombination of H_2O in form of water vapor. The oxygen collecting in the gas-holder then, at all times, ought to be about 99.7 per cent. of purity.

Ignition and slow combustion usually take place with about 94 per cent. of oxygen and 6 per cent. of hydrogen, whilst 8 per cent. of hydrogen gives an explosive mixture, though this is no more alarming than a back-fire in an acetylene blow-pipe.

Oxygen Analysis

Different methods are employed for analyzing the gas, but a very simple and ready means is provided by a Hempel's graduated burette, with levelling tube, and a simple absorption pipette, the latter being charged with clippings of copper foil. Into this is poured a solution of one-third strong ammonia, one-third ammonia carbonate liquor (made by dissolving ammonia carbonate in ammonia), and one-third distilled water.

The Hempels burette, graduated to 100 cubic centimetres, and its levelling tube, is first of all filled with distilled water and all air excluded. A supply of the oxygen gas to be tested is filled in to measure 50 cubic centimetres. The air is then excluded from the pipette and the gas siphoned into the pipette.

The free oxygen rapidly combines with the copper in forming oxide of copper, which gives the bluish tinge in the pipette, and an occasional shaking expedites the process in removing the oxide from the surface of the copper. When the absorption is complete, the remaining gas is siphoned back to the burette and the figure read off. As this is the result of 50 cubic centimetres, it follows that the reading must be multiplied by two in order to give the correct percentage of impurity.

Diagram of Layout of Plant

This diagram is applicable to any electrolytic installation, and should be quite clear. The electrical connections to the plant are shown, together with the pipe lines leading to gas-holders, and from there to the filling stations.

In cases where filling stations are not required, the gases pass through low pressure compressors and receivers. Piping from there leads on to the welding benches, where provision is made for the oxygen regulators as usual.

Application

Whatever type of plant may be employed, it must be understood that the chief point in our discussion lies in the application of the oxygen gas to our particular industry. It is, of course, impossible to give cost prices of the not happen, as each bubble of gas is various plants, but perhaps our illustration may serve as a method of arriving at the cost of oxygen production. In dealing with these figures, it is difficult to give anything like the actual estimate of gas cost, for the simple reason that the cost of electrical energy varies in almost every district, and also, in many cases, in accordance with demand. A works situated in a small town may have to pay as much as 2d. per B.O.T. unit, whilst another concern, which employs blast furnaces and utilizes the waste gas in generating its own power, produces electrical energy at a figure which is almost negligible. In either case, an important factor ruling the question of a works installing its own oxygen plant, is the carriage and handling charges which have to be paid on the full and empty cylinders. The author, in his investigations, has frequently found that these are not always included in the estimate of the cost of gas; but is only right that they should be.

The examples of quotation which we give as illustration will, perhaps, show the number of ways in which the subject might be treated, according to the circumstances under which the gas is to be produced and used.

The first case we will take is the works which is using a quantity of 5,000 cubic feet of oxygen per week, but which gas can only be produced during the hours of work, say 50 hours. In the second case, we will take the cost of production when it is possible to run the plant 24 hours per day for five days per week. The first proposition requires nearly double the capital outlay of the second as, naturally, the generating plant has to be of larger capacity, though in the second case the storage capacity has to be greater. The interesting part lies in the comparative return on capital outlay.

It must, of course, be clearly understood that these figures are only representative and do not apply to any particular plant.

Another question governing the capital outlay is the point as to whether the gas has to be compressed into cylinders or led through piping to the welding benches. In this first case, it will be necessary to have high pressure compressors, whilst in the second case, a low pressure compressor, working up to perhaps 100 lbs. per square inch, with a suitable receiver sufficiently large to maintain a few hours' supply with all plant shut down, will be ample.

In some works, both hydrogen and oxygen gas are utilized; in others, one of the gases is allowed to waste, with the result that, whilst capital laid out in gas-holders, compressing plant, etc., is smaller, the whole of the cost of operation and current has to be charged up to the remaining gas used.

It is essential that each plant be fitted to its own particular requirements, and the cost based accordingly, as in no two

cases has the author found exactly similar circumstances to be overcome.

Following are costs as given in Mr. Stanfield's paper. These are left in their original state, not being converted into dollars and cents, simply because conditions over here are somewhat different from that in the British Isles.

Case I

The first case we have taken is the works using 5,000 cubic feet of oxygen per week of 50 hours, and generating gas on a ten-hour day basis.

Supposing that both oxygen and hydrogen were to be compressed into cylinders, the capital outlay would be, approximately:—

Electrolytic plant, including switchboard, gas separators, purifiers and hydraulic seals	£1,350	0	0
Hydrogen gasholder, 1,000 c. ft. capacity	260	0	0
Oxygen gasholder, 500 c. ft. capacity	130	0	0
High pressure hydrogen compressor	180	0	0
High pressure oxygen compressor	150	0	0
	£2,070	0	0

The production cost sheet is practically self-explanatory.

Production Cost on Hydrogen and Oxygen

For output of 5,000 cubic feet of Oxygen per week (10-hour day generation basis):

	Per hour c. ft.	Per day 10 hours c. ft.	Per year 300 days c. ft.
Oxygen	100	1,000	300,000
Hydrogen	200	2,000	600,000

Electrical energy required to produce one thousand cubic feet of Oxygen and two thousand cubic feet of Hydrogen—312 B.O.T units.

Cost of Energy at 1d per unit—

Per 1,000 c. ft. Oxygen	13/-
Per 1,000 c. ft. Hydrogen	6/6

Overhead Cost

5% interest on £2,070 capital outlay	£103	10	0
10% depreciation	207	0	0
Attendance—Day, one man 4 hours × 300 days at 1/-	60	0	0
Sundries (oil, waste, etc.), say	10	0	0

Net overhead cost of—300 thousand c. ft. Oxygen, 600 thousand c. ft. hydrogen £380 10 0

Total cost per thousand c. ft.—

Oxygen,	12/8 plus 13/- for current 25/8
Hydrogen.	6/4 plus 6/6 for current 12/10

Now again supposing that this works was in the habit of buying this quantity of gas per annum, the saving would be considerable.

Cost of 300,000 c. ft. of Oxygen at £2 per thousand	£600
Cost of 600,000 c. ft. of Hydrogen at £1 15s 0d per thousand	1,050
Carriage on 900 cylinders at 1/- each	45
	£1,695

In all likelihood the cylinders would have to be purchased, for which additional capital would be required:

50 Oxygen cylinders, 100 Hydrogen cylinders, at say £5 each	£750		
Interest and depreciation on £750 at 20 per cent.	£150	0	0
Cost of producing gases	380	10	0
Cost of current	390	0	0
	£920	10	0
Total cost of purchasing gases	£1,695	0	0
Total cost of production	920	10	0
Saving per annum	£774	10	0
Total capital outlay	£2,070		
	750		
	£2,820		

£774 10s return on £2,820 is equivalent to about 27 per cent. profit.

Case II

Works using 5,000 cubic feet of Oxygen during a working week of 50 hours and generating gas on a 24-hour day basis.

As a smaller generating plant will now be required actually less than half the size, the figures will be approximately:

Electrolytic plant, switchboard, etc., as before	£600
Hydrogen gasholder of 2,000 c. ft. capacity	400
Oxygen gasholder of 1,000 c. ft. capacity	260
Compressors, as before	330
	£1,590
Cylinders, as before	£750

Production Cost on Hydrogen and Oxygen

For output of 5,000 cubic feet of Oxygen per week (24-hour day generating basis):

	Per hour c. ft.	Per day 24 hours c. ft.	Per year 300 days c. ft.
Oxygen (approx.)	42	1,000	300,000
Hydrogen	84	2,000	600,000

Electrical energy required to produce one thousand cubic feet of Oxygen and two thousand cubic feet of Hydrogen = 312 B.O.T. units.

Cost of Energy at 1d per unit—

Per 1,000 c. ft. Oxygen	13/-
Per 1,000 c. ft. Hydrogen	6/6

Overhead Cost

5% interest on £1,590 capital outlay	£79	10	0
10% depreciation	159	0	0
Attendance—Day, one man 4 hours × 300 days at 1/-; Night, one man 4 hours × 300 nights at 1/-	120	0	0
Sundries (oil, waste, etc.), say	20	0	0
	£378	10	0

Total cost per 1,000 c. ft.—

Oxygen,	12/6 plus 13/- for current 25/6
Hydrogen,	6/3 plus 6/6 for current 12/9

Cost of purchasing gas and carriage Case I	£1,695	0	0
Interest and depreciation on cylinders as before	£150	0	0
Cost of producing gases	378	10	0
Cost of current	390	0	0
	918	10	0
	£776	10	0
Total plant outlay	£1,590		
Cylinders	750		
	£2,340		

£776 10s return on £2,340 is equivalent to about 33 1/3 per cent.

There is practically no difference in the cost per 1,000 cubic feet of oxygen in Case I and Case II; but where a large installation and a larger capital is concerned, the portion allowed for attendances and sundries is smaller in proportion to the interest and depreciation cost allowed, thus a difference in the cost of some shillings per 1,000 cubic feet may be shown.

The foregoing examples are probably open to a great deal of criticism, and rightly too. For example, one firm may use both oxygen and hydrogen, another uses oxygen alone.

In one case, a firm may pay 1½d. or 2d. per B.O.T. unit for current; in the next case, the charge for current is nil. On the other hand, the author has known oxygen to cost 75s. per 1,000 cubic feet, including carriage charges, and 65s. is by no means an out-of-the-way figure.

Some firms may have to lay down a special motor generator-set to produce the necessary current; others can run direct off the main switchboard. In probably 100 cases investigated, no two sets of conditions were alike.

The problem to be solved is, therefore, "would it pay you to instal an oxygen-producing plant for your own use?"

The matter can easily be settled by applying to some of the firms who are supplying the apparatus, and who would give full information on the subject.

To quote a parallel case, we all realize the use and advantage of having dissolved acetylene supplied in cylinders, and without such a facility we should be badly handicapped very often indeed. At the present day, no firm would dream of laying out a welding shop to employ a number of welders and arrange to instal and work off dissolved acetylene cylinders. The cost would be too great. In the same way, the works of the future, as well as many of the present day factories, will instal their own oxygen plants as naturally as now they instal an acetylene plant.

Some years ago the author was engaged in pioneer work in connection with acetylene welding, arranging lectures and demonstrations all over the country. These created a great deal of interest, but even large firms were very dubious about installing oxy-acetylene welding. That time is now past, and many of these particular firms are among our largest users of acetylene gas, doing work which previously was classified as unsuitable. Particularly during the war, new applications and processes were found almost daily in the manufacture of articles which, prior to the war, were not even considered as likely objects for welding. Just now we are in the comparatively early stages, and perhaps no great time will elapse until the oxy-acetylene process will be awarded its own place as one of the most valuable assets in modern engineering practice.

FINISH THE JOB

How you start is important, very important, but in the end it is how you finish that counts.

The victor in the race is not the one who dashes off swiftest, but the one who leads at the finish.

In the race for success, speed is less than stamina.

Columbus finished his job. So did Washington. So did Lincoln.

Look around to-day.

H. C. Frick, whose recently-published will constitutes one of the noblest documents of America's annals, won because he refused to quit when, engulfed by the panic of '73, his associates and others engaged in the infant coke industry showed the white feather and gave up.

Andrew Carnegie earned most of his fortune by boldly buying out discouraged partners who lost their nerve and their sticktoitiveness.

John D. Rockefeller held on grimly and resolutely when others lost their faith in so mercurial and uncertain a commodity as oil, with its frequent disasters from fire.

Finishing the job isn't always easy. Very often the easiest thing would be to quit. We all are tempted to succumb to difficulties, discouragements, failures, hardships, disasters. We all have moments when we feel, "What's the use?"

But if we are made of firm stuff, if we have the backbone of a man and not a jelly-fish, if we have confidence in ourselves and faith in God, if we know that we are giving our lives a clean, worthy, healthy, helpful purpose, then we pull our belts a notch tighter, we grit our teeth a little harder, we face east, eyes front, and with unfaltering step push forward determined to halt not and whimper not until we finally gain our goal.—Forbes Magazine.

Chart of the Torsional Strength of Shafts

By the Use of the Accompanying Chart the Figuring of the Strength of Shafts is Made Comparatively Easy. Much Time Can be Saved Over the Laborious Use of Mathematics

By JOHN S. WATTS

THE accompanying chart will be found useful in determining the diameter of a shaft required to carry a given torque or torsional moment at any stress from 4,500 to 12,000 pounds per square inch.

To use the chart, simply follow along the horizontal line for the required torque and read off the diameter of the shaft on the diagonal line that intersects this horizontal line at the vertical line for the stress decided upon.

For example, the diameter of shaft required to carry a torsional moment of 120,000 inch pounds at a stress of 6,500 pounds per square inch, will be 4 9-16 in.

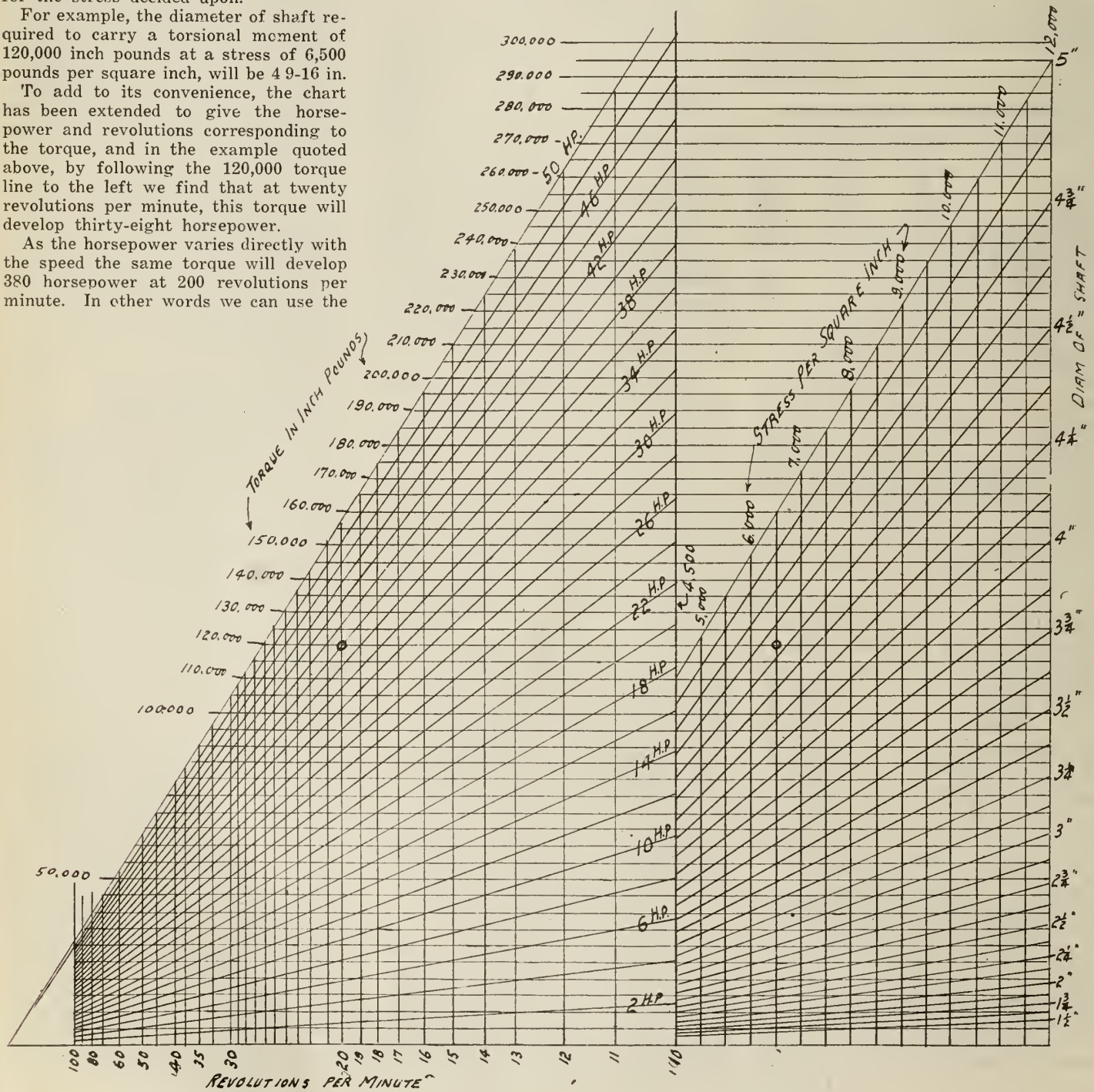
To add to its convenience, the chart has been extended to give the horsepower and revolutions corresponding to the torque, and in the example quoted above, by following the 120,000 torque line to the left we find that at twenty revolutions per minute, this torque will develop thirty-eight horsepower.

As the horsepower varies directly with the speed the same torque will develop 380 horsepower at 200 revolutions per minute. In other words we can use the chart for horsepowers and speeds above or below its range by simply dividing or multiplying the horsepower and the speed by ten, or any other convenient figure.

This enables us to use the chart to determine the size of shaft (up to 5 in. diameter) required to transmit any horsepower at any revolutions per minute, when the horsepower is given instead of the torque.

The chart will also be of material assistance in calculating geared or belt-drives, to transmit a given horsepower at a given speed as from the intersection of the horsepower and revolutions lines we read the corresponding torque, which, being divided by the radius in inches of the gear or pulley, will give us the load in pounds, to be transmitted by the teeth of the gear or by the belt.

It should be remembered that if the



THIS CHART SHOULD BE STUDIED WITH CARE TO GET THE BEST RESULTS.

gears or pulleys on the shaft are not close up to the bearings, a bending stress will be added to the torsional stress, and the shaft must be increased in diameter to take care of this additional stress.

The lowest stress, 4,500 pounds, should be used when the load is constantly reversing in direction and is suddenly applied.

A stress of 9,000 pounds may be used when the load is gradually applied, without shock and gradually reversed.

The maximum stress of 12,000 pounds is allowable only when the load is steady, does not reverse, and is applied gradually without shock.

A description of the method used in constructing this chart may be of interest and a help in making up other charts for solving similar problems.

First, we lay off the horizontal lines for the torques to a convenient scale, in this case 1 in. equals 40,000 inch pounds, and calculate the torsional strength of each diameter of shaft at the maximum stress, 12,000 pounds per square inch, by the formulae

$$T = \frac{\pi}{16} fd^3$$

and mark points on the torque scale to indicate each diameter at the points corresponding to the strength so calculated.

Now the maximum stress being 12,000 pounds per square inch, we measure along the base line, to the left, a distance equal to 12,000 to any scale, in our case we have chosen ⅜ in. = 1,000, and draw the diagonal lines for each diameter to this point.

Measuring back from this same point, distances equal to 4,500, 5,000, 5,500, etc., etc., and erecting vertical lines at each point, it is obvious that the height of each of these vertical lines to its intersection with any diameter diagonal line will be equal to the torsional strength of that diameter of shaft at that stress for which the vertical line is marked.

Now, coming to the triangle at the left, we calculate the torque which will be developed at ten revolutions per minute by fifty horsepower, by the following formulae:

Let T = torque in inch pounds.

$$\text{Then h.p.} = \frac{T \times \frac{2\pi}{12} \times \text{r.p.m.}}{33{,}000}$$

$$\therefore T = \frac{\text{h.p.} \times 33{,}000}{\frac{2\pi}{12} \times \text{r.p.m.}}$$

Marking this point on the torque scale on the central vertical line we have the point corresponding to 50 horsepower, and by dividing this height into twenty-five parts we get point for the torque corresponding to each increment of 2 horsepower up to 50 horsepower at ten revolutions per minute.

We now make the base line of the left-hand triangle ten inches long (to a scale of half size in the chart) because ten is the number of revolutions we assumed for the calculation of the horsepower on the central vertical line.

Now, as the torque is proportional to $\frac{\text{h.p.}}{\text{r.p.m.}}$ the —, we scale back to the right from the end of the base line, distances equal to $\frac{10}{100}$, $\frac{10}{90}$, $\frac{10}{80}$, $\frac{10}{70}$, etc., the denominator of these fractions being the revolutions per minute in each case, and raise vertical lines at each point so marked.

It can be seen that the height of any of these vertical lines to its intersection with any horsepower diagonal line will be proportional to the torque delivered by that horsepower at that number of revolutions.

MANGANESE STEEL

The welding of manganese steel is a problem which is usually found in the frog shop on railroads, although dredge dippers, safes, and other machine parts are manufactured from this metal. Some authorities claim that it is possible to weld manganese steel successfully, but in the author's opinion the process is not yet a complete success, by the oxy-acetylene process.

Manganese frogs and crossings contain between 11 per cent. and 13 per cent. manganese, and the nature of the problem will be better understood when it is explained that when the manganese content is increased above 2 or 3 per cent. the strength and ductility decreases, while the hardness increases.

Manganese frogs and crossings frequently require building up at low points. These low spots are usually caused by the metal becoming fatigued and sagging from the constant pounding of rolling equipment. When made, frogs or crossings occasionally contain blow holes, or pockets, not visible to the eye. These pockets are generally just below the low point and extend the full length of the section which requires building up. Frogs and crossings containing such defects are not susceptible to a welding process. Should the section require the building up of a worn spot caused only by constant pounding, it may be treated autogenously.

The frog or crossing should be preheated to about 1,250 deg. Fahr. (medium cherry), and after the worn spots are built up, during which process the frog or crossing is kept at the aforementioned temperature, it is allowed to cool very slowly. This can be accomplished by burying the object in dry sand.

The parts to be built up should, prior to starting the building up operation, be thoroughly cleaned. Either files, wire brushes, or a portable grinder may be used for this purpose.

The low sections should be built up in sections of about 1 square inch each. Care should be taken to raise the built-up section to the proper height. While the metal of each section is still hot the section should be hammered. This not only expands the new metal but also serves to impart a finished appearance to the weld. The proper surface alignment may be maintained by the use of a straight edge.

Another method which has been used with success is to immerse the frog or crossing in a pan of sufficient depth and width to permit surrounding the entire object with water, a space of but about ¾ of an inch below the surface of the rail showing. This pan may be so constructed that a constant flow of cold water passes through it. When this method is used no after treatment is necessary.

The correct filler rod to use for this work is manganese, and these rods may be made by cutting up old manganese rails. Manganese welding rods are now manufactured for the welding trade. As manganese possesses a marked affinity for oxygen, however, and will burn out very rapidly under the influence of the torch, the necessary rods should not be cut out from old rails with cutting torch. Some other method should be used, or preferably, new rods procured. The process of building up the worn section will in itself burn out manganese from both the original rail section to as near a 11-13 per cent. content as possible, it is advisable not to multiply the difficulties by an advance reduction of the manganese content in the filler rod.

The author has heard welders complain that under the action of the torch manganese steel would "foam," making it exceedingly difficult to execute welds. As a proposed remedy for this difficulty it has been proposed that a very fine aluminum wire be wound around the manganese welding rod in the form of long spirals. The introduction of a very small quantity of aluminum into the weld is said to "quiet" the metal. So-called foaming, however, is an indication that the manganese content has been reduced to a very small percentage.—"Welding Engineer."

An important improvement in the manufacture of coal gas has been perfected by the engineers of a gas company in London, Eng. They have contrived to extract from the gas all the carbon bisulphide—a substance which, when burned, had a deleterious effect on health and also on various materials. Throughout most of the nineteenth century, chemists and engineers strove to solve this problem, but success did not come till the year 1914. The war prevented the erection of plant to carry out the process, but the way is now open for the general adoption of a method which will make a gas flame as harmless to its surroundings as a candle. The process is a catalytic one, the extraction of the impurity being effected by a substance which remains unchanged in spite of its activity. It may be added that British gas companies are now adopting the scientific principle of charging for gas on the basis, not of mere quantity, but of heat-value.

WHAT OUR READERS THINK AND DO

Some Drafting Course Remarks

[Contributed by the Students]

HERE are a few excerpts from replies received relative to our drawing course. The first to speak is a Hamiltonian:

"It gives me pleasure to write my opinions regarding your drawing course. First of all let me state frankly that I was one of those that started to send in my plates. I failed to keep it up on account of my health. I am a returned soldier and have suffered from time to time with my disability. It is this fact that has meant my failure to send the plates in promptly.

"I have been in the hospital several times, so you can see why I failed to send my work along, but I never failed to cut the drafting course out of the magazine in order that I could follow it up. I should be very sorry to see you put an end to the course, for I assure you the lessons are a great benefit to all. Personally I took up a course in tool making under the Soldiers' Re-establishment, but that was not enough. I can honestly state that I have got as much good from your drafting course as I got from my other study.

"I may be one out of a great many that do your plates as they get a chance, so I sincerely hope you will see fit to continue the course.

"Very truly yours,
"H. CRABTREE."

This One From Brandon, Manitoba

"Your personal chat with your drawing students was no doubt read with interest by not only your active students but by those who are plodding along quietly. This class I honestly believe constitutes a large number of your following. They look forward from week to week for your course, and as they follow the same closely, they feel, or should feel that they are slowly but surely laying down a foundation well worth while. In a quiet way I am assimilating your drafting lessons. I have never sent in any plates, nevertheless my interest in your course is keen, and I keep every copy so that I can go back to it for reference any time I desire.

"I would like to answer briefly your questions as follows: Relative to why you are not receiving more plates, I would say that when your course started I was fully determined to send in my work from week to week and purchased all supplies as instructed. I had some difficulty in procuring these as they could not be obtained locally, and besides working from 7 a.m. to 10 p.m. does not leave one in the best condition to compete successfully in a drafting competition, so I decided to plod along quietly and do my best alone.

"I realize that some of these reasons leave me open to well-merited censure, but this is the true reason and may be the cause of a great falling off in the number of plates received.

"You also ask, 'Are the plates too difficult, etc.?' In answer to this I would say to all the questions, 'No.' One outstanding feature of your course is simplicity of speech and clarity of your subject. One has very little trouble in getting a sure grip of each lesson. Speaking for myself I would say that you are not travelling too fast. Your course is so arranged that one is always anticipating what is coming next, so this answers your question: 'Is interest ceasing?' Once more I would repeat, 'no.'

"I am very pleased to have this opportunity of thanking you for the spirit of helpfulness which is an outstanding feature of the course, and hoping you will continue the good work.

"I am, yours truly,
"JNO. S. MILLER."

Up Speaks a Kitchenerite

"I have noted the personal chat addressed to drawing students and the cap would not have fitted better had it been entitled 'Individual Personal Chat.'

"I am very much interested in your course, and have profited very much by it already. I have failed to send in the last two drawings because of lack of time, not lack of interest. The lessons are prepared in the simplest of language, and the ordinary mechanic who is trying to take advantage of the opportunity ought to have no difficulty. I have derived a great amount of information already. I am working on a mechanical contrivance and wrote to a well-known firm in Toronto for information on the application of some of their products to my needs. I drew a sketch noting changes desired, and they understood my wants readily, and were able to give me all desired information without correspondence.

"The course is not progressing too rapidly for me, and is not lacking in interest. As soon as I get my copy of CANADIAN MACHINERY I look the drafting course up first. If a person is going to make the most of these lessons I believe he should start right in to study the week he receives the copy and not settle down to work a week later. He will find something perhaps a little harder than he expected and be late in sending in his plate. Once he is late a few times he is on the fair road to losing interest.

"In closing I hope I have answered the questions satisfactorily, and promise to be more faithful in my work in the future.

"Yours truly,
G. ARUNDEL LAMB."

Here are two more short reasons why we should keep on with the course:

"Although we have drawing classes at the shop where I work, I wait with interest the lessons in your paper. I know I am not the only one that does so. I have not sent in any plates as yet but expect to before long. Perhaps the reason the drawings are not coming in so quickly is because of the sickness going around.

"I find only one fault with the course, and that is they do not appear often enough. I think every week would be best, as two weeks is too long to wait. With hopes that they will be continued,

"Yours truly,
"G. R. HARTLEY,
"Coteau Station, Que."

This One is From Toronto

"The reason I have not been sending in my plates is because I've been studying them at home and also attending night school. Now that school is about over I will start in once more to send my plates.

"Regarding the course itself I have no fault to find. The plates are not too difficult or intricate, and the instructions are always sufficiently clear.

"In closing I might say that the course is the most interesting and helpful series of studies that has ever been published in your journal.

"H. SCOTT."

Our Answer

We appreciate the many replies sent in but which are impossible to reprint owing to their number, so we will content ourselves with assuring students of the continuance of the course commencing April 8th issue.

We would suggest that Mr. Lamb's idea be carried out. The moment you receive your copy get busy; prepare your work and send it in. Should you desire to prepare the work at home, do so, but write in telling us you are working on the course. We desire to ascertain how many readers are actually following the lessons. This is not much to ask of each student. Merely drop us a line saying you are following the course. By this means we will know the interest is sufficient to warrant the work entailed in its preparation. Please remember this and if you decide to follow the lessons write us as soon as you receive your April 8 issue.

CONVERTING A BREAST DRILL INTO A DRILL PRESS

By W. S. Standiford

One of the most useful devices that every mechanic or experimenter has in his home workshop is a breast drill. The drawbacks of this instrument are that it has to be held very carefully if a straight hole is to be bored; and also that it requires considerable "brute force" to make the drill feed into the work. After using a breast drill in the usual manner for a number of years, the writer decided to convert it into a drill press, and thus make it not only easier to operate, but also to do more accurate work than a drill pressed against the body is capable of.

The photographs show the general construction clearly, no dimensions being necessary, as each breast drill made varies so in size that the construction will have to be made to suit the users' instrument; the only thing to do is to follow the shape as depicted in the photographs. Fig. 1 shows the completed apparatus ready for a drill to be inserted. It will be seen that the feed is automatic, it being done by gravity when using a 1-16 inch drill, but wide rubber bands are used to assist the weight of the drill rack and round bar iron weight when larger sizes are used. The bands are put on the projecting lower ends of drill rack (only side being shown in the photograph) and a round pin on the sides of the standards. As this press has been in use for a number of years, using rubber bands, the writer intends to replace them with closed-coil springs fixed to a hinge on their lower ends, so as to be disconnected when the press is used for boring small holes, as too speedy drilling dulls the drills quickly. Closed-coil springs are better than the rubber bands when working with larger drills, as more pressure can be obtained, the amount depending upon the diameter of the wire thickness in the springs.

Fig. 2 shows the standards with the drill rack out, while Fig. 3 illustrates the rack itself, the round bar iron weight being removed from its retaining prongs. The upright wooden standards should be made out of hardwood and have the slots that drill rack slides in carefully made and fitted to the former, so as to have just enough play to let it slide freely up and down. Rub dry graphite on the bearing parts of standards every once in a while, so as to get the wood saturated as much as possible. Use a square when fastening standards on the baseboard. Put cleats upon the cross bars of drill rack, so as to prevent any side play, thus insuring that the holes bored will be straight. This apparatus will be found to give good service in the home workshop, mine being in use over ten years. It is still in good condition, with the exception of the rubber bands, which occasionally get hard and lose their elasticity; the latter being restored by soaking them in kerosene oil. I would advise any other constructor to use closed-coil springs, as it is a nuisance to be fooling with rubber bands. Closed-coil springs will give no trouble.

Legions of inventions have been made to prevent the skidding of rubber tyres, but no one device can be said to be completely satisfactory, either in obviating side-slip or in avoiding damage to the roadway and to the tyre itself. Chains, studs, and all sorts of rubber protuberances have been tried without real success. A British engineer has, however, been working along much simpler and more scientific lines, with most promising results. His notion is to shape the tyre so that when it is in contact with the road it lies flat with a definite edge on each side. Any tendency to skid is resisted by the "squeegee" action of the tyre in this position. Trials have shown that incipient side-slips are quickly checked and that the tyre wears well and has no bad effect on road surfaces.

An original type of heavy motor truck has been produced by a British firm. It is a six-wheeled tractor-truck capable of carrying a useful load of 7½ tons without exceeding a total weight of 6 tons on any axle. It is also designed to haul a 6-ton trailer and is therefore claimed to give a greater carrying capacity than any other type yet produced, although its weight is practically the same as that of a well-built 3-ton truck. The body portion rests on a turn-table over the middle wheels and ingenious arrangements are made for braking the back wheels. A four-cylinder engine develops 47 horse-power at 1,000 revolutions per minute and drives the vehicle at 12 miles per hour.

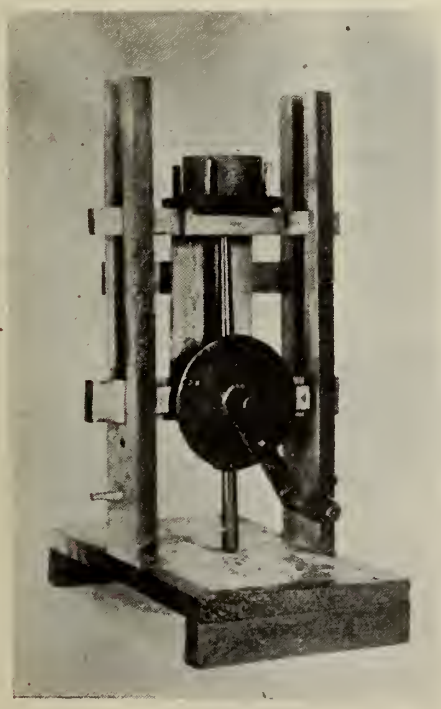


Fig. 1

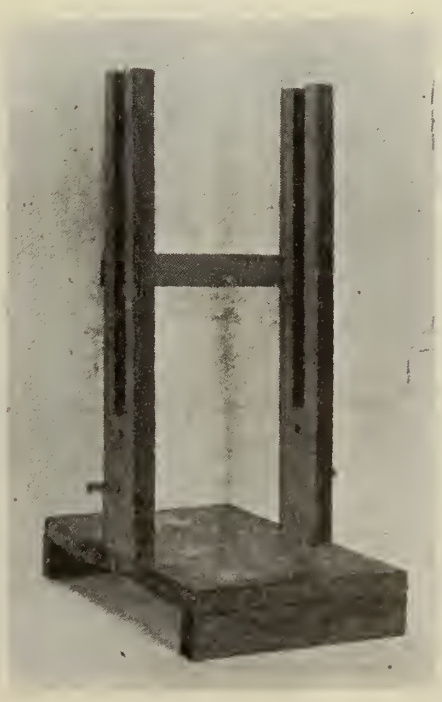


Fig. 2

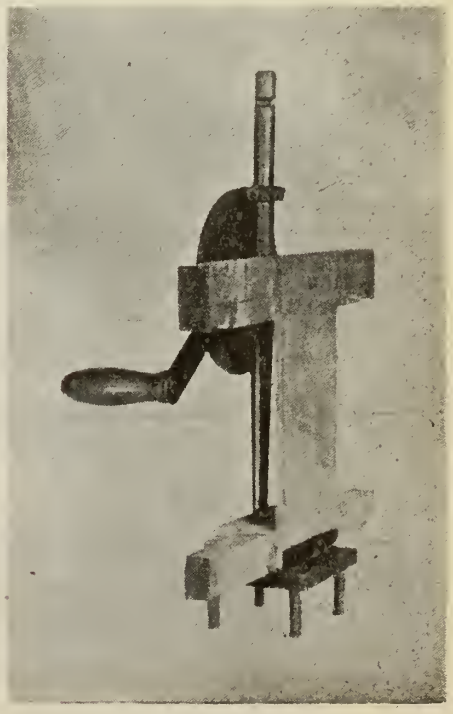


Fig. 3

DEVELOPMENTS IN SHOP EQUIPMENT

HIGH POWER MILLER

The first machine to be marketed by the new Ryerson-Conradson Company is that of their No. 3 helical drive high-power miller. This machine is claimed to include new features which will place it among the leaders in the machine-tool field.

The most striking feature in the design of this machine lies in the application of the helical drive. Helical drive gearing is not universally employed in milling machines, due to the inability (up to the invention of the type described) to secure a sufficient range of speeds as required of a commercial milling machine.

The column is an exceptionally rigid casting, thoroughly ribbed internally and cast integral with the base. Surrounding the base is a deep flange which materially stiffens it and serves as an oil retainer. The face of the column is extended above the overarm, affording very firm support for special fixtures.

The knee is heavy and deep, absorbing all vibration due to heavy cuts. The bearing surface between the knee and the column is greatly increased by extending the back of the knee up to a point nearly level with the top of table. The elevating screw telescopes and is located in the centre of gravity to avoid all binding action when raising or lowering.

The table and saddle is provided with large bearing surfaces and the table is provided with three T-slots 5/8 in. wide, and a large groove to retain and lead all cutting compounds to the drain.

The spindle is of .60 carbon steel, accurately ground, running in bearings of phosphor bronze, scraped to fit. The front bearing is tapered and both bearings are adjustable for wear. The faceplate is forged with integral spindle and arranged with two large keys for driving face mills and arbors.

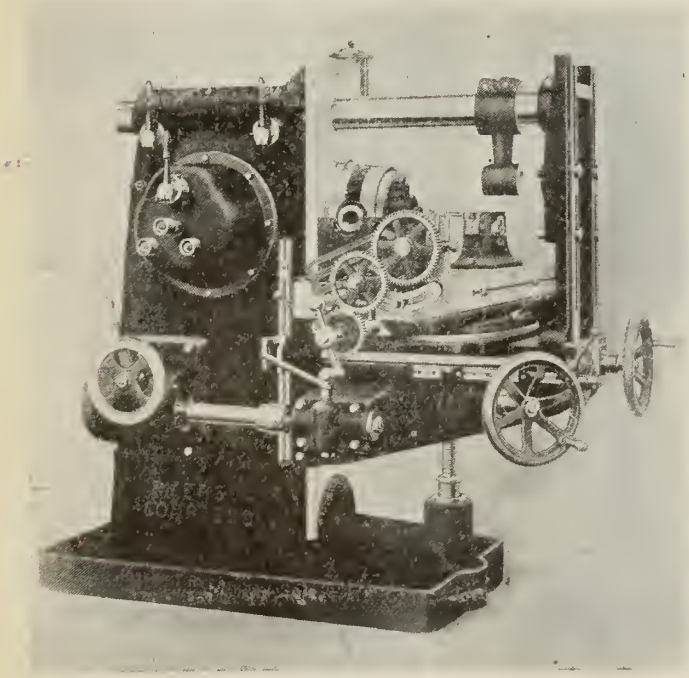
The primary shaft is driven by means of a constant speed pulley on one end and three change gears on the other, which drive a hollow shaft concentric with the primary shaft. This hollow shaft is also provided with two additional change gears, and, in turn, drives either the high speed or low speed set of helical gears which effect the spindle drive. By this method twelve spindle speeds are obtained, ranging from 17 to 290 r.p.m., in practically geometrical progression.

The driving pulley is of the conical friction clutch type and means are provided to automatically apply a brake to the shaft the instant the clutch is disengaged.

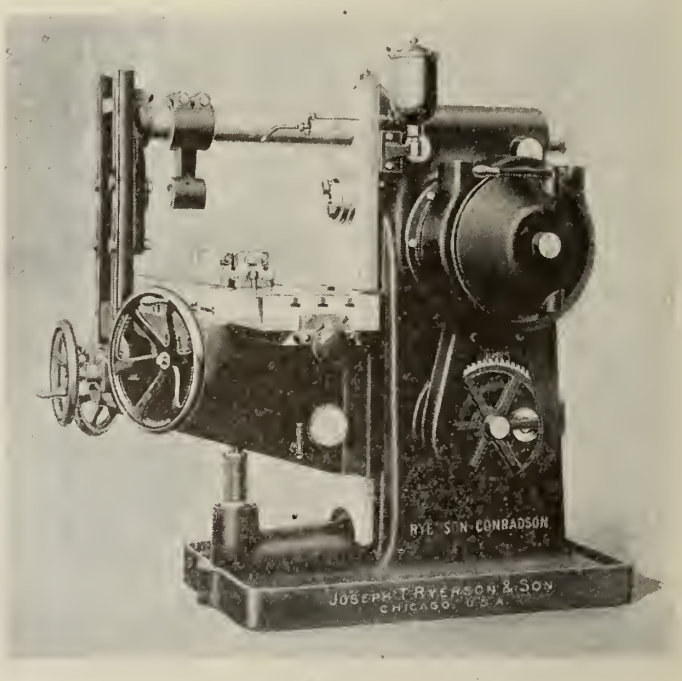
The feed drive is positive from the primary shaft by means of a chain and sprocket. Eight changes are provided by the usual cone of gears in connection with a dive key controlled by a hand wheel, on the circumference of which the various rates of feed are indicated. Two sets of gears, operated by a hand lever, double up the eight feeds, and by this method sixteen feed changes are obtained, ranging from .6 in. to 22.3 in. per minute.

Each feed screw is provided with a graduated dial reading to the thousandths of an inch and readily set back to zero. All feeds are equipped with fixed trips and one adjustable trip which can be placed to stop the table at any desired position along its travel.

These machines are driven at a constant pulley speed of 600 r.p.m., requiring from 5 to 7½ h.p. to operate. The gears run immersed in oil and are completely enclosed, making them dustproof, and owing to the flooded lubrication are practically noiseless. As the driving pulley is also enclosed the machine conforms to all safety regulations of the Workmen's Compensation laws. All thrust is taken up by S. K. F. ball-bearings. All bearings are bronze bush-



FRONT VIEW OF THE MACHINE.



AS IT APPEARS FROM THE REAR.

ed. Change gears are all cut from solid chrome nickel steel stock and are heat-treated; all others are of steel or bronze, no cast gears being used, with the exception of the large elevating bevel gear, which is of cast steel.

Following are the machine's principal specifications:

HIGH POWER MILLER

Type of Machine.	Plain	Universal
Longitudinal movement	35"	34"
Cross traverse movement	14⅝"	13"
Vertical movement	20"	18½"
Diameter of spindle nose	5 1-16"	5 1-16"
Spindle, front bearing, large end	4¼"	4¼"
Spindle, front bearing, small end	3¾"	3¾"
Spindle, rear bearing	3⅛"	3⅛"
Taper hole in spindle	No. 11 B. & S.	No. 11 B. & S.
Hole through spindle	13-16"	13-16"
Distance, spindle centre to bottom of arm	6 5-16"	6 5-16"
Distance, end of spindle to arbor bushing	27"	27"
Distance, face of spindle to arm braces	30⅜"	30⅜"
Diameter of overarm	4⅜"	4⅜"
Table dimensions	63¼" x 12¾"	63¼" to 12¾"
Table working surface	53" x 12¾"	53" x 12¾"
Spindle speeds, range	17 to 290 R.P.M.	17 to 290 R.P.M.
Spindle speeds, number of changes	12	12
Feed range per minute	6" to 22.3"	6" to 22.3"
Feed, number of changes	16	16
Floor Space—		
Parallel to spindle	76½"	76½"
At right angles to spindle	111"	111"
Pulley speed	600 R.P.M.	600 R.P.M.
Pulley diameter	14"	14"
Width of belt	4"	4"
Horse-power required	5 to 7½	5 to 7½
Weight, net	5,575 lbs.	5,910 lbs.

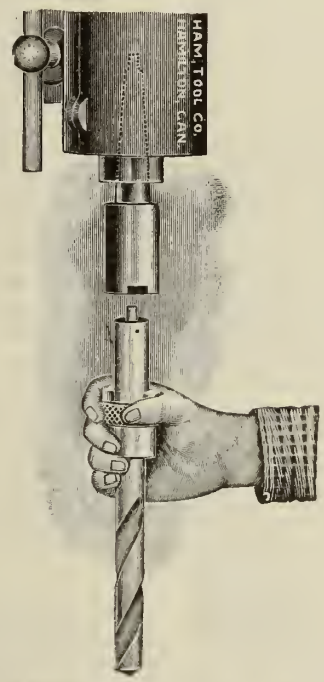
BEAVER CHUCK AND COLLET

The Hamilton Tool Co., Ltd., Hamilton, Canada, have placed on the market what is known as the Beaver clutch and collet. This tool is patented and is especially designed to be used in the rapid interchange of drills, reamers, counterbores, etc., on any machine without stopping the machine. Of course the device is especially useful for drill press work.

These chucks and collets are made of high grade tool steel and are very simple in construction, positive in operation, and have proven great time savers. A self-contained device releases the collet and tool instantly, requiring neither hammer, wrench, nor key to operate. And it only requires one hand to do it. There is nothing to catch the operator.

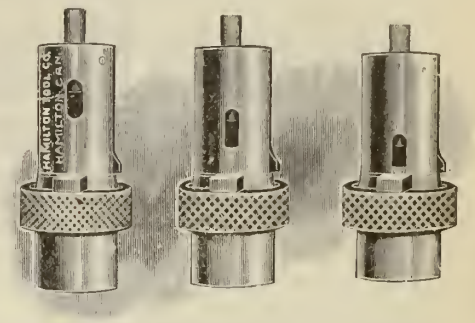
Chuck is fitted with a Morse taper shank of the required taper to fit the machine spindle, and is bored so that each collet of the set will fit snugly into it. The collets are bored to take tools having either Morse taper or straight shanks, as required.

Lengthwise of the collet shank is set in a narrow strip of steel which is kept in position by means of a pin and spring. On this steel strip is a catch, which, when the collet is engaged, fits into a groove on the inner side of the chuck, thus holding the collet and tool firmly in position. The inner side of the knurled ring is so constructed that when grasped between the forefinger and the thumb and pulled outward the catch is instantly released, thus freeing the collet and tool from the chuck, which still remains firm in the machine spindle. A spring steel wire firmly seated in a groove around the collet prevents the knurled ring from coming off when being pulled outward to release the collet. The sliding pin in the end of the collet is a very simple and most effective method of knocking out tools.



SHOWING HOW EASY IT IS TO OPERATE.

GENERAL VIEW OF COLLET FOR NO. 1 CHUCK. NOTE THE EJECTING PIN AT THE TOP.



SOME OTHER VIEWS OF THE COLLETS.

To engage the collet grasp it by the knurled collar and push into the chuck. To disengage the collet, grasp it by the knurled collar and pull straight out from the chuck. The various illustrations explain fully the design of the chuck and its uses.

The Halcomb Steel Company of Syracuse, N.Y., publishes prominently in its plant organ, under the heading of "Who's Who in Safety," each month, the names of all foremen in whose departments there were no accidents during the previous month. Directly opposite, under the heading "Those Who Spilled the Beans," are published the names of the other foremen, with the number of accidents charged to his department after each name. The Corn Products Refining Company, Chicago, last October conducted a safety drive among all its plants, at the close of which a bulletin was posted, showing the name of every foreman in whose department one or more accidents had occurred, together with the number of accidents in each department.

Discussing the effect of such publicity, Grover Kingsley, safety engineer of the Halcomb Steel Company, writes: "This has proven a stimulus to good safety work in a great number of instances. Foremen want to keep their names out of the 'Who Spilled the Beans' Column. Contrary to expectations, this sort of publicity does not create antagonism to safety, and I attribute this principally to the humorous phrase used to designate foremen whose departments show accidents."

The Greenfield Tap & Die Corporation, Greenfield, Mass., have issued a new book, known as their catalogue No. 43. This book contains not only a detailed description of their line of gauges, but some mighty interesting and useful tables as well. To the mechanic, purchasing agent, etc., we can safely recommend the worth of this catalogue, for it will not only familiarize them with the Greenfield line of gauges, but act as a handy text-book besides.

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Canada and Export

THE CANADIAN Industries Fair, which is being held in London, England, in June, will give Canadian manufacturers a good opportunity to put their goods before the buyers of the Old World.

Canadian firms should not go into any such a proposition with the idea that exhibiting their goods in London is going to establish an export trade for them. Exhibiting their goods at such a place is simply a step in the propaganda that will be necessary to secure a lucrative place in the foreign markets.

The first thing for any firm considering an export trade is to study the markets of the world. It is poor policy to think that they can speed up and produce a surplus that the foreign trade will absorb. The foreign buyer is just as particular as the buyer in Canada. He wants goods that are suitable to his climate, to his conditions, or to his plans of carrying on his business, and any or all of these may be quite foreign to Canadian conditions.

We very often have examples of this in Old Country firms trying to cater to the Canadian markets with something that they "thought" would suit the people here, or something they considered should be used here.

It would be good business for any Canadian firm considering export business to analyze the foreign market before making a move. Select a field that looks likely, secure the necessary channels of distribution, and then make a dead set on that territory. It is, according to the experience of men who have been through the mill, better to concentrate on some given territory than to so spread effort around that it becomes so thin as to have neither force nor staying power.

Enthusiastic—Sometimes

THE WHISTLE blew in a Toronto industrial concern a few days ago, as it has done for a good many years. There was more action in the next three minutes than there had been all day, with the possible exception of the noon scramble.

There was vim, ginger, push, pep — all these things and more — crowded into the few brief minutes following the tooting of the whistle.

A few nights ago young men started to line up outside the box office where tickets were going to be sold at 10 o'clock the following morning for a championship hockey match.

They stood in line all night and kept on standing until 10 o'clock in the morning.

There was surely perseverance, determination, and a keen desire to succeed in this demonstration.

But why is it that certain of us can pump up a heap more enthusiasm around quitting time, or over a hockey match, than over the great big task of making a success of our daily work?

Certain it is, were the same steam turned into business as was turned into the 5 o'clock quitting hour or the all-night stand for a hockey ticket there would be much greater successes and fewer people tossed out into the discard as very average or no good at all.

Essential or Not?

THERE is an increase in the number of those who are not performing any necessary service. Offices in Toronto and other cities are scarce — very scarce — because there are processions after them.

It seems to be an easy matter for a person to worm themselves into some little agency, where their chief function in reality is to get in the line of distribution between the producer and the consumer.

During the war the United States authorities went through the land, and arbitrarily called a business essential or non-essential. There were some surprises then. It will be recalled that the gatherers of scrap metal were classed as doing a necessary work, while some very prosperous-looking establishments were passed up as being quite unnecessary to the carrying on of business or United States' participation in the world war.

It would not be an unmixed evil were the substantial business fabric of the Dominion able to shake itself sufficiently to cause a number of the barnacles to drop off.

There seems to be no way of keeping a number of seemingly important little chaps from crowding themselves into the business world in one useless capacity or another.

There are many ways of writing and concluding letters with a punch, but one from a brokerage firm has this compelling farewell: "Hoping to be able to make some money for you. . . .," etc.

The war is pretty much over in various corners of Europe, but we are approaching the season of the year when the speckled hen is apt to get over the fence and make a frontal attack on the neighbor's Dutch setts.

The speculator and the premium operator are doing mighty little to help the consumer of iron and steel when he most needs help, which is right now.

It is very easy to figure out that prices cannot possibly go any higher, only to come down to the office and find announcement of 'steen lines that have hopped over night.

When you see a man on the street with grey socks in this windy weather, and on the same street see some girl with silk hosiery — well, one's got too much on or else the other's not got enough. Great chance for a rather illuminating argument here.

OUR BIG CHANCE IS IN DEVELOPING CANADA

Lloyd Harris Speaks at Brantford Regarding a Greater Degree of Business Independence

LLOYD HARRIS was the speaker at the Brantford Travellers' Club in that city on Saturday afternoon. He reviewed, with many interesting incidents, replete with humor, his thirty-five years as a travelling man, for as he said, he was still a salesman and always intended remaining one. His first mission outside of the Dominion had been when he took over the chairmanship of the Canadian War Mission to Washington in 1917. At that time, the United States, having just entered the war, Canadian munition manufacturers were in grave danger of losing their trade. Commercial relations with the United States became strained and it was difficult to obtain raw materials from the other side. Restrictions were placed on imports coming from Canada and the country needed representation at Washington to show the Government there the true status of Canadian manufacturers. Americans could not believe that Canadians could turn out quite as good products as they. With the aid of a few typical travellers of this country the trade commissioner had gone to the States and secured immense orders at a marginal expenditure. In fact, the costs of securing the war orders for Canadian manufacturers had been only a fifteenth of one per cent. of the amount of the orders. Though the American Government had the interest of their people at heart they had not shown the best business insight in their initial systems for placing war orders. It was the typical Canadian traveller who had convinced the Americans that it was a poor policy to refuse Canadian war contracts.

Dependent on United States

Impressions formed by Mr. Harris while in Washington were that Canada had grown up dependent largely upon American manufacturers, to a degree similar to Britain's dependency on Germany for many products at the outbreak of the war. The mihsion at Washington had to use the most compromising judgment in licensing war orders for Canadian firms, and in some cases refuse to endorse them.

Must Develop Canada

"We must develop Canada, our own resources and manufactures, so as to make us as independent as possible," said Mr. Harris. The simplest source of supply had too often been the United States. Neighborly relations with the Americans were to be greatly desired, but the two countries had so little in common in the way of manufacturing industries there was every reason for them remaining independent of each other.

"This talk of free trade with the United States can only lead to one thing — political union with that country," the speaker pointed out, and this condition was scarcely thought of by either country.

Trade With Europe

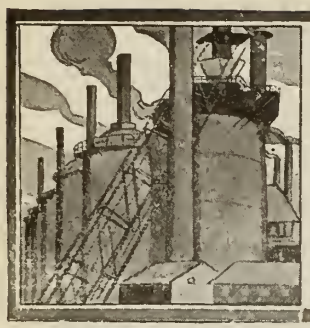
Leaving Washington suddenly at the signing of the armistice, Mr. Harris had gone to London as chairman of the Canadian Trade Mission. Trade interests there demanded Canadian representation, and the mission was able after a certain amount of educational work to secure considerable British and European trade for Canadian business. Manufactured exports from Canada have been increased sixfold since before the war, and there was every reason to believe that that mark could be kept up for years to come. Bureaucratic stupidity had been responsible for a ban being placed on Canadian-made goods sold to Great Britain when the war ended. The British Ministry had to be shown the folly of such a measure and the Canadian mission was able to do so. Canadian goods had now an established preference in England. While in London the mission had entertained many peace delegates and other representatives from many nations. Canada's reputation as a warring nation had awakened the confidence of the world and orders for Canadian-made goods could be had for the asking. The chief trouble was that the supply would not meet the demand. Manufacturers in this country had been busy developing the domestic field without paying much attention to the foreign market. The speaker emphasized the necessity of the business men of the Dominion studying the markets within the British Empire. This was the choicest field for Canadian products and intercolonial free trade would be a great boon. At present the British people in all parts of the world were commencing to learn the advisability of educating themselves to each other's interests, resources and abilities.

The Gold Coast Field

Canada could, for instance, find an excellent market in the Gold Coast, a hitherto unknown and undeveloped colony. They now had a Canadian-born Governor there, who had in his time been a traveller and salesman of ability, and Canadian-made goods were greatly in demand. Mr. Harris had unofficially discussed intercolonial free trade with the Premiers of the greater colonies, and all expressed the opinion that it would prove of undoubted benefit to all.

Efficient Leadership

Speaking on the problems presented by Governments, Mr. Harris gave his views as a citizen toward the present leadership in Canada. He expressed his desire for a safe, sane and sound Government, with efficient leadership. The national debt amounted to $200 per capita, while the resources of the Dominion amounted to $2,000 per capita. An efficient Government would seek to develop these resources and pay off the debt at an early date, but under the present administration this could hardly be expected. Properly developed, the steel industry alone would make Canada independent of the other countries. Other industries need correct manipulation, some to be developed enormously, and restrictions carefully prepared for others. The pulp industry was an example of where immediate restrictions were necessary. Canadians in general had always expected too much from all Governments, which they blamed for a multitude of things. The Governments had attempted many more projects than they should try. Greater individual effort would eliminate a great deal of this useless investigation. The Government must restrict itself to straight business projects that concerned the best interests of the people. Legislation would have to be enacted to make available equal opportunities for all. Men of ability could, therefore, get ahead when they deserved to.



MARKET DEVELOPMENTS

Getting Tired of the Premium Operators

There is a Growing Feeling That He Has Gone His Limit and That Any Change Now Will be in Favor of the Consumer—High Prices for Some Jobbers' Lines

PRICES continue to provide considerable speculation in the steel and iron markets. Quotations given by jobbers and warehouses are for the most part purely nominal. The supply in many lines is so uncertain and resort has to be had to the premium market so frequently, that each shipment and each sale is tied with a set of conditions all its own, and it is on these that the price is placed. The trade is becoming weary of the operation of many of the premium channels, and it looks as though, in nearly every line they had reached their peak, and whatever happens now will be in favor of the consumer. The Steel Corporation has notified its agencies that it will look after its customers, and that none of them needs to approach the point of suspending operations because they cannot get supplies.

Shipments are coming in more freely in all lines of machine tools, and supplies, due to better shipping; but it cannot be said that there is any improvement in the matter of schedules, which are still extended some months into the future.

The automobile, truck and kindred lines continue to stay in the machine tool market as the best buyers of material. Reports from New York markets this week seem to show a difference of opinion among dealers as to the sustained demand for machinery, some of them claiming that their experience shows a falling off.

Capacity operation of plants is reflected in the continued demand in this district for small tools and supplies generally. Prices for these lines remain firm, and it is understood that several of the makers of small tools contemplate putting large stocks in Toronto for distribution purposes.

OPENING OF MONTREAL PORT IS SURE TO HELP THE SITUATION

Special to CANADIAN MACHINERY.

MONTREAL, Quebec, April 1.—Apart from the evident irregularities that still exist in relation to car supply, there appears to be an impression that things are on the turn and conditions from now on will show steady, though perhaps slow improvement. Reports from the States would seem to imply that the supply of raw materials are more adequate and that production has increased in consequence. Local mills and steel foundries are operating close to capacity, but are frequently handicapped by the irregular shipments of material. Dealers in iron and steel commodities are optimistic regarding early future conditions, but do not anticipate any marked relief for some time to come, owing to the fairly heavy requirements in various lines of industry.

The effect that the new plate mill at Sydney will have on future steel trade is the fact that regular shipments of steel plate from the mill to British and European points will be an important branch of the company's business this year. The car situation is still one that interferes with maximum transfer of freight, and Canadian shippers are still having considerable difficulty in keeping goods moving to the States. With the opening of the port here, pressure on the railroads will be relieved, but the exact date of opening is still uncertain. The placing of heavy contracts for C. P. R. equipment will demand increased supplies of plates and shapes, and it is not unlikely that the upward price tendency will continue on these lines.

Tin a Little Easier

Conservative trading is still a factor in the movement of non-ferrous metals. Copper has taken on a stronger tendency following a comparatively easy period. The market, however, has returned to its former state of firmness and sales have increased. Tin shipments are quite regular and dealers are able to supply the present normal demand. Local quotations are slightly easier at 75 cents per pound. Lead is becoming easier, but other metals are firm.

Good Business in Rebuilds

Despite the continual advances that are reported from time to time on every line of equipment, the general demand shows no apparent falling off. Labor costs to-day are given as one of the reasons for higher prices, and this same condition may be said to be responsible for the maintained inquiry for modern machine tools. It is the belief of many manufacturers that lower cost of production may be had by increasing the facilities for greater output, a condition that is only possible by installing such up-to-date equipment as will counteract the higher wage scale that is the basis of increased costs. The business carried on in used machine tools is of considerable volume, and many firms are actively engaged in rebuilding equipment for supplying the heavy demand that now obtains. In many instances buyers will arrange for a rebuilt tool to tide them over until a new machine can be secured. There appears to be a considerable export trade at present from the States to Europe and the Far East, and this is sometimes given as the reason for delayed delivery on tools to Canada. Dealers report a steady movement of all classes of supplies, with English lines on the increase.

Uncertainty in Scrap

The week has developed no new features and the movement of scrap has been in less volume than for some weeks past. There is a steady demand for machinery scrap and the supply is inadequate to fill the full requirements of the trade. Dealers are dependent on the accumulation from varied sources as there is little dismantling of plants at the present time. Under these conditions the consumption of cast scrap prevents the possibility of stocking this material, the consequence being a very strong market with quotations of a nominal character. The mills are regular buyers of heavy melting steel and prices above $18 have been reported, but dealers state that definite quotations on any line are very difficult to state owing to the uncertainty that prevails in all lines.

CAN SEE NOTHING BETTER AS YET

Shipments a Little Better, But Accumulation of Orders Still Remains

TORONTO.—Deliveries in machine tools are showing some little improvement with the clearing up of congested winter conditions and the raising of some of the embargoes. But there is a great big improvement to be made yet. Actual delivery schedules to which the builders of machine tools will definitely commit themselves show little or no improvement. There is occasionally a chance machine that can be gathered in to beat the schedule, but that is not the usual experience. For instance, one Toronto firm had an opportunity to get a big boring mill on a ten-day shipment. They did not close at the time, and if they decide now to go ahead with their contemplated addition they will get some in August as the best delivery date.

The automobile business, in one way or another, is still the best buyer. Some of the existing companies have developments under way, while announcement is made that other concerns are going to start the manufacture of either trucks or cars.

The supply business is receiving a great deal of attention in this territory. It is rumored that several of the largest makers of small tools are contemplating putting large stocks in Toronto from which to serve this district. One firm has an expert in the city at present demonstrating drills, etc., in several of the shops. There is a good volume of trade passing in these lines.

Business All Holds Good

Toronto dealers who have returned from the U. S. steel district bring very ordinary reports of anything better for the future in the way of securing a better allotment of material for this district. There is no doubt that shipping conditions have been very much against a betterment of deliveries, but with the clearing up of the winter troubles a better schedule is looked for right away.

"There is one thing quite certain," stated one of the Toronto men who has just returned, "and that is that the trade in the States and here also is getting pretty well fed up on the treatment they have been receiving from many of the premium mills and dealers since there has been a shortage and demand. The brokers who pick up odds and ends hang on and live for one thing alone, and that is to squeeze out the last fraction of a cent to some customer who must have the stuff or close down."

The Steel Corporation, it is understood, have let it be known that as far as possible they will not let any of their customers be short to the point of having to cease operations from lack of material. To do this they are spreading their material over as far as possible.

Jobbers in this district, it may be stated, are trying to do the same thing. It would be no trick at all for them to clear out many of the much wanted lines at an attractive price. They have a long list of consumers, though, and they feel that it is up to them to do something for each of these.

Some of the speculators who have bought rather freely from the premium mills are having rough going. One agent took on quite a tonnage of black sheets at 8 cents mill. At the price he would find it necessary to put them up for re-sale here he is having trouble in making headway. Galvanized are at present the most demanded in the sheet family. There are many concerns that simply must have these or else close down. The fact that the price is high does not enter into the consideration in most cases. It is still possible to pass these increased charges along to the consumer. Some of the trade here are predicting galvanized sheets at between 15 and 16 cents before long. As the situation looks at present any price, on any prediction, is simply a good or a bad guess as the future may determine. Certainly there is small chance of anyone sitting down and figuring out how the market is going to turn.

Some boiler tubes are arriving this week, but against these shipments there is an accumulation of orders that soon take up the entire assortment.

There is not a great deal of material being offered for sale, although prices are attractive. The American market is showing strength, although there is not the labor available at a low enough figure to have a proper assortment. It is reported that some of the transportation companies are sending in material without much classification. As a general thing these companies adhere to the standard classification approved of by the Railway Storekeepers' Association. In that the classifications are carried almost to extremes, there being no less than 98 classes in which the discarded material is put.

Absence of sufficient scrap material in this country is causing some of the steel producers to look around for semi-finished material such as sheet bars, etc., at the U. S. mills, but they find little encouragement of service in the near future as the U. S. mills have been forced to turn away a good sized tonnage of sheet bars because their capacity cannot touch the demand.

POINTS IN WEEK'S MARKETING NOTES

The exact date of opening the port of Montreal has not been announced. It is certain to relieve a lot of congestion.

—

The C.P.R. orders for heavy equipment makes more business in plate, shapes, etc.

—

Some jobbers state that they would not be surprised to see galvanized sheets selling around 15 or 16 cents.

—

Speculators who took on tonnages of black sheets at 8c f.o.b. mills, are having troubles in arranging for their resale.

—

The premium market has gone to the limit in nearly every class, is the belief of the steel trade.

—

Automobile and truck propositions, and concerns allied with this business, continue to be about the best buyers in the machine tool market.

—

New York dealers differ in their reports of the present market. Some hold that inquiries are dropping off, while others claim that business is better than ever.

—

There is a nice lot of business going in small tools and supplies. Prices are firm at the new levels.

—

Some boiler tubes are coming in, but there is a large accumulation of orders against these shipments.

—

The Steel Corporation policy is to keep their customers going. They have asked their local office to inform them of any case where suspension from lack of material is threatened.

REPORTS DIFFER ABOUT INQUIRIES

New York Dealers Not Agreed Upon The Amount of Business in Sight

Special to CANADIAN MACHINERY.

NEW YORK, April 1.—The New York representative of one machine-tool manufacturer says that last week was one of the best he has had this year. On the other hand, some sales representatives point to a diminishing number of inquiries and sales. On the whole a fair amount of business is being done, though business is not nearly so active as during the first two months of the year.

The General Electric Co. continues to occupy a conspicuous position in the market, its purchases and inquiries in the past week being larger, perhaps, than that of any other Eastern company. Additional inquiries for the company's new Bridgeport, Conn., plant have been sent out and a list of tools has been purchased for the machine shop of the Edison Lamp Works Division at Harrison, N.J. The latter purchases consisted largely of milling machines, turret lathes and drills.

The Nathan Mfg. Co., New York City, has bought a list of tools for its 106th Street plant. The Federal Shipbuilding Co., Kearney, N.J., is buying miscellaneous tools.

Railroad business is not developing rapidly, but it is probable that the Lehigh Valley Railroad will soon close on thirty or forty machines, for which inquiries were sent out recently.

FANCY PRICES HAD MERRY LIFE BUT PROBABLY A SHORT ONE

Special to CANADIAN MACHINERY.

PITTSBURGH, April 1.—Production of pig iron in the United States in 1919 is officially reported at 31,015,364 gross tons, this corresponding quite well with the unofficial estimates. Production had been quite uniform in the three preceding years, at about 39,000,000 tons, but 1916 had the advantage by a slight margin. Thus there was a decrease of about 20 per cent. Productive capacity, however, had grown materially since 1916, being in 1919 in the neighborhood of 44,000,000 tons, so that production was only 70 per cent. of capacity. The strike which began September 22 is of recent memory, and naturally occurs as an important cause of the year's light production, but as a matter of fact the chief cause of the light production was lack of sufficient orders. By the time the strike was practically over pig iron had become very scarce, but if there had been no strike it might have been moderately plentiful up to the end of the year.

While the production of foundry iron in 1919 was less than in 1918 the decrease was not as great as the decreases in Bessemer and basic iron. The 4,916,758 tons of foundry and ferrosilicon produced in 1919 constituted 15.85 per cent. of the total pig iron production of the year, while the 5,145,260 tons of these grades produced in 1918 comprised only 13.17 per cent. of that year's production.

Of the 31,015,364 tons of pig iron produced in 1919, 22,325,137 tons were for the use of the makers themselves, while 8,690,227 tons were produced for sale, being in other words "merchant iron." Of this total 4,817,234 tons or 55 per cent. was foundry and ferrosilicon. The rate of production has been increasing sharply of late, and will probably very soon be over 40,000,000 tons a year.

Price Restrictions Off

By the order issued by President Wilson last week, all price and other restrictions come off coal and coke as of this date, so that April 1 sees an absolutely open market. Where this open market will find its level is more or less of a question, as the only thing that has seemed clear in the minds of the trade in the past few days is that prices will be very high. It is regarded as conservative to talk of coal at $3.50, it being stated that large operators desire to hold the market down to about that level, while the smaller operators may push prices for spot lots to considerably higher ranges. For Connellsville coke a price of about $9 is predicted.

The removal of price restrictions on coal will not of itself increase the production of coal, nor will the removal of price restrictions on coke alone increase the production of coke. Production of coal has been restricted almost solely by transportation conditions, and that is true also of coke. However, if there is a free market the steel interests that have by-product coke ovens can bid higher prices for coal, and there is no doubt that they will bid higher and higher prices for coal until they get all they require, and thus the output of by-product coke will be increased. As to Connellsville coke there will be no increase in production except such as comes from improving car supplies spring weather helping the operation of the railroads. As to steel mill operations, it is very expensive indeed for output to be restricted as it has been of late at certain works by shortage of coal, and it is cheaper in the long run to pay almost any conceivable prices for coal than to do without.

The removal of the price restrictions on coal and coke, therefore, is certain to be attended quite promptly by a very considerable increase in pig iron and steel production, even though production for three months past has been materially greater than was predicted. While there has been transportation difficulties they have not been as great as was feared, while in the matter of labor, the supply of labor, and labor supplies, have been decidedly better than was expected, and very nearly normal.

Third Quarter Steel

Several of the large independent steel producers are now definitely committed to a policy of selling their products quarter by quarter, opening their order books for delivery in one quarter just after the beginning of the preceding quarter. Thus within a few days several large sellers are likely to announce definitely to their customers the prices they expect on third quarter deliveries. These prices will not be higher than the general level indicated by 3 cents for bars, 3.10c for shapes and 3.25c for plates, while they may be lower. It is understood that some sales have been made to customers entitled to special treatment, perhaps at somewhat less than the prices just mentioned. These same independents used to sell much farther ahead, and it is an interesting question whether they are selling for shorter periods ahead now because they wish to restrict their obligations or because they see that the trade does not wish to commit itself so far ahead. It is stated that there has been a considerable volume of inquiry of late for third quarter delivery, but it does not appear that consumers were disappointed when they found that the mills preferred to hold off, as to all the trade, whereby one consumer would not be disadvantaged as compared with another.

Thus it can hardly be said that the forward market for steel products is particularly strong, and it is certainly not advancing. As for the market for prompt deliveries, it is distinctly easing off, with inquiry much reduced and with prices slightly on the down grade. All these trends are precisely what were to have been expected, for at the beginning of the year it was well recognized that there was an acute shortage of steel, caused chiefly by the strike, and it was commonly predicted that it would require about six months for the mills to catch up with the country's requirements. With production distinctly greater in the past three months than was expected, and with railroad consumption of steel in the next few months smaller than was expected by the buying trade (there having been fears on the part of many consumers that railroad demand would restrict their own supplies) the shortage is likely to be made up somewhat sooner than was expected, and the fancy prices are naturally marked for eventual disappearance. The real basis of the market is the Steel Corporation prices. Below that leval it is quite improbable the market will go for quite a time.

Pig Iron

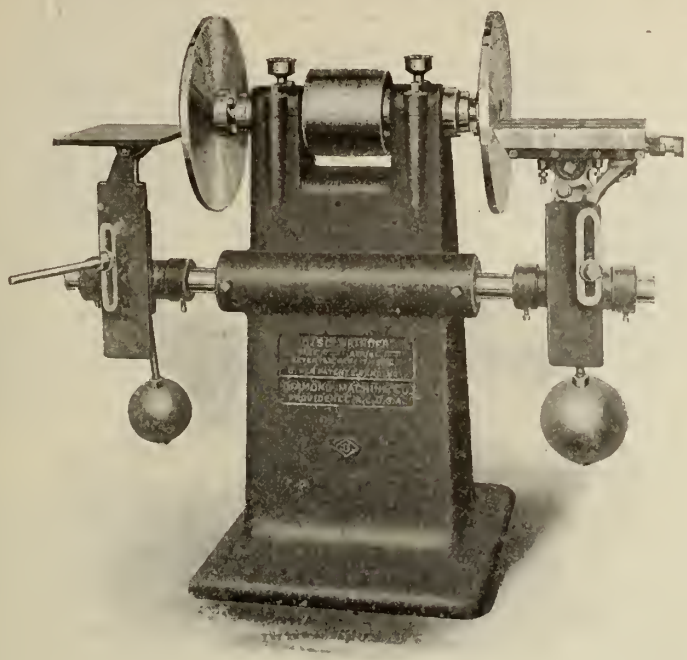
It is between buying movements in pig iron, there being little inquiry for early deliveries and practically none for second half. As forward prices for steel products are not advancing to the levels recently shown by early deliveries, while deliveries are declining, it does not seem that steel producers who use purchased iron will be able to pay present pig iron prices and come out whole. As to foundries, they are not likely to buy for second half unless a fresh scarcity develops. Pig iron rarely declines when the market is dull, as there is no incentive to cut prices, hence the continuance of recent quotations is no particular evidence of strength. The valley market remains at $42 for Bessemer, $41.50 for basic and $42 for foundry, freight for Pittsburgh being $1.40.

ALCOHOL AS A MOTOR FUEL

Alcohol, which has been considerably discussed as the much-sought-for substitute for gasoline as a motor fuel, receives possibly more consideration than other proposed substitutes because there appears to be no limit to the possible sources of supply of alcohol.

The British Government, viewing with concern the rising price of gasoline, appointed a special committee to inquire into the production and utilization of alcohol as a motor fuel. This committee has recently submitted its report and we learn from "Power" that it found that while alcohol is obtainable from molasses, potatoes, wood pulp and other vegetable products, the yield, contrary to popular opinion, is not large.

The usability of alcohol in internal-combustion engines with a properly designed carburetor and slightly modified compression is well recognized, so that there is no obstacle from the engineering standpoint. It is purely a commercial problem. Owing to the somewhat lower heat value of alcohol a correspondingly greater quantity must be used per horse-power-hour, so that in order to compete with gasoline the cost per gallon must be proportionately less.—Houghton Digest.



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Acid Electric
STEEL CASTINGS

Acid Electric Steel Castings show superior ability to resist wear and crystallization. They are smooth in texture, free from Blow Holes, and machine perfectly. We specialize in

Railroad and Other High Grade Castings

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The Week's Events in Montreal Industry

At a meeting of the Nova Scotia Accident Prevention Association, held in Halifax last week, G. D. McDougall, general superintendent of the Nova Scotia Steel and Coal Company, was elected president.

The Lyall Construction Company of Montreal has received the contract for the erection of a Winnipeg warehouse and mail order building for T. Eaton and Company, at an approximate cost of $3,000,000. It is stated that this building will be the largest of its kind on the American continent.

The report of the Montreal Technical Institute for the year just closed, shows a deficit of $3,800. The Board of Governors, composed of a number of prominent business heads of industrial and commercial organizations, will make an appeal to the various manufacturing firms for subscriptions to carry on the work of the institution.

Following a recent interview between a delegation of the Montreal Board of Trade and the Minister of Marine, the Hon. C. C. Ballantyne, the latter has agreed to arrange a joint meeting of the Montreal Harbor Board and a deputation of the Board of Trade, to discuss the increased wharfage rates that are to become effective on the first of April.

Canadian contractors have been invited to tender on the proposed developments of the port of St. Pierre, Miquelon, the small French island off the south coast of Newfoundland. The French Government has authorized the construction of two great breakwaters, about 3,600 feet in length and a maximum depth of 20 feet. A modern lighthouse and other harbor facilities are part of the undertaking.

A statement is expected shortly on proposed developments on the part of the Canadian National Railways, in connection with the erection of a new station at Quebec and the improvement of the water front between the city and the Quebec bridge. W. A. Kingsland, superintendent of the Western division, has been studying the proposition for some time, with the result that terminal improvements at this place may soon be in progress.

J. L. Lemieux, for six years associated with Lymburners, Limited, as mechanical superintendent, and prior to that as general foreman of Robt. Mitchell and Sons, has opened the Modern Machine Works at 83 Bleury St., Montreal, and will carry on a general machine shop for construction and repair work. He will also be in a position to take care of special work, such as the designing and building of machine tools, experimental work, jigs, fixtures, etc.

In a statement issued by the Canadian Railway Association it would appear that this body will not generally adopt a revision of the train schedules to meet the advocates of daylight saving. Where cities or municipalities adopt the plan the suburban services of the different railroads may be arranged to conform to the changed conditions, but no general recognition of daylight saving will be made by the Canadian railroads.

The annual emptying of the Lachine Canal for the usual cleaning and repairs is now in progress, but owing to the heavy ice the time taken to allow the water to flow out has been increased to avoid any possible injury to the canal or the locks. The duration of suspension will depend on the condition of the canal bottom and the amount of the repairs required. It is expected that the canal will be ready for the passage of vessels about the middle of April.

Of the vessels now under construction for the Canadian Government Merchant Marine, four will be launched from the Canadian Vickers yard this year, two early in the season and the others in the fall. About June the Tidewater Shipbuilding Company at Three Rivers will be putting two into the water, and the Davie yard will launch one probably in May. The two 10,000-ton vessels under construction by the Halifax Shipyards will also be ready for launching this summer.

Present plans indicate that Montreal will inaugurate the daylight saving on May 2. The Administration Commission arrived at this decision after the combined requests of various trade bodies in the city. It is not yet learned what the policy of the railways will be, but it is thought that the local trains will be scheduled to run on the basis of the new time, and that this practice will be extended to through trains, if the roads in the States adopt the daylight saving system.

Announcement has been made that the Dominion Iron and Steel Corporation has arranged with the Canadian Government Merchant Marine to have their vessels make regular calls to the Steel Company's shipping ports for the purpose of taking care of the steel products of the company that is being transported to the United Kingdom. Sydney will be the port of call during the summer and Louisburg during the winter. It is stated that other steamship lines are negotiating for a share of the Steel Company's business.

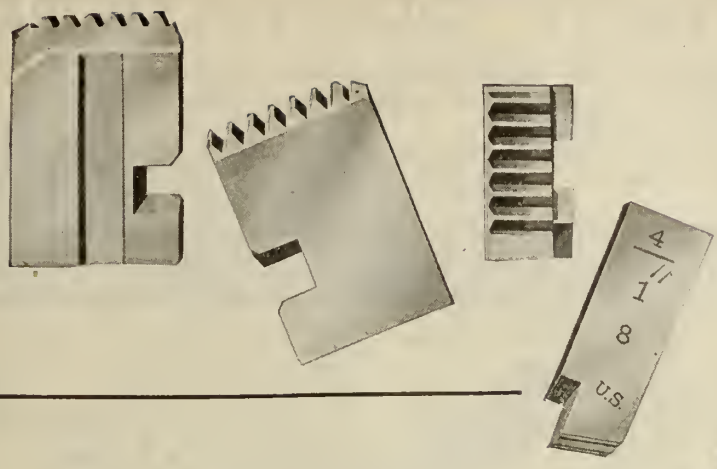
In connection with the recent announcement that the Canadian Pacific Railway Company had arranged with a couple of financial firms for the sale of notes to the value of $12,000,000, it is pleasing to note that the equipment to be purchased will be built entirely in Canada, thus assuring an active period of car construction and allied industries throughout the present year. This is, virtually, the first extensive financing done by the C. P. R. since the beginning of the war, and indicates the need for reconstruction work on the Canadian railroads in readiness for peace-time developments.

W. Rodger, A.M.E.I. of C., who, for the past nineteen months has been manager of works at the Halifax Shipyards, has resigned from his position with that firm to enter business for himself. He has opened an office in Room 19 of the Redford Chambers, Halifax, N.S., under the name of the Nova Scotia Consulting Engineer and Inspection Bureau. He will specialize on problems of water development, supervisor of structures, marine and naval architect, appraisal of works, inspection of material, and the making of designs and specifications for engineering development. During his term of office at the Halifax Shipyards he supervised the greater part of the erection of the plant and the installation of the equipment. Mr. Rodger has had a wide experience in both mechanical and marine engineering, having served with many of the larger engineering and shipbuilding firms, both in Scotland and this country.

France's new inheritance tax will be based upon the peculiar principle that the more children a man has the less his estate should be taxed, and vice versa. If a man dies without children the State will take 33 per cent. If there are two children to be provided for the tax will be 25 per cent.; if three children, 18¾ per cent.; if four or more there will be no tax.

Here is a good chance for the return of the old-time families of 12 members and up.

An electrically-welded ship recently launched from a shipyard at Birkenhead, Eng., makes the second of this novel class of vessel. No rivets have been employed even in the hull, all the plates being butt-welded by the electric arc process. The first 1,000-ton ship constructed on this principle has been at sea for over two years and has thoroughly justified the confidence expressed by the British engineers who advocated this radical change in methods of ship construction in order to save labor and materials.



Sharp Chasers Cut Clean Threads

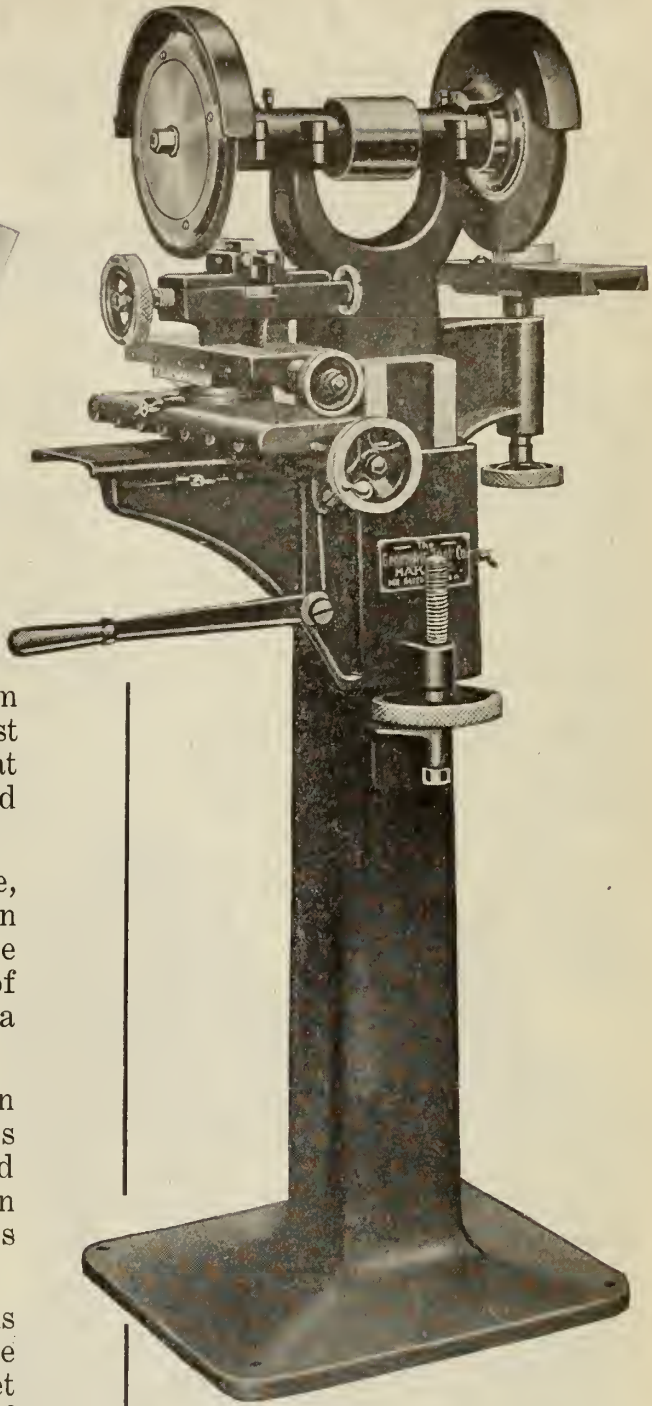
Accurate, uniform threads result only from dies which are maintained in the highest state of cutting efficiency. This means that chasers must be kept sharp, and ground uniformly.

Even if just touched up from time to time, the chasers respond splendidly, with clean threads. And with this machine — the Geometric Chaser Grinder—the matter of keeping threading tools up to scratch is a comparatively simple matter.

Various makes of chasers can be ground on this adaptable machine. The two wheels permit the easy grinding of both milled and tapped chasers. In addition, the plain wheel lends itself readily to various kinds of tool grinding.

Uniform grinding of a set of chasers is purely a mechanical matter through the use of adjustments which can be accurately set to govern the grinding of an entire set of chasers.

The Catalogue describing this machine is a mine of information on chaser grinding. Write for it



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SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$42 40
Lake Superior, charcoal, Chicago	57 00
Standard low phos., Philadelphia	50 00
Bessemer, Pittsburgh	43 00
Basic, Valley furnace	42 90
Toronto price:—	
Silicon, 2.25% to 2.75%	52 00
No. 2 Foundry, 1.75 to 2.25%	50 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 50
Steel bars, base, Toronto	5 50
Iron bars, base, Montreal	5 50
Steel bars, base, Montreal	5 50
Reinforcing bars, base	5 00
Steel hoops	7 00
Norway iron	11 00
Tire steel	5 75
Spring steel	10 00
Band steel, No. 10 gauge and 3-16 in. base	6 00
Chequered floor plate, 3-16 in.	9 40
Chequered floor plate, ¼ in.	9 00
Staybolt iron	9 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	4 00
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 90
Small shapes under 3"	3 62

FREIGHT RATES

Pittsburgh to Following Points	Per 100 Pounds. C.L.	L.C.L.
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

	Gross. Montreal	Toronto
Lake copper	$25 00	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	77 00	75 00
Spelter	12 50	12 25
Lead	12 00	12 00
Antimony	14 50	14 00
Aluminum	34 00	35 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$ 7 25	$ 7 25
Plates, ¼ up	6 50	6 50

Price List No. 38

WROUGHT PIPES

Standard Buttweld

Per 100 feet

	Steel Blk.	Steel Gal.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Gal.
⅛	$ 6 00	$ 8 00	$.....	$.....
¼	4 83	6 96	5 31	7 44
⅜	4 83	6 96	5 31	7 44
½	6 42	7 99	7 10	8 67
¾	8 11	10 24	9 03	11 16
1	11 99	15 13	13 35	16 49
1¼	16 22	20 47	18 06	22 31
1½	19 39	24 48	21 59	26 68
2	26 09	32 93	29 05	35 89
2½	41 24	52 07	.....	.....
3	53 93	68 09	.....	.....
3½	68 54	85 56	.....	.....
4	81 21	101 37	.....	.....

Standard Lapweld

	Steel Blk.	Steel Gal.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Gal.
	Per 100 feet			
2	$29 79	$36 63	$33 49	$39 96
2½	43 58	54 41	49 43	60 26
3	56 99	71 15	64 64	78 80
3½	70 38	87 40	79 58	96 60
4	83 39	103 55	94 29	114 45
4½	95	1 19	1 20	1 45
5	1 10	1 39	1 40	1 69
6	1 43	1 80	1 81	2 19
7	1 87	2 36	2 34	2 83
8L	1 96	2 48	2 46	2 98
8	2 26	2 85	2 84	3 43
9	2 71	3 42	3 40	4 11
10L	2 51	3 17	3 15	3 81
10	3 23	4 08	4 06	4 90

Terms 2% 30 days, approved credit

Freight equalized on Chatham, Guelph, Hamilton, London, Montreal, Toronto, Welland.

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.
4½" and larger 50%.
4" and under, running thread, 30%.
Standard couplings, 4-in. and under, 30%
Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds. Montreal	Toronto
Copper, light	$15 00	$14 00
Copper, crucible	18 00	18 00
Copper, heavy	18 00	18 00
Copper wire	18 00	18 00
No. 1 machine composition	16 00	17 00
New brass cuttings	11 00	11 75
Red brass cuttings	14 00	15 75
Yellow brass turnings	8 50	9 50
Light brass	6 50	7 00
Medium brass	8 00	7 75
Scrap zinc	6 50	6 00
Heavy lead	7 00	7 75
Tea lead	4 50	5 00
Aluminum	19 00	20 00
	Per Ton	Gross
Heavy melting steel	18 00	18 00
Boiler plate	15 50	15 00
Axles (wrought iron)	22 00	20 00
Rails (scrap)	18 00	18 00
Malleable scrap	25 00	25 00
No. 1 machine cast iron	32 00	33 00
Pipe, wrought	12 00	12 00
Car wheels	22 00	26 00
Steel axles	22 00	20 00
Mach. shop turnings	11 00	11 00
Stove plate	25 00	25 00
Cast boring	12 00	12 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜-in. and less	10
Carriage bolts, 7-16 and up	Net
Coach and lag screws	25
Stove bolts	55
Wrought washers	45
Elevator bolts	Net
Machine bolts, 7/16 and over	Net
Machine bolts, ⅜-in. and less	15
Blank bolts	Net
Bolt ends	Net
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square, blank	add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 50
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent.
Set screws	25 and 5
Sq. and hex. hd. cap screws	22½
Rd. and fil. hd. cap screws	plus 17½
Flat but. hd. cap screws	plus 30
Fin. and semi-fin. nuts up to 1-in.	20
Fin. and Semi-fin. nuts, over 1 in., up to 1½-in.	10
Fin. and Semi-fin. nuts over 1½ in., up to 2-in.	Net
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$60 00
Open-hearth billets	60 00
O.H. sheet bars	76 00
Forging billets	56 00-75 00
Wire rods	52 00-70 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 70
Cut nails	5 85
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 35½
British Manila rope	0 28
New Zealand hemp	0 28
Transmission rope, Manila	0 47
Cotton rope, ¼-in. and up	0 88

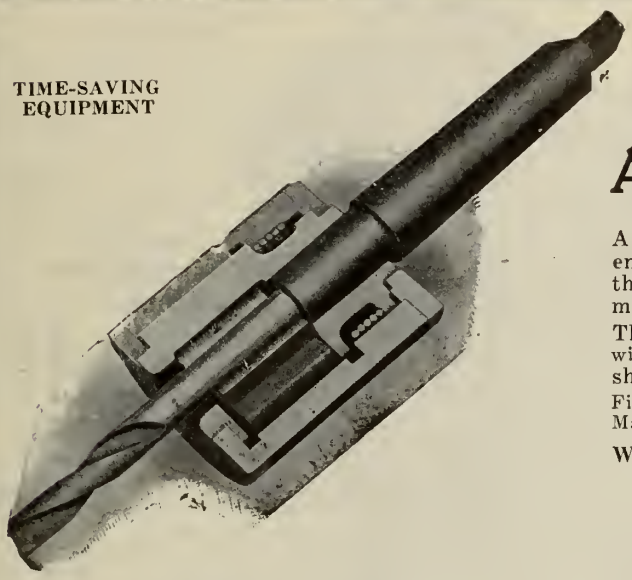
POLISHED DRILL ROD

Discount off list, Montreal and Toronto ..... net

Aikenhead's

When you purchase your tools at AIKENHEAD'S you may rest assured of the Quality. Two well-known lines are displayed below!

TIME-SAVING EQUIPMENT



WAHLSTROM
Automatic Drill Chucks

A strong, instantly gripping and releasing chuck that holds the entire shank in a grip that becomes firmer as the resistance to the tool increases. The clutch can't slip, and the jaws never mark a tool.

The operator can make any change of tools in two seconds, without stopping the spindle and simply by grasping the loose shell of the chuck.

Figure out the labor saving in your plant on drilling jobs.
Made in a number of sizes to take straight or taper shank tools.

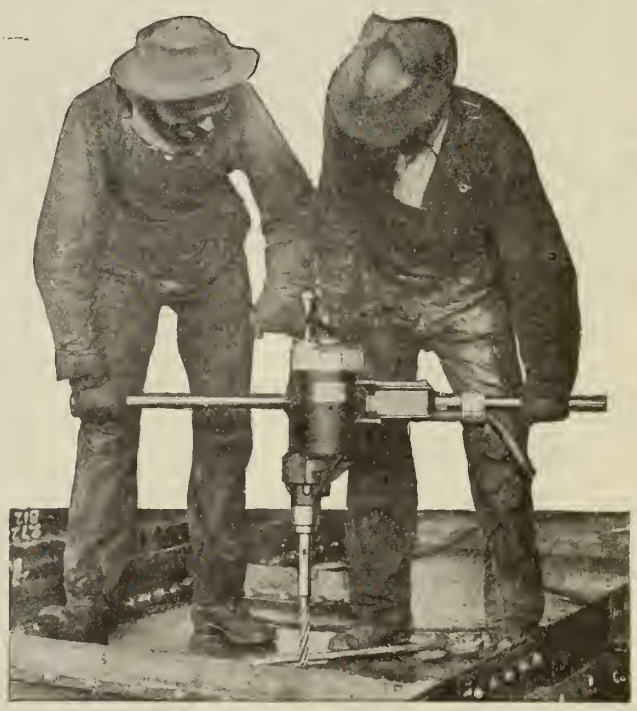
Write for the Wahlstrom Booklet.

Van Dorn
ELECTRIC DRILLS
Make More Holes In Less Time

VAN DORN Electric Drills make neat, clean holes 50 per cent. faster than the best pneumatic drills.

They are both fool-proof and trouble-proof.

For 15 years Van Dorn Electric Drills have ben the recognized standard by which all portable electric drills are judged. Supremacy that insures continuous service in your work. BUY THEM AT AIKENHEAD'S.



AIKENHEAD HARDWARE LIMITED
17 Temperance St., TORONTO ONT.

Aikenhead's

MISCELLANEOUS

Solder, strictly	$ 0 40
Solder, guaranteed	0 43
Babbitt metals	18 to 70
Soldering coppers, lb.	0 62
Lead wool, per lb.	0 16
Putty, 100-lb. drums	8 30
White lead, pure, cwt.	20 00
Red dry lead, 100-lb. kegs, per cwt.	16 50
Glue, English	0 40
Tarred slater's paper, roll	1 30
Gasoline, per gal., bulk	0 35
Benzine, per gal., bulk	0 35
Pure turp., single bbls., gal.	3 60
Linseed oil, raw, single bbls.	3 00
Linseed oil, boiled, single bbls.	3 03
Sandpaper, B. & A.	List plus 43
Emery cloth	List plus 37½
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin, "D," per lb.	0 14
Borax crystal and granular	0 14
Wood alcohol, per gal.	2 70
Whiting, plain, per 100 lbs.	2 75

CARBON DRILLS AND REAMERS

S.S. drills, wire sizes	32½
Can. carbon cutters, plus	20
Standard drills, all sizes	32½
3-fluted drills, plus	10
Jobbers' and letter sizes	32½
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	net
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus 20 to	40
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At warehouse]

Rounds and squares	$7 base
Hexagons and flats	$8 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	60	75
Class B	27	37
Class C	18	27

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 8 50	$ 9 50
Sheets, black, No. 10	8 50	9 00
Canada plates, dull, 52 sheets	8 50	10 00
Can. plates, all bright	8 60	9 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	11 00	....
Fleur-de-Lis, 28 B.W.G.	10 50	....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28.	....	....
Premier, No. 28, U.S.	11 50	10 50
Premier, 10¾-oz.	11 50	10 90
Zinc sheets	16 50	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	29 50
1¾ in.	31 50	30 00
2 in.	30 00	30 00
2¼ in.	35 00	29 00
2½ in.	42 00	37 00
3 in.	50 00	48 00
3¼ in.	.. ..	48 50
3½ in.	63 00	51 50
4 in.	85 00	65 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	24½
Palacine	27½
Machine oil, per gal.	43½
Black oil, per gal.	18½
Cylinder oil, Capital	82
Cylinder oil, Acme	70
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	$2 60
Union thread cutting oil, antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil, bbls., net	13½

BELTING—No 1 OAK TANNED

Extra heavy, single and double	10%
Standard	10%
Cut leather lacing, No. 1	2 75
Leather in side	2 40

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 60
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	09
Pumice, ground	06
Emery glue	30
Tripoli composition	09
Crocus composition	12
Emery composition	10
Rouge, silver	60
Rouge, powder, nickel	45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE

XXX Extra	24	Atlas	20
Peerless	22½	X Empire	19½
Grand	22½	Ideal	19
Superior	22½	X Press	17½
X L C R	21		

Colored

Lion	17	Popular	13
Standard	15	Keen	11
No. 1	15		

Wool Packing

Arrow	35	Anvil	22
Axle	28	Anchor	17

Washed Wipers

Select White	20	Dark colored	09
Mixed colored	10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades... 15%

ANODES

Nickel	.58 to .65
Copper	.38 to .45
Tin	.70 to .70
Zinc	.18 to .18

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10.		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6 x 4 base	45 00	44 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 75	$14 50
Sheets, 3½ lbs. sq. ft.	10 50	14 00
Sheets, 4 to 6 lbs. sq. ft.	10 25	13 50

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

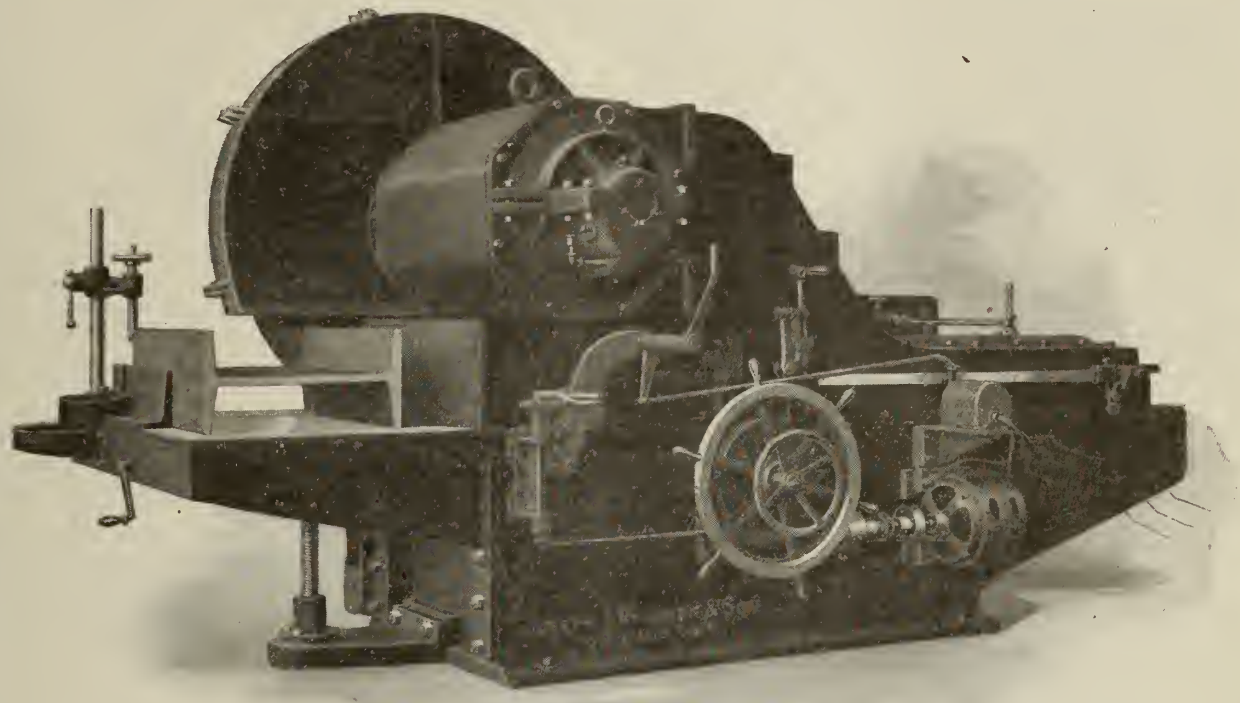
PLATING CHEMICALS

Acid, boracic	$ .23
Acid, hydrochloric	.03¼
Acid, nitric	.10
Acid, sulphuric	.03¼
Ammonia, aqua	.15
Ammonium, carbonate	.20
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.14
Copper, carbonate, annhy	.41
Copper, sulphate	.16
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.08
Nickel carbonate	.32
Nickel sulphate	.19
Potassium sulphide (substitute)	.42
Silver chloride (per oz.)	1.25
Silver nitrate (per oz.)	1.20
Sodium bisulphate	.11
Sodium carbonate crystals	.06
Sodium cyanide, 127-130%	.38
Sodium hyposulphite per 100 lbs	8.00
Sodium phosphate	.18
Tin chloride	1.00
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated

RYERSON

Universal High Speed Friction Saw



No. 4 Universal High Speed Friction Saw

The Ryerson High Speed Friction Saw is designed for rapid cutting of steel shapes of all descriptions. The use of the High Speed Friction Saw in railroad shops is a recognized necessity for the efficient and rapid cutting of rails, beams, angles, channels, tees, zees, round bars, etc., as well as the various special sections which are being employed in steel construction. This saw will cut different shapes in rapid succession without the necessity of interchanging any attachments or clamping the material. A 24" I-beam can be cut in 50 seconds. This saw is made in various sizes, from No. 1 to No. 5, with capacity to cut from the smallest to the largest section rolled.

Write for complete descriptive bulletins and prices

ESTABLISHED 1842 INCORPORATED 1888

JOSEPH T. RYERSON & SON

CLYDE M. CARR, PRESIDENT JOSEPH T. RYERSON, VICE-PRES.

MACHINERY

CHICAGO ST. LOUIS DETROIT BUFFALO NEW YORK

CANADIAN REPRESENTATIVES: Garlock-Walker Machinery Co., 32 Front St., West, Toronto, Canada

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PIG IRON TRADE

There is evidence of a fresh buying movement in the pig iron market. Trading is more active, and prices are firm, and in some cases higher. Following are reports from various U. S. centres:

Chicago.—There has been an active week of trading, and sales aggregating 30,000 tons for last half delivery have been booked. There is also a brisk enquiry, some 8,000 tons of malleable and foundry being asked for. The price of 1.75 to 2.25 silicon iron is at $43 base.

Philadelphia.—There has been good business in the domestic field, and some iron has been sold for export. The export business consisted of 2,000 tons Bessemer at $46 furnace for Italy. Eastern Pennsylvania iron is now $44 for No. 2 foundry, furnace.

Pittsburgh.—Basic is not getting much attention, some export enquiry being the only activity noted. Bessemer is around $42 valley furnace, several transactions having been made at this figure. Foundry iron has been active at $43 furnace for 1.75 to 2.25 silicon for second quarter delivery.

U.S. SCRAP METAL

The scrap metal market is not very active. In some places prices have softened, while in others conditions show no change. Following are reports from various U. S. centres:

Chicago.—The scrap market here appears to be moving slowly upward from the low level reached a couple of weeks ago. Little business is being done and the railroads are not offering much scrap as yet.

Boston.—Prices are weaker in this district and cars are still scarce. There is a better demand for cast iron scrap than for steel. No. 1 and No. 2 machinery scrap sold from $44 to $46, about 2,000 tons changing hands.

New York.—With the changing of weather conditions a big movement of scrap has been inaugurated. This is mostly on old contracts which have been held up by embargoes and coal shortages.

Philadelphia.—Demand is light in most grades, and heavy melting steel has gone down some. Mills are not anxious to buy this grade, but would perhaps take on if it could be secured around $25.

Pittsburgh.—Conditions show practically no change here. Steel manufacturers are endeavoring to postpone delivery of material they have on contract. Steel-making grades of scrap are considerably in excess of the demand and are correspondingly weak in price.

Buffalo.—There is more interest being shown in heavy melting steel, and for No. 1 grade $26 can be got. There have been many rejections of heavy melting scrap lately owing to consumers finding a good proportion of light scrap unsuitable to their needs.

Cleveland.—The market is in a very infirm condition and some grades have been marked down. Heavy melting steel is $25 to $26. No grades have been marked up and dealers are buying just enough to carry them from day to day.

Detroit. — The Norwegian American Line are planning to send their ships direct from Scandinavian ports to Detroit, Chicago and Duluth, as soon as navigation on the St. Lawrence opens. Owing to congestion at New York several of their steamers have had to be switched to Montreal.

Belfast.—John Moir, a riveter employed in a Belfast shipyard, has been appointed a Member of the Order of the British Empire for making a world's record in riveting. He drove 11,209 rivets in a standard ship in nine hours, on June 5, 1919. He is the first shipyard worker to be so decorated.

Brantford.—Manufacturers of agricultural implements are experiencing great difficulty in securing steel for their requirements. The motor and allied trades are using such large quantities that the older companies have difficulty in getting delivery even at the higher prices they are paying.

After the signing of the Armistice the British authorities established a postal aeroplane service to Cologne and in connection with this service systematic use was made of wireless telephony. Wireless telephone stations were placed on the ground at distance of 50 miles from each other and with the use of quite small sets were able to transmit messages to aircraft up to 30 miles away. They could also receive from the air to about 50 miles. Frequently these distances were exceeded and an aeroplane was in communication at one and the same time with three stations. Considering the small size of the apparatus employed, these were remarkable results and testify to the rapid progress made by the British air service since the first trials of wireless telephony to aeroplanes in 1915.

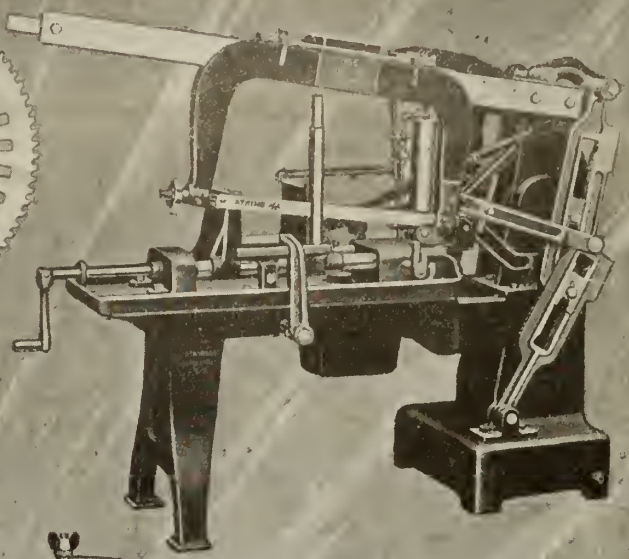
In general design overhead electric cranes for engineering works have tended to become standardized, but a large British firm have introduced a notable departure which carries many advantages. Instead of the usual double-girder arrangement, giving a square appearance, there is a triangular girder, the apex of the triangle being downwards. This design gives a very rigid yet light girder and enables the load to be lifted one or two feet higher than would be possible with the usual type of girder. The driver also has a clearer view of the load from his "cab" than is otherwise possible. The firm has installed this new type in its own works and finds it most suitable for comparatively light loads on long spans—the very conditions which are least suited to the ordinary girders.

Extensive irrigation schemes for the Holy Land are being worked out by a Norwegian civil engineer named Albert Hiorth. His plan embraces a great tunnel, 37 miles long, to connect the Mediterranean Sea with the Dead Sea, through which the water will pass, its force producing electricity to light the country and drive its machinery; also a great pumping plant at the southern end of the Sea of Galilee, with a system of dams, by which the adjoining country will be irrigated, turning arid wastes into fertile fields. As the water will be from the sea, the salt will be abstracted before it touches the land, and used for commercial purposes. In these modern days nothing is wasted.

"So Long, Boys! Take Keer o' Yersels"

THEY SURE DID HAVE THEIR NERVE TO STAY WITH US SO LONG, I'LL SAY!
AND I HAD TO WORK AND KEEP THAT GUY GOING THE PACE HE DID
WINTER
SPRING'S
SUN
EPIDEMICS
TOO MANY WEEKS OF SLEET AND SNOW
SORROW AND REMORSE
HOUSEWIFE

ATKINS STERLING QUALITY SAWS



O'er Land and Sea
North South East West

Atkins Sterling Quality **Saws**

are noted for their efficiency. Their use will increase your production.

Ask for new literature describing Atkins Kwik Kut Power Hack Saw and Metal Cutting Band Saw Machines, Circular Metal Cutting Saws, AAA Hack Saw Blades and Frames, etc.

"A Better Saw For Every Use"

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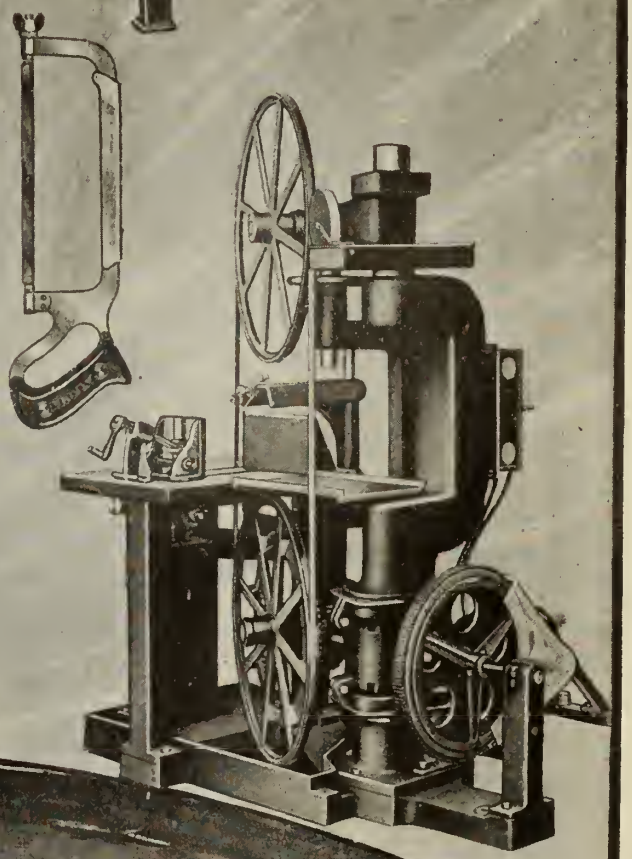
E. C. Atkins & Co.

Established 1857

"The Sterling Quality Saw People"

Factory: HAMILTON, ONT.

Branch: VANCOUVER, B. C.



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS PERSONAL AND TRADE NOTES

Trade Gossip

New Arrangement. — Announcement has recently been made by Joseph T. Ryerson & Son, of Chicago and New York, and the Camden Iron Works, Camden, N. J., of a new selling arrangement whereby Joseph T. Ryerson & Son become representatives of the Camden Iron Works in the sale of their hydraulic machinery products.

Houses Scarce in Guelph. — Guelph manufacturers are making plans for building a number of houses for their employees. The shortage of houses is causing a lot of inconvenience. The housing commission have applications from parties desiring to erect houses, sufficient to absorb the $168,000 they have at their disposal.

Toronto Harbor Outlay.—Included in the estimates tabled in the House of Commons is an appropriation of $1,700,000 for Toronto Harbor improvements, $200,000 for breakwater protection on Toronto Island, $25,000 for improvements on Toronto Dominion Buildings and $425,000 for the completion of Toronto Postal Station B.

Figures of the Standard Oil Co. of California show oil production in California for November amounted to 270,339 barrels a day, a decrease of 7,250 barrels daily from October output. November shipments amounted to 298,939 barrels daily, a decrease of 7,121 barrels a day compared with October. Total shipments were 8,968,162 barrels. Stocks show a decrease of 858,007 barrels compared with October, amounting to 31,159,030 barrels.

British Columbia Steel. — That a powerful British iron and steel company will locate in British Columbia and establish a complete plant for turning out all products of the industry is the word reaching Vancouver from England. Work on preliminaries connected with the firm's flotation for activity in his province has already started. The company will be capitalized at five million pounds sterling, and will work here with an established coal company having rail and water connections. Native ores of British Columbia are to be utilized.

The National Safety Council has distributed a questionnaire covering the subject of industrial dermatoses or skin diseases occurring among employees engaged in certain manufacturing occupations. The latter include chemical manufacturing and munition plants, where compounds such as picric acid are used, and tanneries, where lime, acid, or dichromate frequently cause eczema. In the shoe industry, a hardening of the skin may occur on the abdomen from the worker pressing the shoe against his side for the purpose of steadying it, which in turn may result in chronic inflammatory skin disease. The questionnaire states such conditions are readily preventable.

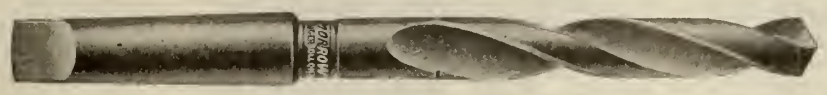
To Make Castings and Machinery.—The McFarlane Engineering Co., Paris, Ont., are converting into a grey iron foundry, the plant used by them during the war in the production of munitions. There will be two cupolas with a production of twenty tons daily. The foundry will be equipped with electric cranes and all modern appliances. It is also proposed to manufacture woodworking machinery, certain lines of machine tools and specialties. Arrangements are being made for production in Canada of some American lines. The McFarlane plant promises an important industrial development. There is an available floor space of 85,000 square feet, with side tracks and electrical substation.

New Canadian Enterprise.—The Diamond State Fibre Co. of Canada has been incorporated to engage in the manufacture and sale of vulcanized fibre, known under the name of "Diamond Fibre." In the electrical field it is used for insulating bushings, gaskets, washers, wire conduits, etc., while in the mechanical field it is used for noiseless gears, discs, wheels, timer rings, etc. At present the Canadian company will import the raw material from Maidstone, Eng., or from Bridgeport, Penn. A mill will be built in Canada as soon as conditions warrant such a move. Mr. T. Elwood Webster is managing director of the company, and is located at 455 King St. W., Toronto.

New Sarnia Firm.—A new company has been formed in Sarnia, which has the promise of becoming one of Sarnia's

— Cluff in the Rochester Herald.

Luring Them On



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Set the highest standard in Twist Drills

FIRST—They are produced from the highest grade High Speed Steel that money can buy—*Guaranteed not less than* 18% *Tungsten content.*

SECOND—*Morrow* Drills are Forged the Morrow way—(the toughness is beaten into the drill). They are made for difficult work in tough materials.

THIRD—*Morrow* Drills are then Hot Twisted by the *Morrow* process—invented by ourselves—given the correct twist at proper heat—extra wide chip space—note the grain of the Steel follows the special twist of the tool—the grain is not broken or distorted as with other makes of milled drills.

FOURTH—Morrow Drills are scientifically heat treated to Morrow high standard and

FIFTH—"Morrow" inspection of "Morrow" high speed Drills is the most rigid inspection ever given Twist Drills.

Every Morrow Drill or Reamer is absolutely warranted to give *you* satisfaction or you get your money back.

Send an order to-day and make your requisition read "Morrow."

"More holes with less re-grinding."

JOHN MORROW SCREW & NUT CO., LTD.

INGERSOLL **CANADA**

INGERSOLL

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A manufacturing opportunity. The LITTLE TWISTER Belt Power Transmitter for Ford and Dodge cars.
This is the simplest, lightest, best selling device of its kind. A twelve months' test of selling direct has netted 25% of sales from all inquiries.
500 LITTLE TWISTERS in daily use giving testified satisfaction. Entire patent rights are for sale. Thorough investigation invited from responsible manufacturers.
FRANK R. WEISGERBER,
Salina, Kans.

DROP FORGE DIES
Send us your blueprints and specifications. Entrust your requirements to experienced workmen and up-to-date equipment. Have your dies made in Canada. First-class workmanship guaranteed.
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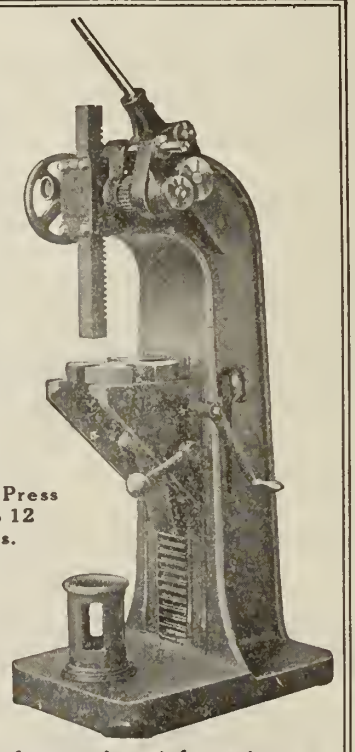
prominent industries. The company is known as the National Engineering Company, Limited, and will engage in the manufacture of milk condensers, air blowers and compressors, automobile air pumps and oil burners. All of these products are now in demand, in fact, several thousand dollars' worth of their machines have already been ordered for immediate delivery. These will be marketed under the trade mark of "Neco," and will be used in every part of the country. The officers of the company are: J. W. Lawrence, president; Willis A. Swan, vice-president; J. E. B. Phelps, secretary-treasurer; B. M. Phelps, sales manager; directors, J. W. Lawrence, Willis A. Swan, J. E. B. Phelps, A. D. McKenzie and Fred Chambers. Manufacturing has already been started and new machinery will be installed within a few days.

MARINE

Toronto.—The case of Fred Torno against Frank W. Callaghan, M. J. Shaw and W. R Sweet involving the ownership of the "Chicora" has been settled in favor of the latter. Judge Orde dismissed the action with costs.

Welland.—The stern section of the "Canadian Otter" was launched from the yard of the British-American Shipbuilding Company recently, and the second section will follow as soon as ready. The vessel, when joined together, will be 320 feet long.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Canadian Representatives:
Chas. A. Strelinger Co., Windsor, Ont.

Windsor.—The death is announced of William H. Gatfield, of the firm of Duff and Gatfield, marine reporters of Amherstburg. The deceased gentleman was 75 years old, and is survived by a daughter and five sons.

Detroit.—The first boats will be placed in commission about April 1st, according to President Schantz, of the Detroit & Cleveland Navigation Company. The steamers Eastern States and City of Detroit II will start the service between Detroit and Cleveland about that date. Last season the first trip was made March 10.

Cleveland.—An agreement has been reached between the Great Lakes Towing Company, and the licensed tugmen, tug firemen, and linemen, under which the men get a general advance in wages. Captains and engineers will be paid $2,400 a season of ten months. Firemen and linemen were given an advance of $17.50 a month, which brings wages to $165 a month without board.

According to a report published in "Ships and Shipping," a French salvage company headed by Baron E. de Wardner, who is now in this country, will attempt to raise the Lusitania, which was torpedoed off the Irish coast by a German submarine. Soundings have been made around the ship, which lies in about 300 feet of water, and her position has been buoyed. The company expects that the work of salvaging the ship will require about twenty months.

SYDNEY BAR MILL WILL OPEN AGAIN

Detroit Company Will Build Its Canadian Plant and Employ 500 Hands

Guelph.—The biggest industrial announcement that has yet come from the Chamber of Commerce was made when it was officially given out that Guelph had secured the Commerce Motor Trucks, Ltd., the Canadian factory of the Commerce Motor Car Co., Ltd., of Detroit. The Federal charter is now being applied for, and plans have already been prepared for the erection of a large motor truck factory. Building on the factory is to start within the next 30 days, and the directors hope that the building will be complete and ready for occupancy by next October. The new industrial concern will give employment to 500 men, when they start manufacturing, and indirectly will give employment to another 2,000, as it is the intention of the company to purchase locally many of the parts that will be required for the assembling of their motor trucks. The parent concern was established in Detroit in 1910, and it now has a capacity of 12,000 trucks annually. The Canadian company will be designed to equal the one in Detroit.

The directors of the Canadian company are: Walter E. Parker, E. M. Baker, Charles L. Granger, Geo. D. Wilcox, all of Detroit, and J. M. Taylor, F.

E. Partridge and J. E. Carter, of Guelph. The factory will be established on 25 acres of ground secured from J. W. Lyon, opposite the Moncrief Furnace Co., on the York Road. It is the intention to endeavor to influence several equipment companies in Detroit to come to Guelph also, and already arrangements are being made whereby a car wheel and axle factory are to come here. In order to accommodate their employees, the employers will build several hundred houses.

GUELPH LANDS NEW INDUSTRY

Increased Activity Noticed at Many Parts of The Corporation Plant

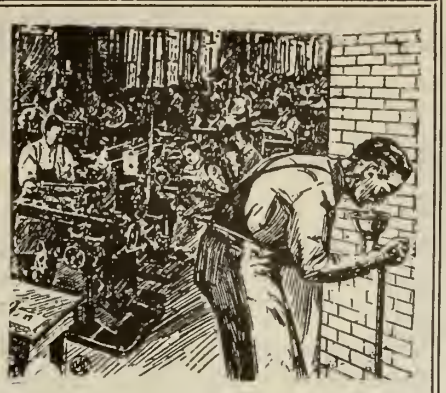
Sydney.—That the bar mill at the Sydney Steel Plant will be in operation, was the information given by an official.

The mill has not been operating for several months, owing to scarcity of orders for bars, but the company has received sufficient domestic orders, it is understood, to warrant them starting the mill again. Workmen are now busily making repairs and overhauling the machinery. It is expected that repairs will be effected so that operations can be resumed the first of the week.

This week the company will finish rolling the 7,500 ton rail order for the Roumanian Government. As no further orders for rails are offering at present, the company are compelled to close down the mill for a short time. There are few demands for rails from any of the Dominion or United States railways at the present time, but it is confidently expected that additional orders will be booked in the very near future.

Workmen are now engaged, or will be in the course of a few days, in giving the Bessemer furnaces a complete overhauling. The bottoms and sides will be newly relined, and the work will require about two months to complete. Upon the completion of the repairs, it is hoped business will have so improved that the furnaces will be blown in.

The 16-inch mill which has been operating on single shift since it started up some weeks ago, is being placed on double shift immediately. This will give employment to an additional number of workmen, as also will the opening of the bar mill.



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"PURO" WILL SAFEGUARD THE HEALTH F YOUR EMPOYEES and protect your staff against disorganization by sickness.
Easily attached. Simply unscrew the ordinary faucet and put on the "Puro."
Write us to-day for full information regarding the cost of installation of the "PURO" Sanitary Drinking Fountain Service.

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Building Active During February

Permits to Value of $4,568,074 Issued Last Month—A Large Increase—Total for the Corresponding Month a Year Ago $1,864,597—Building Conditions Unfavorable

Compiled by FINANCIAL POST.

THE opening months of the year give promise of a revival of building activity throughout the Dominion on a scale that has not been attained since before the war. Returns of building permits issued during the month of February indicate that the totals for the previous month have been surpassed and the volume of building for the corresponding month a year ago, has been more than doubled. The total value of permits issued during the last month for the thirty-eight cities of the Dominion reached a total of $4,568,074, as compared with $1,864,597 for February, 1919, and $3,731,267 for the month of January. This may be regarded as a creditable showing in the face of unprecedented difficulties encountered by the building trades. The cost of labor has risen to an excessive degree, and the condition of the market for all forms of building materials shows no sign of improvement The severity of the present winter has also had a tendency to interfere with operations.

The returns of practically all cities show a substantial increase for the month. As usual the twenty-four Eastern cities lead with a total value of $3,388,348 of permits issued, as against a total of $1,179,726 for the fourteen cities in Western Canada. Toronto again leads with a total of $1,462,768, a large increase over the total for the same month a year ago of $676,185. As in January, the city of Windsor was her nearest rival with permits to the value of $492,000. Montreal again fell far behind, although at $386,335 there was a considerable improvement over the total of $151,740 for February, 1919. In the West, Vancouver leads with permits to the value of $298,799, against $65,810 for the same month a year ago. Regina is a close second at $237.250; and Winnipeg has a total of $119,950 against $20.650 a year ago. The severity of the winter in the Prairie Provinces has had a depressing effect on building, and it is expected that genuine activity will develop in the spring. Halifax was one of the few cities whose totals for the month have declined, standing at $182,160 as compared with $250,248 a year ago. Stratford, St. Thomas and St. Catharines also report declines.

The gain for the first two months of the year is $5,274,560, the total standing at $8,299,341, as against $3,024,781 for the previous year. In the early months of 1919 the future outlook was beclouded in uncertainty and as a consequence construction was delayed. This year there are other difficulties, but the condition of the country is reflected in the increased totals reported. The totals will undoubtedly increase as the more favorable months for building approach.

The following are among the permits issued during the past month: Toronto, Baldwin's Limited, factory, $200,000; Adams Limited, store, $300,000; M. Loew Limited, theatre, $275,000; York Township, schoolhouse, $121,000; Brantford, Brantford Roofing Co., $8,000; Hamilton, factory addition for Hamilton Cotton Co., $30,000; and factory addition for Brown, Boggs Co., $30,000; Peterborough, factory of Canadian Aladdin Co., $12,000; Windsor, Allan Theatre, $195,000; Burroughs Adding Machine Co., factory, $200,000; Woodstock, factory for McKinney Lumber Co., $20,000; Winnipeg, church, $50,000; Calgary, new wing to Yale Hotel, $50,000; Edmonton, Carroll Wison Co., $30,000; C. P. R. building, $60,000, and extension to freight sheds, $20,000; Regina, Regina Trading Co., store, $125,000; H. G. Smith & Co., warehouse, $40,000; Vancouver, D. Spencer Limited, store, $100,000; Empress Manufacturing Co., factory, $20,000; Vancouver Knitting Co.; factory, $10,000.

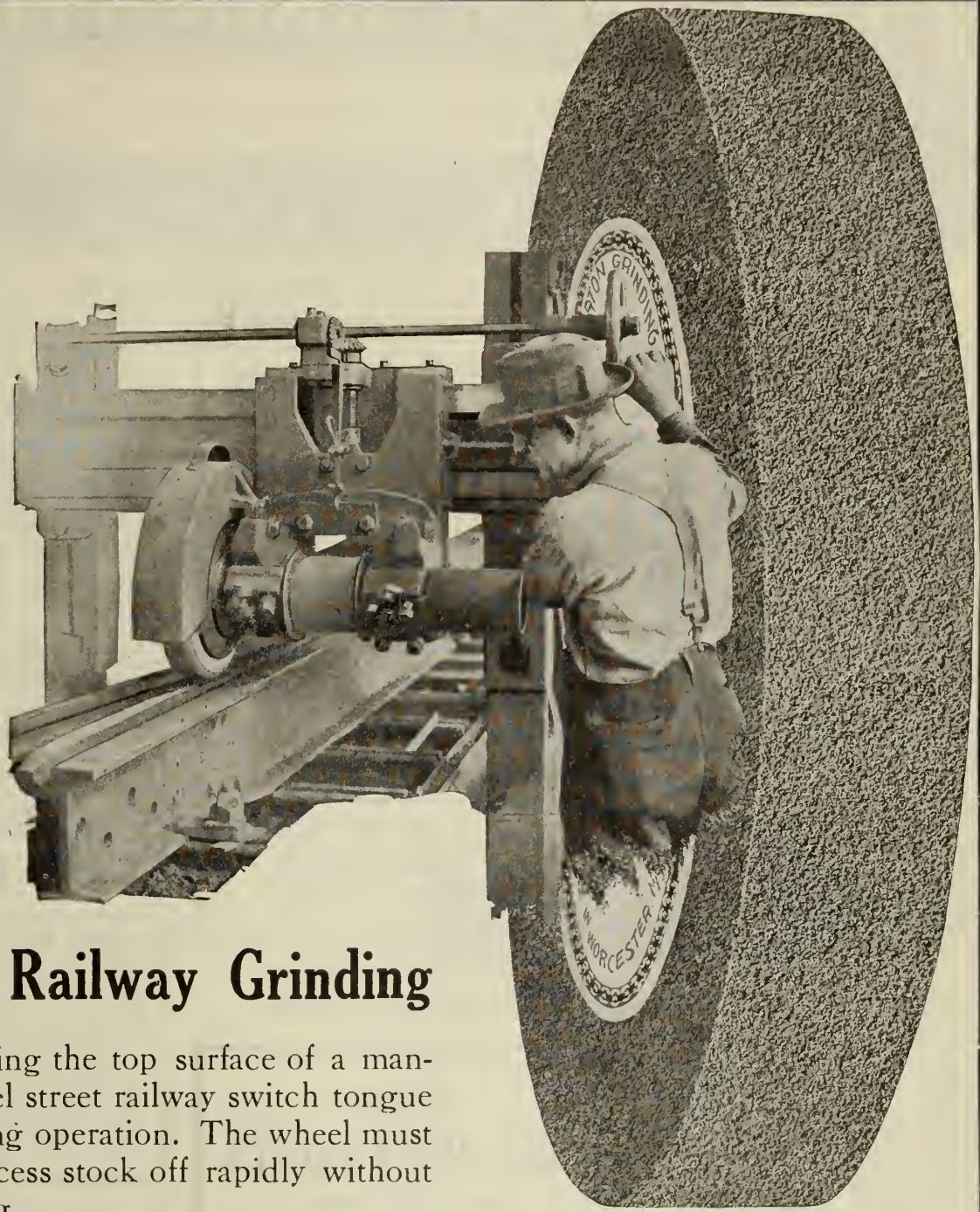
BUILDING PERMITS ISSUED IN FEBRUARY

EASTERN CITIES

	Feb., 1920	Feb., 1919	Change	2 Mos. 1920	2 Mos. 1919	Change
MARITIMES—						
Halifax	$ 182,160	$ 250,248—	68,088	379,025	387,540—	8,515
Sydney	10,210	14,885—	4,675	24,730	29,040—	4,310
QUEBEC—						
Montreal	386,335	151,740+	234,595	613,990	211,894+	402,096
Quebec	160,910	53,630+	107,280	271,560	73,725+	197,835
Westmount	26,000	.....+	26,000	72,000	.....+	72,000
ONTARIO—						
Brantford	16,150	4,275+	11,875	146,620	6,925+	139,695
Chatham	7,500	8,100—	600	15,950	11,900+	4,050
Ft. William	7,400	4,500+	2,850	7,950	5,050+	2,900
Hamilton	218,775	189,965+	28.810	354,225	364,215—	9,990
Kitchener	14,850	2,660+	12,190	21,200	102,260—	81,060
Kingston	1,200	11,312—	10,112	7,855	13,579—	5,724
London	43,525	41,795+	1,730	73,210	59,326+	13,884
Ottawa	57,500	19,500+	38,000	136,200	69,850+	66,350
Peterboro	21,900	21,350+	550	26,850	21,540+	5,310
Pt. Arthur	5,740	322+	5,418	6,970	3,910+	3,060
Stratford	4,040	5,245—	1,205	8,238	5,325+	2,913
St. Catharines	7,445	18,140—	10,695	18,505	35,920—	17,415
St. Thomas	1,410	7,665—	6,255	4,210	10,865—	6,655
Toronto	1,462,768	676,185+	786,583	2,932,098	901,560+	2,030,538
Welland	8,900	14,150—	5,250	10,100	29,405—	19,305
Windsor	492,900	15,850+	477,050	1,128,850	42,400+	1,086,450
Woodstock	26,130	2,750+	23,380	28,630	2,750+	25,880
North Bay	2,000	.....+	2,000	4,000	....+	4,000
York Township	222,600	124,620+	97,980	276,850	169,600+	107,250
Total 24 E. cities	$3,388,348	$1,638,937+	1,749,411	$6,569,816	$2,558,579+	$4,011,237

WESTERN CITIES

MANITOBA—						
Brandon	$ 8,000	$ 4,600+	3.400	$ 9,252	$ 4,600+	$ 4,652
St. Boniface	21,000	1,850+	19,150	21,500	1,850+	19,650
Winnipeg	119,950	20,650+	99,300	206,400	120,050+	86,350
ALBERTA—						
Calgary	105,800	47,500+	58,300	157,800	65,500+	92,300
Edmonton	149,100	3,200+	145,900	151,750	18,050+	133,700
Lethbridge	7,200	1,650+	5,550	16,000	1,600+	14,350
SASKATCHEWAN—						
Moose Jaw	4,950	1,625+	3.325	17,200	2,425+	14,775
Pr. Albert	13,450	2,900+	10.550	17,700	2,900+	14,800
Saskatoon	3,050	6,200—	3,150	33,475	8,120+	25,355
Regina	237,250	42,600+	194,650	249,650	46,700+	202,950
BRITISH COLUMBIA—						
Prince Rupert	36,010	.....+	36,010	56,340	1,800+	54,540
Vancouver	298,799	65,810+	232,989	570,116	144,007+	426,109
Victoria	79,952	10,000+	69,952	117,177	25,975+	91,202
N. Westminster	95,215	17,075+	78,140	105,165	22,575+	82,590
Total 14 W. cities	$1,179,726	$ 225,660+	954,066	$1,729,525	$ 466,202+	$1,263,323
Grd. to. 38 cities	$4,568,074	$1,864,597+	$2,703,477	$8,299,341	$3,024,781+	$5,274,560



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ONE 30 H.P. GENERAL ELECTRIC MOTOR 3 phase 60 cycle 550 volt 5011 Frame. Northern Crane Works, Walkerville, Ont. (c17m)

SECOND-HAND UPSETTING MACHINE, 3½" or 4"; in good condition; immediate delivery. Apply Canada Foundries & Forgings, Ltd., Welland, Ont. (c14m)

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ONE 20-FT. BED HEAVY ENGINE GAP LATHE Broadbent make (England), 70" x 15" swing in gap; 46" swing over bed; 4" belt; 5 step cone; 14' between centres; tight and loose pulley; compound rest and face plate. Darling Brothers Limited, 120 Prince St., Montreal. (c14m)

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1—Only 6" No. 570 B. & S. Vernier Caliper, $18.50 net.
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1	54" x 10'	20	I. MATHESON & CO.	100 lbs.
1	60" x 14'		LEONARD	150 lbs.
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1	66" x 14'	70	JOHN INGLIS	85 lbs.
1	60" x 14'	70	ERIE	90 lbs.
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2	60" x 16'	80	ERIE CITY	90 lbs.
1	60" x 14'	(approx. 80)	GOLDIE & McCULLOCH	125 lbs.
1	60" x 16	100	EXCELSIOR IRON WORKS	110 lbs.
1	48" x 16'	100	LEONARD	120 lbs.
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1	72" x 13'	100		125 lbs.
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2	66" x 16'		MURRAY IRON WORKS	125 lbs.
1	60" x 18'	115	ROBB MUMFORD	100 lbs.
1	60" x 18'	125	ROBB MUMFORD	100 lbs.
1	72" x 21'	125	DILLON	125 lbs.
1	66" x 18'	125	BIGELOW	
1	66" x 20'8"		ROBINSON BOILER WORKS	100 lbs.
2	78" x 18'		DILLON	150 lbs.
1	72" x 19'6"		D. M. DILLON	115 lbs.
1	72" x 14'	150		120/125 lbs.
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5	72" x 20'6"	187½	D. C. DILLON	150 lbs.
2	72" x 20'	170		125 lbs.
2	35' x 48"	250	KEELER	200 lbs.
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The cleaning of metal or other parts in the process of manufacture has become an essential operation—as vital to the finished product as machining or any other step.

It is logical that the acceptance of this truth forced the development of a ***science of cleaning***. The Oakley Chemical Company was a pioneer and for eleven years has been the leading exponent of the science of industrial cleaning. It has demonstrated that by the application of scientific and tested methods and materials for cleaning, production is increased—quality of the work improved—time saved—and costs reduced.

An industrial cleaning problem must be approached from the correct technical viewpoint—investigated as to what happens before and after the work is cleaned—how it is cleaned—and how any change would involve each step.

Oakite Service has succeeded because it is based upon—and has put into execution—these fundamental principles.

If you have a cleaning problem—ask us

OAKITE

MANUFACTURED BY

OAKLEY CHEMICAL CO.

44 THAMES STREET · NEW YORK

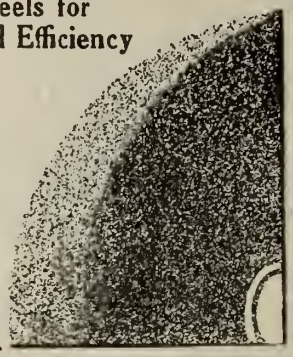
Buy Your Grinding Wheels Direct!

Brantford Wheels for Durability and Efficiency

Remember this when you are considering an order for Emery Wheels: We sell direct to the user—you save the middleman's profit. Then you can depend upon our wheels giving the most efficient service—our wheels represent highest quality in raw materials and manufacture.

Give them a trial.

Brantford Emery Wheel Co.
Brantford, Ontario



Greaves-Etchells Electric Furnace

FURNACES FOR EVERY PURPOSE

Electric Furnace Construction Co.
Finance Bldg. Phila., Pa.

When Writing Advertisers Please Mention This Paper.

STORAGE TANKS
AIR TANKS

Electric Weld

PNEUMATIC TANKS
GASOLINE TANKS

RANGE BOILERS AND EXPANSION TANKS

Canadian John Wood Mfg. Co., Limited
TORONTO, ONTARIO

THE U.S. GOVERNMENT

Has a large quantity of surplus manufacturing

Equipment and Supplies For Sale!

Canadian Manufacturers are presented with an opportunity to secure at low prices good quality new and used Miscellaneous Machinery, Shop Equipment, Miscellaneous Tools, Electrical Equipment, Testing Equipment, Miscellaneous Hardware, Etc.

For Immediate Disposal

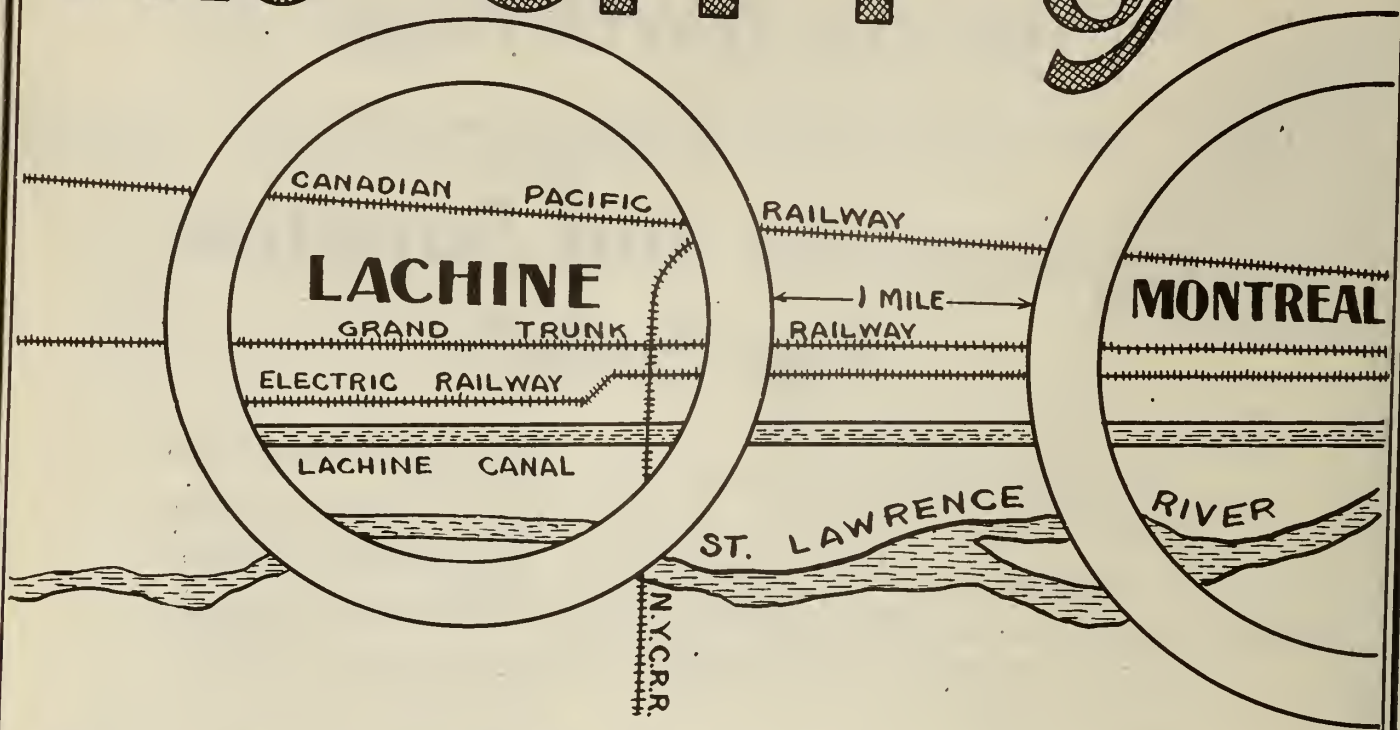
comprising

Accumulators
Air Compressors
Belting
Blowers
Brinell Machines
Chucks
Circuit Breakers
Dies
Drilling Machines
Forges
Furnaces
Generators
Grinders
Hoists
Lathes
Millers
Motors
Presses
Pulleys
Pumps
Pyrometers
Reamers
Scales
Scleroscopes
Screw Machines
Shapers
Switch Boxes
Taps
Tensile Machines
Thermometers
Transformers
Trucks
Vises
Welding Equipment

Toronto District Salvage Board
Ordnance Department U.S. Army
39 Adelaide St. East, Toronto, Ont.

If interested tear out this page and place with letters to be answered.

The CITY of

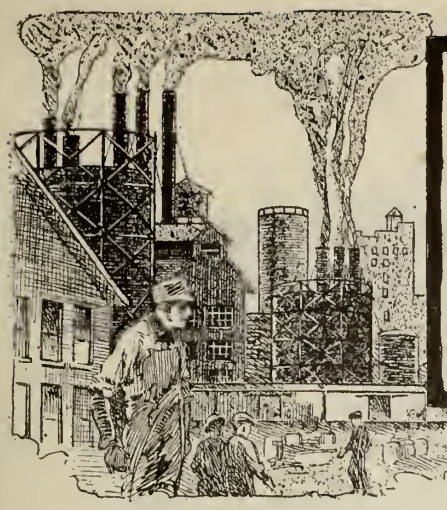


LACHINE—
Quebec
A city of exceptional industrial opportunities

Lachine surrounds the manufacturer with the economic conditions that allow him to meet competition successfully. It places him in a commanding position in relation to the important markets of Canada and the United States and offers fine opportunities for extensive ocean trade within the British Empire. It obtains all the advantages of the close proximity of a city of three-quarters of a million population —a city that is the commercial and financial centre of the Dominion. It is the home of a number of Canada's most important engineering establishments—selected as the most suitable location. Don't neglect to investigate Lachine. It is to-day the finest industrial opportunity in the Dominion.

Full information from

E. Leduc, Sec.-Treas., City of Lachine



STEEL PLATE CONSTRUCTION

Oil Storage, Gasoline Tanks, Air Receivers, Pneumatic Water Supply Tanks, Smoke Stacks, Boiler Breeching, Riveted Steel Pipe, Bins and Hoppers.

THE

TORONTO IRON WORKS

LIMITED

HEAD OFFICE: ROYAL BANK BLDG. TORONTO WORKS: CHERRY STREET

Are You Able to Turn Your Spare Hours Into Dollars?

If not—and you are really trying to cash in on the spare moments you have during the day or after working hours—if you have made up your mind to take hold of some proposition and sail right in and actually increase your monthly income without hindering your regular work—surely you will want to know about MACLEAN'S plan for making each spare moment count. And even if you are already making money during your spare time—still you can add to your income with very little additional efforts. For you can have full particulars of MACLEAN'S plan absolutely free. If you will merely drop us a card we will send you the complete details of this plan. It will cost you nothing to find out exactly how others with spare time have materially increased their monthly earnings. For full information or the agency in your locality, write and right now,

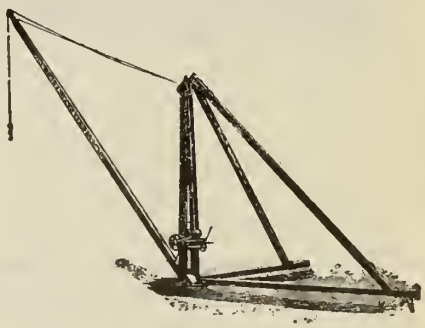
Dept. WB

MACLEAN PUBLISHING COMPANY, Limited

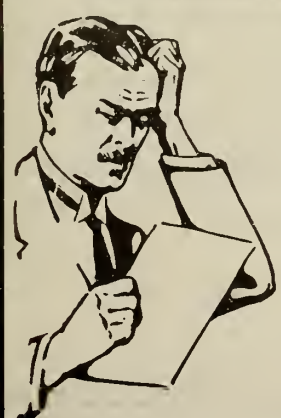
143-153 University Ave., Toronto

The HEPBURN Scotch Derrick

A simple piece of equipment that has been proved to be of immense value in the handling of heavy material. A valuable labor and time-saving addition to the hoisting equipment of the foundry or yard. Indispensable in the handling of heavy castings and machinery, loading and unloading, construction work, etc. Repair parts always carried in stock. Standard price list on request.



John T. Hepburn, Limited, 18-60 Van Horne St., Toronto



Power Transmission Expenses Reduced by

"Renold" and "Morse" Patent Silent Chains

AS

No Slip, Minimum Journal Friction
Maximum Efficiency, Increased Production

Sole Canadian Agents:

JONES & GLASSCO, Reg'd

ENGINEERS

TORONTO MONTREAL

250 H.P. Renold Silent Chain Drive

Demand versus Acceptance

Editorial in "Printers' Ink"

A prominent retail merchant walked into the office of "Printers' Ink" the other day and asked us to advise advertisers to go easy on the you'll-have-calls-for-my-goods argument. According to this man, this plea does more harm than good.

He says that too often it is the concern that advertises only in flashes for the sole purpose of impressing the retailer, that is the loudest in talking about calls. The buyer discounts these promises, because he knows from experience that the few calls that such advertising may produce can be safely ignored.

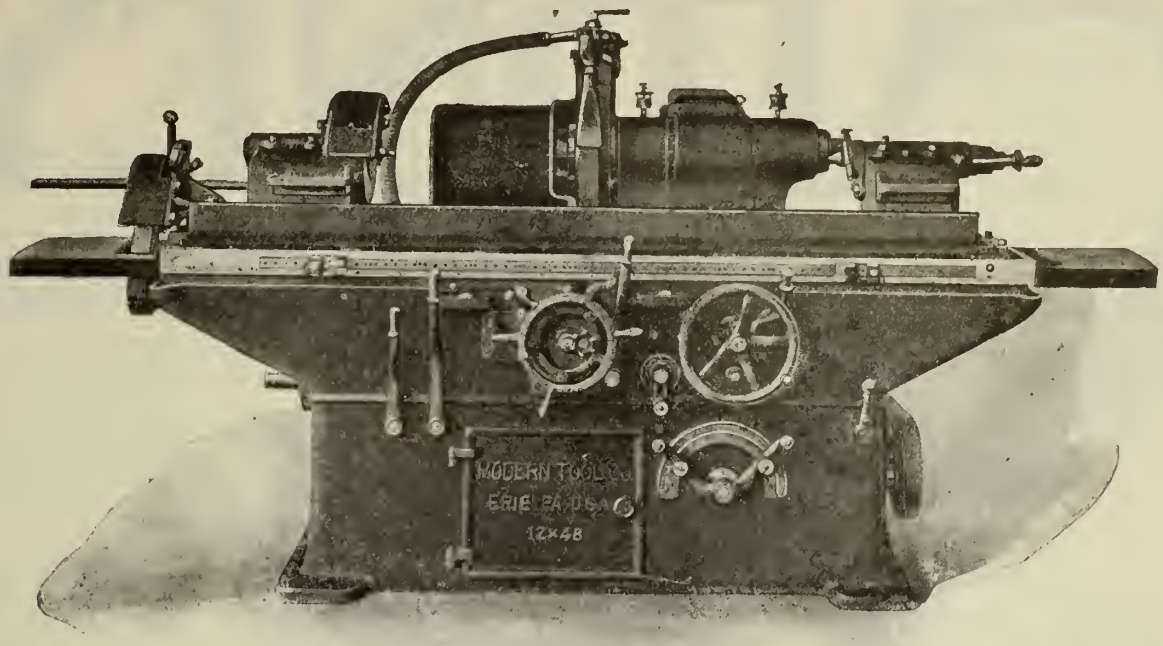
When an article is well advertised, it may be taken for granted that the retailer will receive calls for it. But to emphasize this too much is dangerous. There is nothing easier than for the buyer to declare that he is not receiving calls. That is always his pet objection, and an overmastering one it is. Most salesmen give way before it.

As a matter of fact, the call argument is fallacious, both from the standpoint of the man who uses it to make a sale and also from the standpoint of the prospect who tries to get out of buying by saying he never had a call. Demand is not always expressed vocally. Advertising accumulates a host of desires in most persons that they do not express until a favorable occasion for the purchase of the desired article arises.

The chances are they may never ask for the product at all. Some time when they see it displayed, they will buy it merely by saying, "I will take one of those." Every experienced advertiser knows that advertising is vastly more potent in creating consumer acceptance of a product than it is in bringing oral demand for that product.

Recently one of Hart, Schaffner and Marx's largest dealers told us that it is seldom a man comes into his store and asks for this brand of clothes. This retailer is widely known as a Hart, Schaffner and Marx distributor. Customers who come in take it for granted that they will be given these clothes. They do not call for the brand; they accept it. Nine times out of ten that is the way advertising works.

It is a mistake to pin too much faith on the "call" theory. It is rarely a reliable guide. We heard a druggist not long ago say that he had greatly increased his sales since he stopped waiting for "calls" and began to handle everything that he thought his trade should buy. One illustration that he gave is graphic. He declared that he always carried dental floss, but did not display it because "there were so few calls for it." In an entire year he sold only a gross of floss. However, a salesman one day induced him to group all his dental goods in an imposing display. The sale of all this merchandise immediately increased. Almost everyone who came in picked something off the counter. The increase in the floss sales was particularly noticeable. Picking up a package his customers would say, "My dentist told me to use this. I did not know that you handled it." He now sells twenty-four gross of dental floss in a year. In this one case waiting for calls was euchring this druggist out of about 96 per cent. of his possible floss business.



MODERN

Plain Grinding Machines

Made in 8 sizes:

8 in. x 30 in.	**16 in. x 36 in.**	**16 in. x 48 in.**	**16 in. x 60 in.**
8 in. x 18 in.	**12 in. x 36 in.**	**12 in. x 48 in.**	**12 in. x 60 in.**

The 12″ x 48″ size is illustrated above.

Our line of sizes anticipates and satisfies the grinding requirements of 95% or more shops and factories.

In quality and quantity of work Moderns have no equal. Superiority in services is based on superiority of manufacture and design.

Some features in which superiority is especially noticeable are:

Rigidity, Accuracy, Volume of Output, Ease of Handling.

Send for complete technical bulletins. Get the full story of "Modern" superiority.

MODERN TOOL COMPANY, - ERIE, PA.

Main Office and Works: State and Peach Streets

CANADIAN AGENTS:
Rudel-Belnap Machinery Co., Ltd., Toronto and Montreal, Canada.

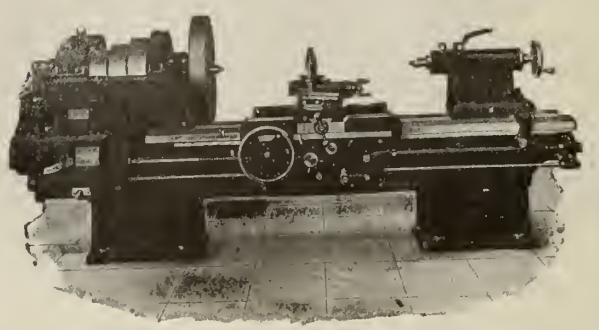
Sales Agents in Foreign Countries:
Yamatake Co., Tokio, Japan
Leo C. Steinle, 53 Victoria St., London, S. W., England
Glaenzer & Perreaud, Paris, France
Hijo de Miguel Mateu, Barcelona, Spain
C. Civita & Co., Milan, Italy
Rylander & Asplund, Stockholm, Sweden
J. Lambercier & Co., Geneva, Switzerland.

If interested tear out this page and place with letters to be answered

SIDNEY

Sidney for Service

Sidney-for-Service Lathes are noted for their power and rigidity. Take deep cuts through toughest metal without pause or chatter.



Specifications include 3-step cone, double brake gear, semi-quick change gear lathe, built on 10 ft. bed. This lathe also furnished with quick-change gears. Bed lengths available: 10, 12, 14, 16, 18 and 20 ft.

The Sydney Line comprises 15-inch, 17-inch, 19-inch, 25-inch, 27-inch, 30-inch and 36-inch lathes, which are adaptable to the finest tool room work or the heaviest duty shipyard or factory rapid production work.

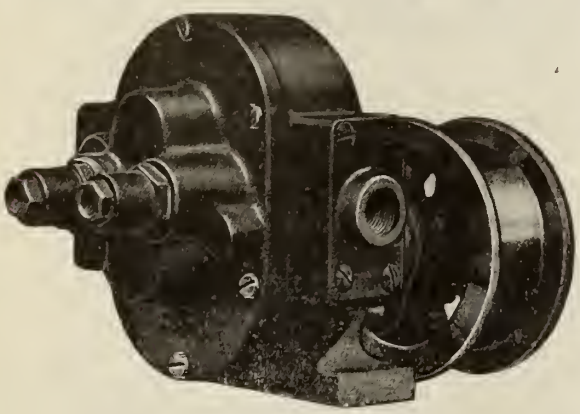
Heavy Duty Engine Lathes

The Sidney Tool Company, Sidney, Ohio

Canadian Agents: Yeates Machinery & Supply Co., Montreal, Que.
H. W. Petrie, Limited, Toronto, Ontario

Lubricant TRAHERN *Pumps*

TRAHERN ROCKFORD, ILL. TRADE MARK



The PUMP That OUTLIVES the MACHINE

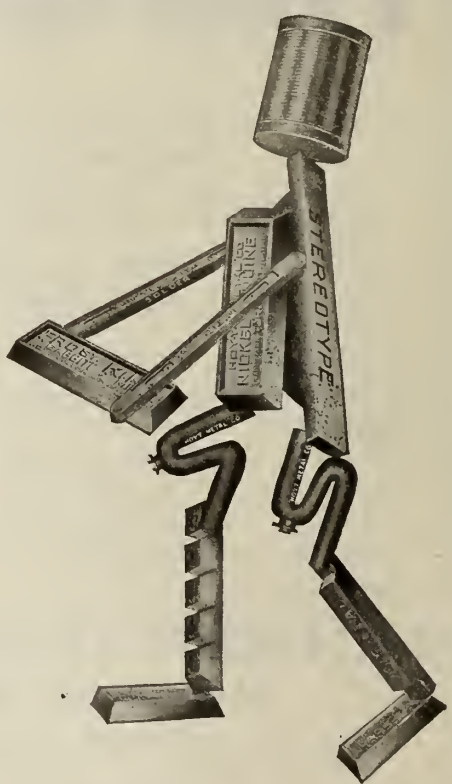
TRAHERN Rotary Geared Lubricating Pumps are for use on metal working machines of all kinds. They are especially constructed to operate at low speed (300 to 500 R.P.M.), thus obtaining minimum wear and very long life. They will shoot forcefully any quantity of coolant at will of operator up to 16½ gallons per minute.

Investigate.
Ask for Bulletin 44.

TRAHERN PUMP CO.

ROCKFORD, ILL., U.S.A.

FROST KING BABBITT



will withstand heavy pressure without increasing its temperature

For general machinery bearings it is without a peer.

If you are from Missouri try a sample lot and be convinced.

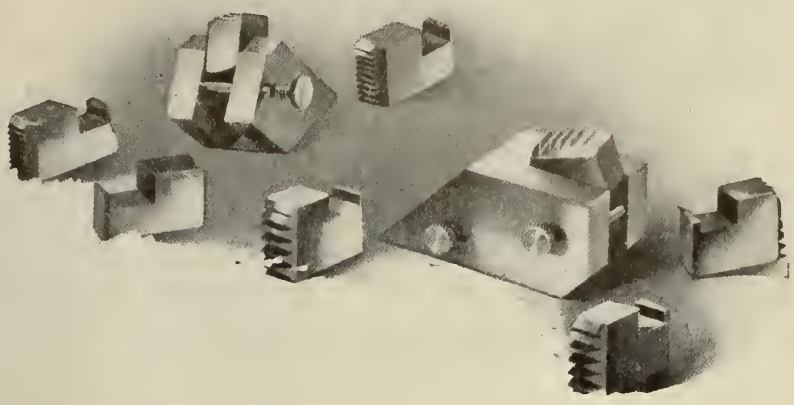
HOYT METAL COMPANY

MONTREAL TORONTO WINNIPEG

If interested tear out this page and place with letters to be answered

Chasers for HARTNESS Dies are easily ground

These Jigs



And any small Grinder will grind Hartness Chasers quickly and correctly.

These Jigs are sent **Gratis** with new dies, and are sold separately at modest prices. Full instructions for Grinding Chasers are sent with chasers. **A special Grinder** for this purpose **is not required.**

Jones & Lamson Machine Company

(AUTOMATIC DIE DEPARTMENT)

American Agents for Dies and Chasers:

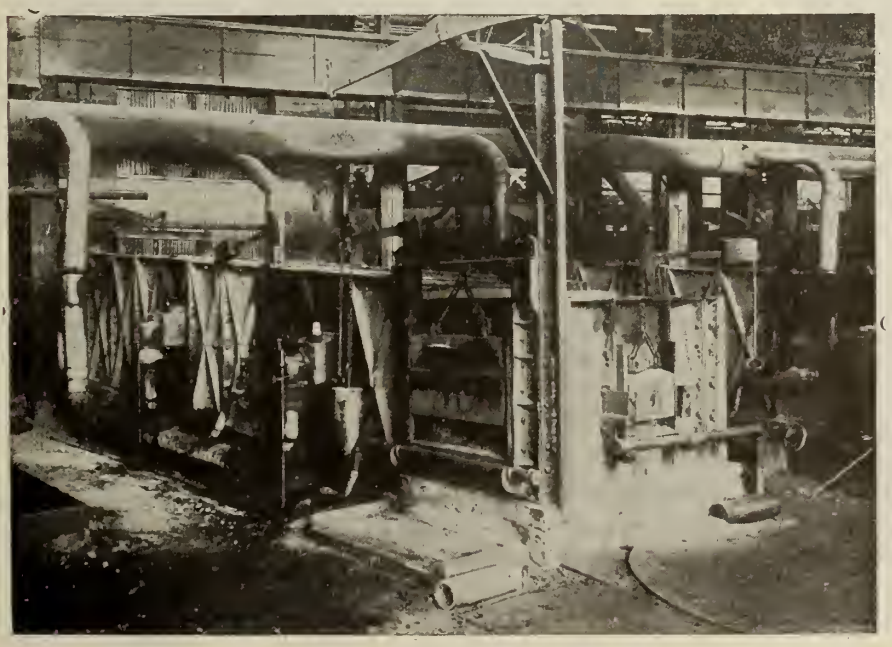
Boyer, Campbell Company, Detroit.
E. L. Essley Machy. Co., Chicago, Milwaukee and Duluth.

Foreign Agents:

France, Spain, Belgium—F. Auberty & Company, 91 Rue de Maubeuge, Paris, France.
Holland—Spliethoff, Beewukes & Company, Rotterdam, Holland.
Australia—McPherson's Pty., Ltd., Melbourne, Australia.
Japan, Manchuria, Korea, Formosa—Mitsui Bussan Kaisha, Ltd., Tokyo, Japan.
Sweden—A. B. Galco, Ltd., Stockholm.

Another MECOL Furnace

demonstrated its superior features point by point to a group of men whose years of experience in the heat-treatment of metals made them appreciative judges.



We refer to the "Mecol" Furnace shown in this illustration, installed at the Pointe St. Charles Works of the Canadian Steel Foundries, Limited.

Our intimate knowledge of heat-treating methods, and our long experience in the building of efficient furnaces fit us to give helpful advice—and that we will do promptly if you

Write

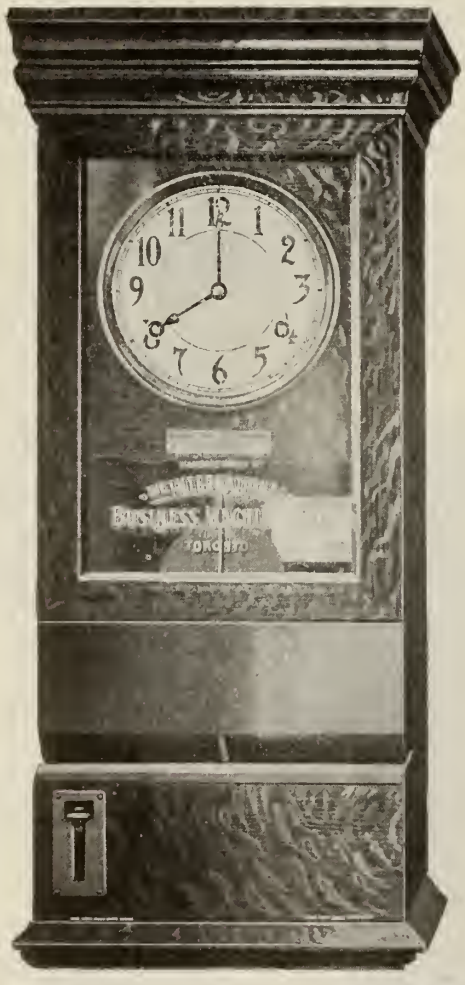
Mechanical Engineering
Company, Limited
Room 308, Bank of Toronto Bldg., Montreal
Three Rivers, Quebec, Canada

If interested tear out this page and place with letters to be answered

"Pencil Records! don't go"

Make this a rule in your plant. It's a good one for any business. For the business depending on labor time records it is absolutely imperative.

International "Job" Time Recorders



International Job Time Recorder

Every job or operation calls for a "job card." The workman punches the time he starts it. He again punches the time he finishes. Both records are *printed* on the card by mechanism inside the machine, in absolutely accurate unchangeable figures. *There* you have the basis of a complete time-keeping system that will keep track of actual working time and, quite as important, give you a tracer on your "expense labor time" — the working time you are paying for but not using.

You need our Service We can help you

Let us send you our latest folders

International Business Machines Company Limited

FRANK E. MUTTON, Vice-President and General Manager

Head Office and Factory: Campbell Ave., Toronto, Ont.
Branches in all principal cities

(Also makers of Hollerith Electric Tabulators and Dayton Scales)

"MORRIS" TRIPLE-GEAR CHAIN-BLOCK

It is essential that your hoisting equipment be selected with the utmost care if you would attain the highest efficiency in handling your material.

Progressive concerns throughout the world have standardized on "MORRIS" hoists because of the efficient and dependable service they give.

The "MORRIS" Triple-Gear Chain-Block is particularly adaptable where a close-lifting, speedy hoist is required.

Every detail in the design of "MORRIS" Triple-Gear Chain-Blocks has been developed with a view to obtaining the highest efficiency and greatest durability.

The success which has been met in this direction can be gauged by the fact that the "MORRIS" Triple-Gear Chain-Block is accepted as the leader in its class. "MORRIS" Chain-Blocks are built to meet every hoisting requirement.

Catalog on Request.

THE HERBERT MORRIS CRANE & HOIST COMPANY, Limited

TORONTO NIAGARA FALLS MONTREAL

Hoisting and Conveying Equipment of Every Description

Electric Cranes
Electric Hoists
Electric Industrial Trucks

Hand Cranes
Overhead Tracks

Chain-Blocks
Trolleys

Floor Cranes
Elevating Trucks
Winches, etc.

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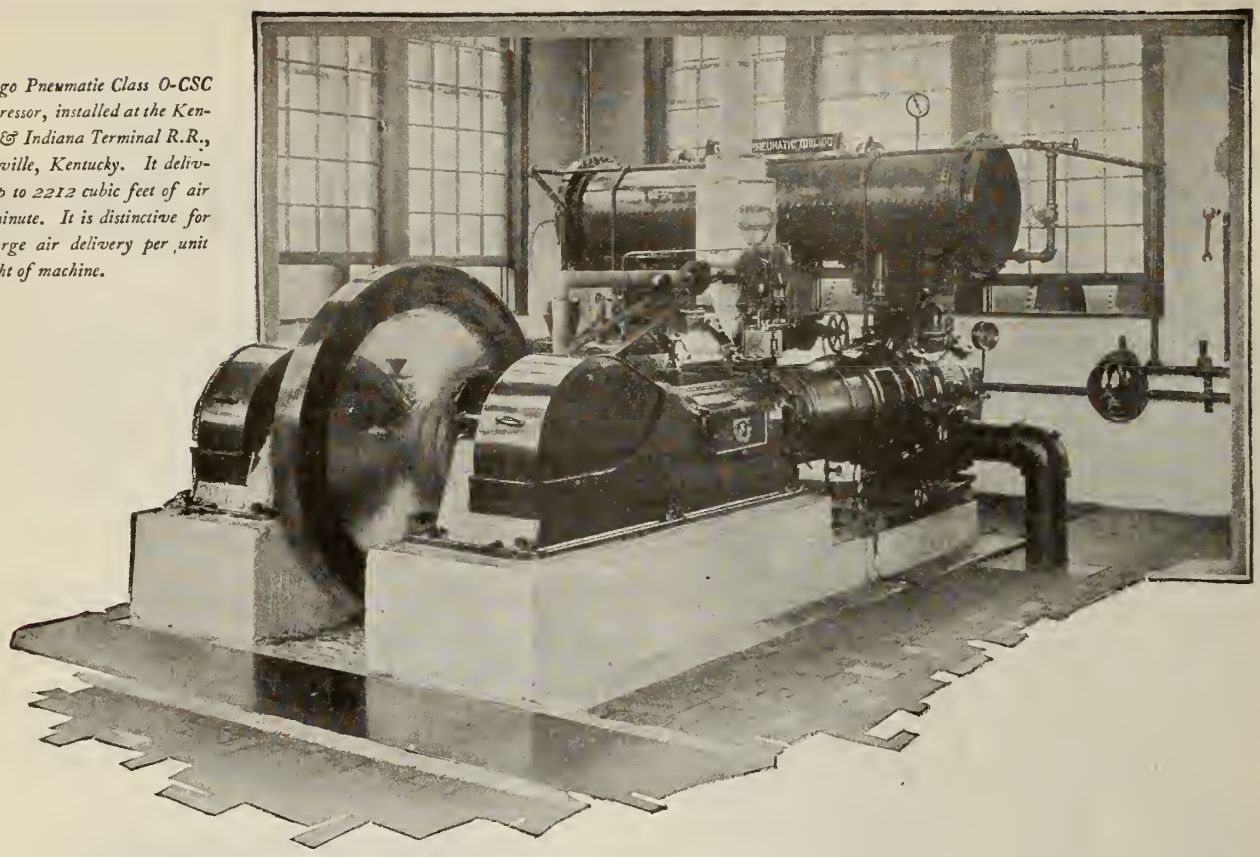


Chicago Pneumatic Class O-CSC Compressor, installed at the Kentucky & Indiana Terminal R.R., Louisville, Kentucky. It delivers up to 2212 cubic feet of air per minute. It is distinctive for its large air delivery per unit weight of machine.

An Air Compressor is as good as its Valves

AN outstanding feature of the Chicago Pneumatic Air Compressor is its Simplate Flat Disc Valves. Over 300,000 Simplates now in daily service—many for over five years—have perfect performance records. The Simplate Valve is made of special alloy steel, scientifically heat treated, and in action has a movement of less than one-eighth inch. Wear is so negligible that Simplates are practically indestructible. Their simple construction eliminates necessity for adjustments, neither is lubrication required. Chicago Pneumatic Simplate Valve Air Compressors are built in over 300 distinct sizes and types. Ask for Bulletins describing types in which you are interested.

Sales Representatives

The Holden Company, Limited

354-356 St. James Street, Montreal, Canada

Sales and Service Branches: TORONTO, 342 Adelaide Street, West WINNIPEG, 150 Princess Street VANCOUVER, 81 Pender Street

Canadian Factory: Canadian Pneumatic Tool Company, Montreal

C-40-H

BOYER PNEUMATIC HAMMERS · · LITTLE GIANT PNEUMATIC AND ELECTRIC TOOLS
CHICAGO PNEUMATIC AIR COMPRESSORS · · VACUUM PUMPS · · PNEUMATIC HOISTS
GIANT OIL AND GAS ENGINES ROCK DRILLS · · COAL DRILLS

GIANT ENGINES

Dependable Power at *Less Cost Per Hour*

For Roofs—old and new

Scores of buildings need roofing
Scores of roofs need repairing

BRANTFORD
Asphalt Slates

Made of the same material as Brantford Crystal Roofing, but in individual size shingles. Crystal Roofing has a crushed slate surface of red or green, 80 lbs. per square. Brantford Asphalt Slates are in great demand.

ASBESTOS FIBRE
(*Liquid*) CEMENT

—a rubberlike adhesive and tough preparation made from finest asbestos fibre, creosote and durable oils. Makes any roof, no matter in what condition, absolutely proof against climatic conditions. Easily applied over any kind of roof, metal, gravel, paper or composition.

Asbestos Sheathing

With fire prevention uppermost in the minds of everybody from the school-boy up there is no doubt a growing tendency to fireproof buildings. Asbestos Sheathing is a recognized fire-prevention material. Recommend it to builders.

Jewel Roofing

Comes in 1, 2 and 3-ply, guaranteed respectively for 3, 5 and 8 years. We think it is the best value on the market for this quality of roofing.

Excello Roofing

—a better grade roofing with a longer guarantee. Comes in 1, 2 and 3-ply, guaranteed for 5, 10 and 15 years respectively. Place your orders early.

We also carry a full stock of regular lines of plain and tarred felt in 10, 12 and 16-oz. weights.

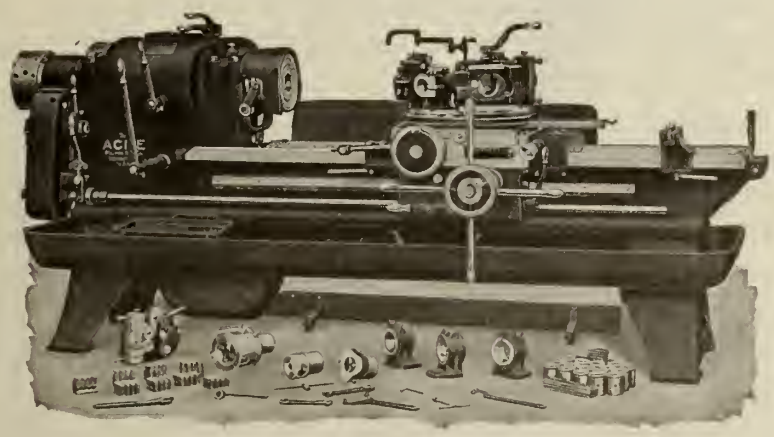
WRITE FOR PRICES

Rice Lewis and Son, Limited, Toronto

Doubly Efficient—Does Both Bar and Chuck Work

This Cincinnati Acme Flat Turret Lathe is a double-production, geared head machine of the sliding gear type. It operates on minimum power because the only gears running are those doing the actual work.

This machine saves remarkable time and labor machining either bar work or chuck work up to 16 in. diameter.



3¼ in. x 36 in. Flat Turret Lathe, Equipped for Bar Work.

Head is cast solid with the bed. You know what that means: accuracy, rigidity, constant and perfect alignment of spindle with vees, upon which the turret carriage travels.

We also make a full line of Screw Machines and Turret Lathes.

Write for Valuable Bulletin

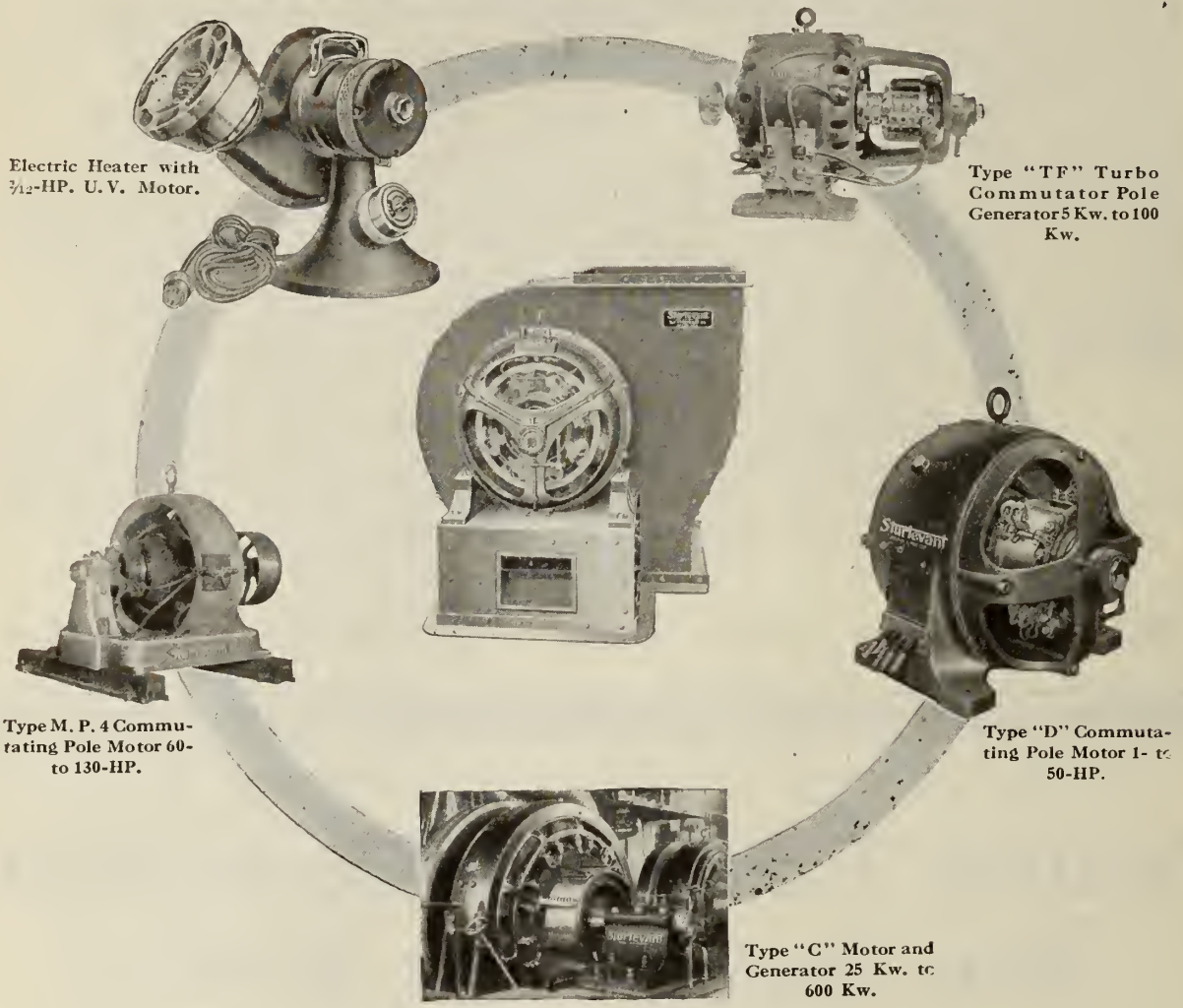
The Acme Machine Tool Co.
Cincinnati, Ohio

Canadian Agents: Rudel-Belnap Machinery Co., of Montreal and Toronto

If interested tear out this page and place with letters to be answered

Sturtevant

Reg U.S. Pat. Off. PUTS AIR TO WORK


Electric Heater with 3/12-HP. U.V. Motor.
Type "TF" Turbo Commutator Pole Generator 5 Kw. to 100 Kw.
Type M. P. 4 Commutating Pole Motor 60- to 130-HP.
Type "D" Commutating Pole Motor 1- to 50-HP.
Type "C" Motor and Generator 25 Kw. to 600 Kw.

IN THE RING---

SINCE 1890

PERFORMANCE records are pretty good proofs of the staying qualities of a motor. Thirty years with minimum repairs seems like a fine record for any motor, yet there are many bearing the Sturtevant name that are giving splendid satisfaction to-day—they were built in the early 90's.

THESE units, while originally designed to meet the flexible demands of fan driving, are adaptable to general industrial purposes where direct current is used—they are built for heavy duty with guaranteed overload capacity—there is a wide range of sizes and capacities for your selection.

Write for the new Catalog 264H

B. F. STURTEVANT COMPANY OF CANADA, LTD.

Head Office and Works: GALT, ONT.

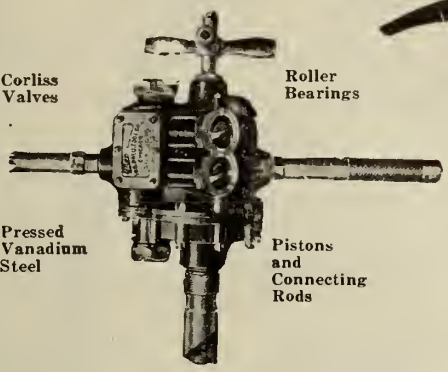
Sales Offices: TORONTO and MONTREAL

Thor

Pneumatic Tools

Piston Air Drills and Reamers

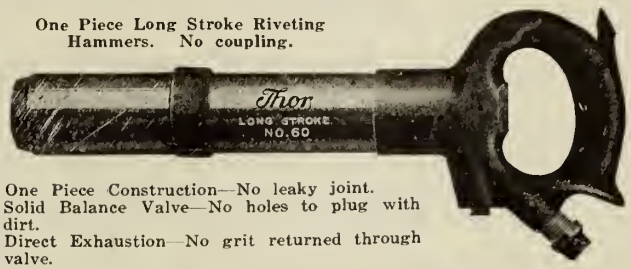
Chipping, Calking and Blue Beading Hammers.



Four cylinder type, two on each side, Semi-Corliss valve close to each pair of cylinders gives greater efficiency and power, saves clearance losses and allows air to enter cylinder at full pressure of the pipe line.

SPEED UP YOUR PRODUCTION AND BE PREPARED FOR THE COMING BOOM

One Piece Long Stroke Riveting Hammers. No coupling.



One Piece Construction—No leaky joint.
Solid Balance Valve—No holes to plug with dirt.
Direct Exhaustion—No grit returned through valve.

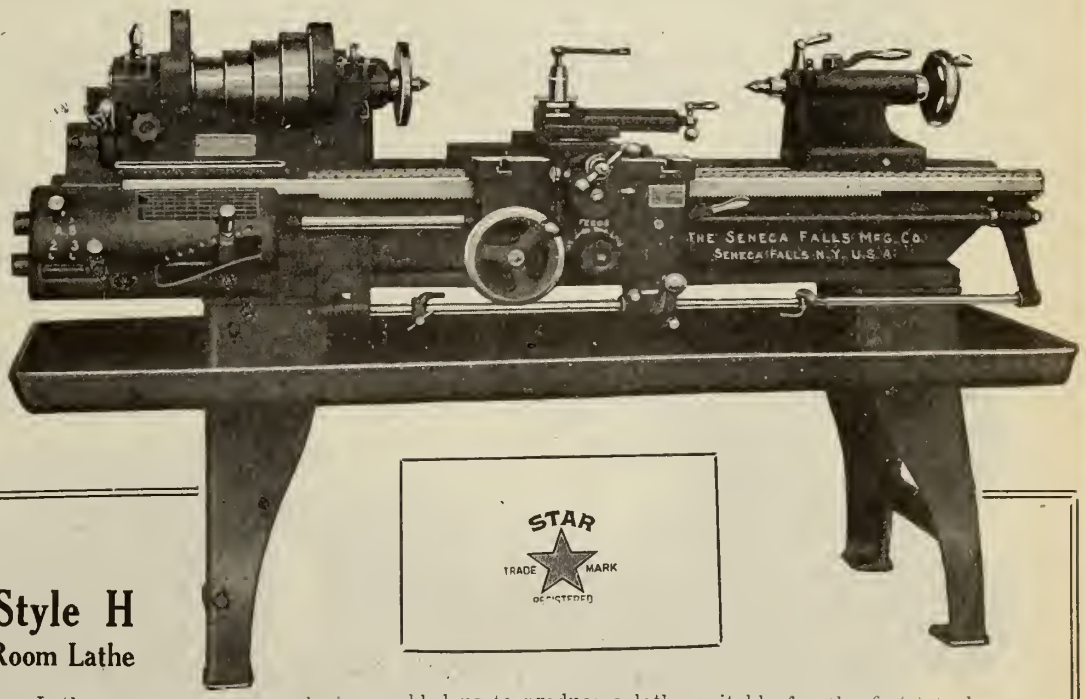
Four sizes. 1-in. to 4-in. stroke. The barrel and all wearing parts are hardened and ground, making the Thor Chipper practically free from vibration.

Independent Pneumatic Tool Company

General Office: 600 West Jackson Blvd., Chicago

CANADIAN OFFICES: 334 St. James St., MONTREAL; 32 Front St., TORONTO; 123 Bannatyne Ave. E., WINNIPEG; 1142 Homer St., VANCOUVER

The Ideal Tool Room Machine



STAR TRADE MARK REGISTERED

12" x 6' Star Style H
Quick Change Tool Room Lathe

The Star Tool Room Lathe possesses some exclusive points of superiority that are valuable as time and labor saving features in tool room work. It is a simple, sturdy machine, and has proved to be a valuable tool on rapid manufacturing production which requires speed and accuracy.

We would like to describe the details of this "Star" to you, show you how an efficient organization has enabled us to produce a lathe suitable for the finest tool room work, and to market it at a reasonable price. Let us mail the Star catalogue to you. It describes many exclusive "STAR" features in detail—the Micrometer Cross Feed Stop, the Apron Reverse for all speeds and threads, the Automatic Carriage Stops, the Quick Change Gear with 48 changes of feed or thread, and many other valuable points of design. This catalogue is gladly mailed on request.

SENECA FALLS MFG. COMPANY, INC., 366 W. Falls St., Seneca Falls, N.Y.

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ROCKFORD

HORIZONTAL BORING MACHINE FOR HEAVY OPERATIONS

Turns Out Work Rapidly and Accurately

Special features of Rockford Horizontal Heavy Duty Boring Machines are massive design, great strength and ability to stand up under the toughest of heavy operations and turn out accurate work with great rapidity.

The machine shown is of the Double End type. It has a direct motor drive with interchangeable pick-off gears. Forward and reverse feeds, feed back gears are other points of this splendidly designed machine worthy of special attention.

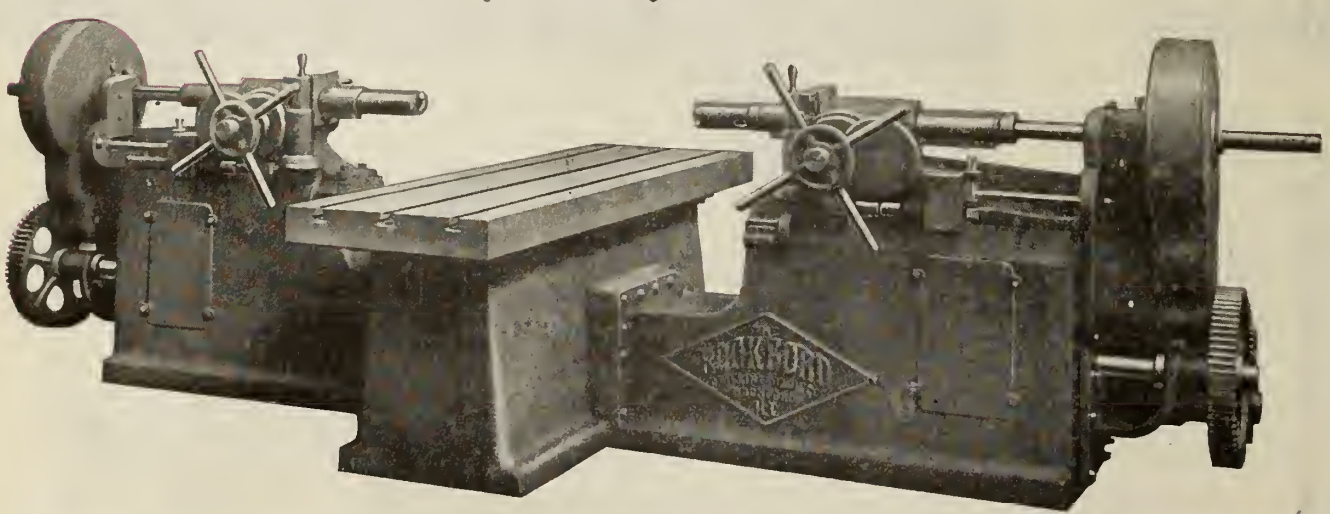
Complete Tooling Equipment goes with each installation where desired.

Write to-day for full information.

Rockford Drilling Machine Co.

Canadian Agents:
Rudel-Belnap Machinery Co., Toronto, Montreal

Rockford, Illinois



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Engineers, Manufacturers and Erectors of Steel Structures

Industrial Bridges, Buildings, Towers, Smoke Flues and Stacks, Chutes, Coal Bins, Ore Bins, Tanks, Cranes, Engine Houses, Grain Elevators, Derricks.

Structural Steel and Steel Plate Work, and a combination of the two lines.

Prompt Deliveries Assured

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THE "SEMPLE" TAP

Patent Applied for.

A SCIENTIFICALLY CORRECT CUTTING TOOL

makes tapping a pleasure

The Most MODERN,
The Most EFFICIENT,
The Most ECONOMICAL.

Send for a "SEMPLE" Sample Tap. Made in any thread
Special Taps for blind holes.

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Heat Under Accurate Control

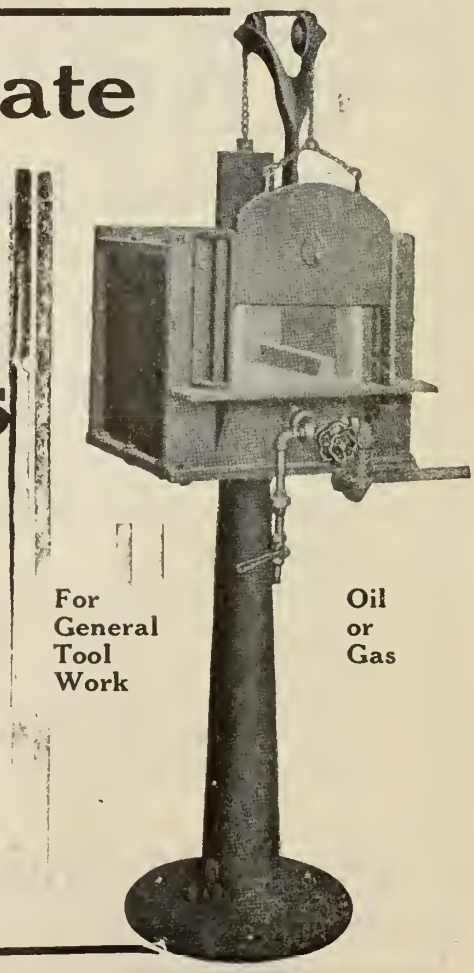
Here is an important factor in the heat treatment of metals. An intense heat, rapidly developed, and always under accurate control of the operator, are features that distinguish

BELLEVUE FURNACES

These tool forges are particularly adapted for the requirements of the small machine shop for annealing and tempering dies, cutters, reamers, etc.

Combustion is perfect and no flames come in contact with material. Built to stand the highest temperature. Doors are properly counterbalanced. In every way BELLEVUE FURNACES meet with the demand for durability, efficiency and convenience.

Let us advise you about your heat-treating problems.



For General Tool Work

Oil or Gas

Bellevue Industrial Furnace Company

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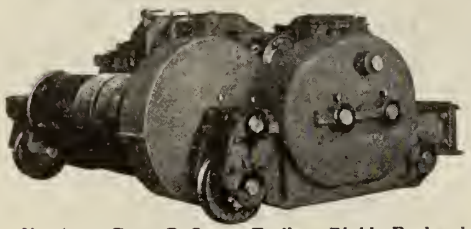
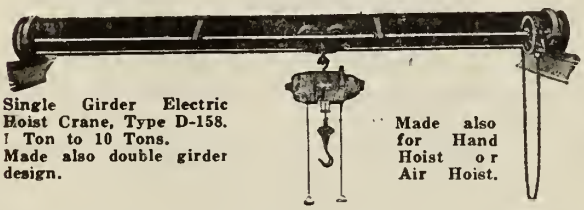
Electric and Hand Traveling Cranes

Type E—3-Motor Electric Traveling Crane, 2 Tons to 100 Tons



Northern Type E Crane Trolley, Rigid, Enclosed Construction. Patented in Canada.

We make a wide range of CRANE and HOIST designs. All sizes and capacities, 1 ton to 100 tons.



Single Girder Electric Hoist Crane, Type D-158. ½ Ton to 10 Tons. Made also double girder design.

Made also for Hand Hoist or Air Hoist.

Get our prices and specifications before you buy.

In asking prices, state SERVICE, CAPACITY, SIZE OR SPAN POWER, and, if electric, KIND OF CURRENT.

Catalogs free.

Type D Electric Hoists —½ to 10 Tons.

Air Hoists, Trolleys and Tracks.

Type No. 20 Air Hoist.

Northern Crane Works, Limited

Walkerville, Ontario, Canada

"OLIVER" No. 404

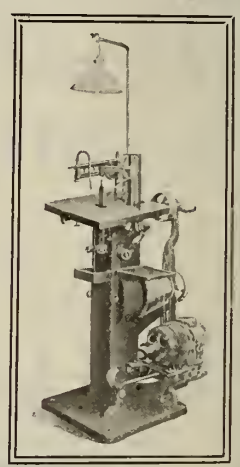
High Power Filing Machine

(Rearwin Patent)

Five Years in Hard Service And No Repairs

The proprietor of the West Michigan Machine & Tool Co., Grand Rapids, heartily endorses the "Oliver" No. 404 High Power Filing Machine. He assures us that this one has been forced so hard, at times, that 8-inch cross-cut files have been broken; but in spite of exacting service, the machine has not required repairs of any kind.

This company is one of the concerns which appreciates the advantage of saving the skilled die maker's time with efficient mechanical helps. The "Oliver" No. 404 High Power Filing Machine is an economical and accurate tool which it will pay you to investigate.



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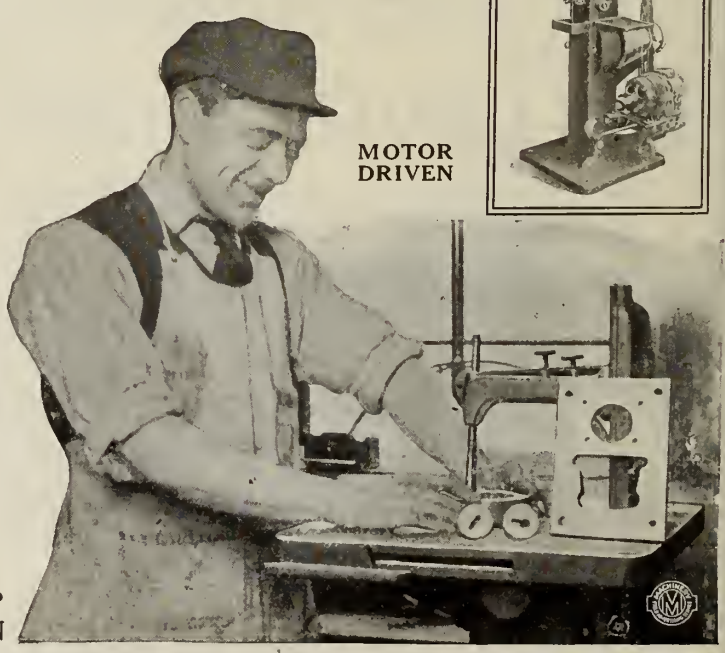
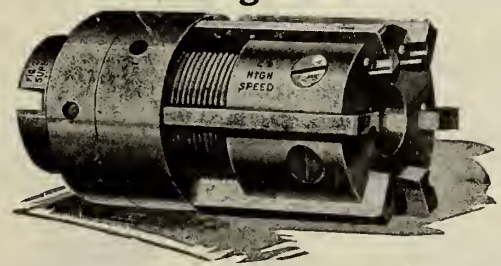


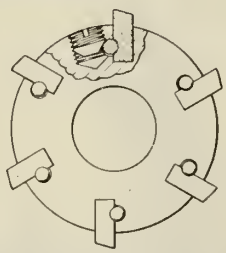
Oliver Machinery Co.

GRAND RAPIDS MICHIGAN

BRITISH SMELTING & REFINING Co. Limited.
Drummond Building Montreal.

If you are still using solid reamers instead of





McCrosky SUPER Adjustable Reamers

Consider the 2" High Speed SUPER

The original cost is $3.15 less than that of a 2" solid reamer.
It has an adjustment of .120 for wear. With its original set of blades it can ream more holes than a dozen solid reamers.
A new set of 2" H.S. SUPER blades cost $8.10. With them you are ready to out-wear another dozen reamers.
The 2" H.S. SUPER is not an exception. Every SUPER of every size will save you money, save you time, and improve your production.

Get the details. Catalog No. 7 has them. Write for it.

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Meadville, Pa., U.S.A.

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McCrosky COST CUTTING TOOLS

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VOLTA
Electric Furnace

For economy, it is essential that the furnace be so designed and equipped as to reduce to a minimum the refining time and delay between heats.
Volta Furnaces are the result of 10 years' experience **and nothing is spared to make them efficient.**
We are capable of advising you on your steel casting proposition.

Volta Manufacturing Co., Limited

WELLAND - ONTARIO

BESIDES being cheaper, electric steel castings have other advantages over ordinary steel castings. The product has a particularly homogeneous structure, a fine grain, superior physical properties, and a chemical composition which can be perfectly controlled.

FOR QUALITY CASTINGS

Illustration shows 6-ton VOLTA Furnace in running position.

TRADE Sterling MARK

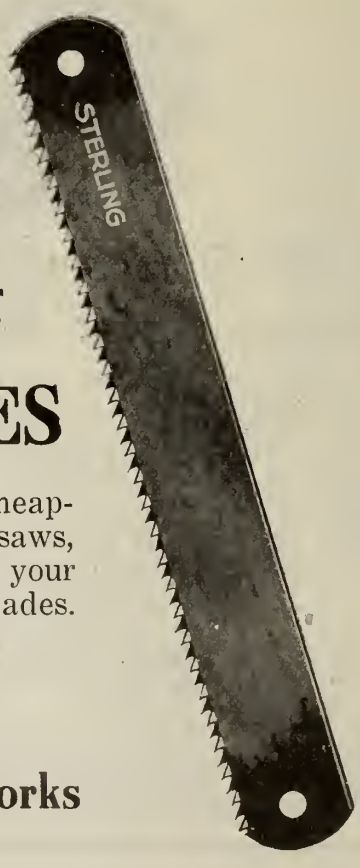
STERLING
HACK SAW BLADES

A proof of the fact that quality is always cheapest in the end. If you want durable hack saws, fast-cutting, keen and tough, then be sure your order calls for "STERLING" Hack Saw Blades. It's a guarantee of satisfaction.

Manufactured by

Diamond Saw & Stamping Works

BUFFALO. N.Y., U.S.A.



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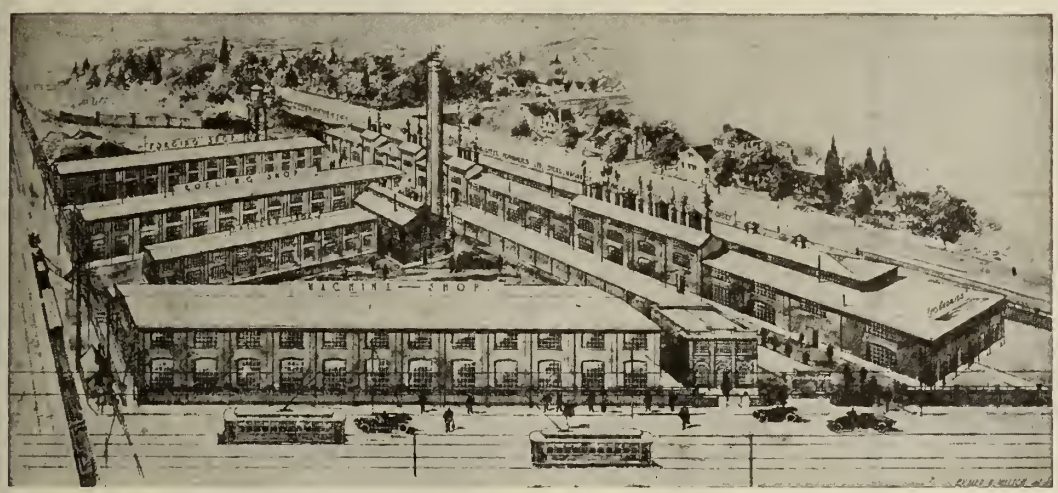
Steel, Chrome, Manganese and Nickel Steel Castings

Annealed and Unannealed

Cement Mill and Mining Machinery Castings, Stamp Mills, Crushing Plants, Excavating Outfits, Steel Car Wheels, Locomotive Driving Wheels and Frames, etc.

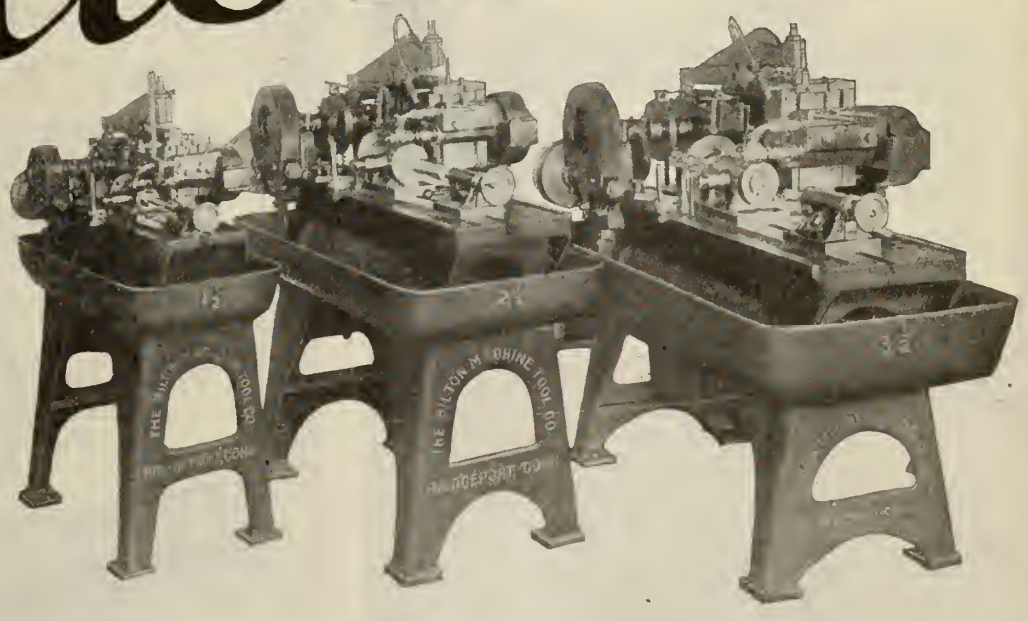


Machine-Moulded Gears

"HISCO" machine-moulded gears, while requiring no pattern, insure accuracy, dependability, quality, and the price is minus the cost of patterns—which in these days of high prices of lumber is something to be considered.

Specify "HISCO" Products

Bilton GEAR MILLERS



Fully Automatic

Their adaptability is almost unlimited on small work—such as cutting spur, bevel, miter, angle gears, saws, ratchets, sprockets, cutters, knurls, taps, cylinders, form cutting, manufacturing, milling, etc.

A big time saver, as indexing takes place during return stroke of cutter—which is removing metal 90% of the time.

Write us for Catalog 30-6

Over 500 leading manufacturers now use the Bilton for high production on accurate work

Bilton Machine Tool Co. Housatonic Avenue Bridgeport, Conn., U.S.A.

Foreign Agents: Alfred Herbert, Ltd. Chas. Churchill & Co., Ltd.

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THERE is as much difference in the various makes of High Speed Steel as there is in men—

The practice and methods of manufacturers differ widely in every mill and anyone who is at all familiar with the manufacture of High Speed Steel thoroughly understands this

"Red Cut Superior"

The Nationally Known—First Quality

HIGH SPEED STEEL

is the best for all Machine Work

ARE YOUR TOOLS MADE OF "Red Cut"?

VANADIUM-ALLOYS STEEL COMPANY

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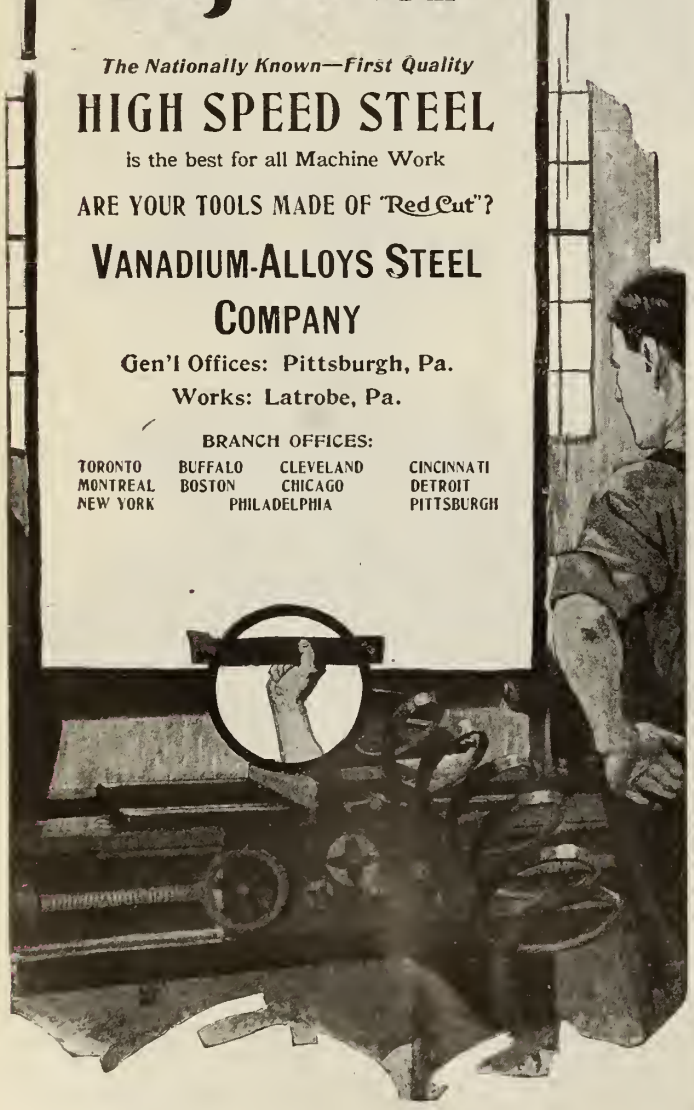
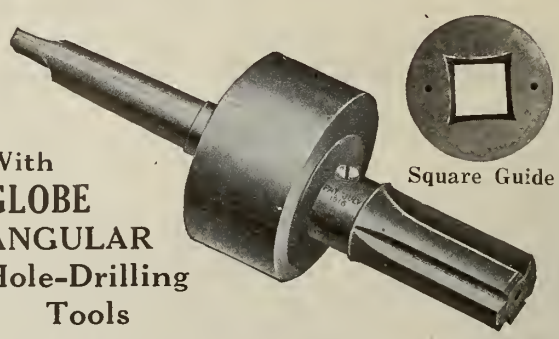


DRILL

those Square, Hexagon or other Angular Holes



With GLOBE ANGULAR Hole-Drilling Tools

Square Guide

A GREAT TIME-SAVER

A large number of Canadian manufacturers are profiting by reduced production cost — a direct result of Globe Angular Hole Drilling Tools.

Why not investigate? Let us send you full details?

Globe Engineering Co., Limited

HAMILTON, CANADA

We wanted something original— this is what we got

"BOTH of these operations and half another — I'll show you later—completed in the time our old taps took to do one; that, I guess, is why we continue to use your Victor Collapsible Taps."

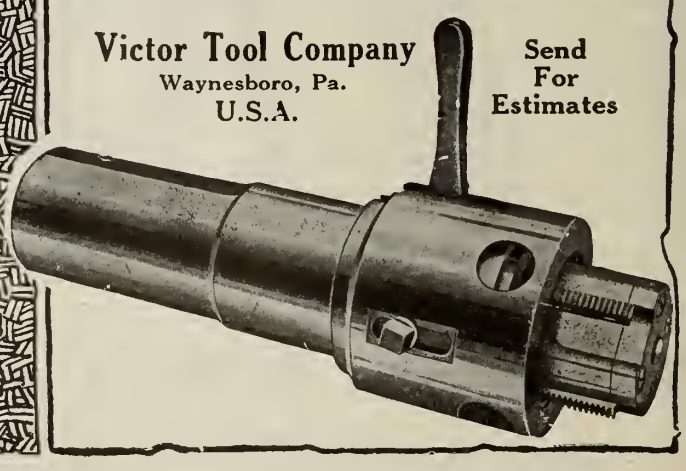
It was the often-heard story of time saved, of costs lowered, of all threads clean and smooth. And it was pleasant to hear.

Victor Tool Company

Waynesboro, Pa.

U.S.A.

Send For Estimates



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Meet every demand in fire brick service

Elk brands fire brick are made for every purpose, each brand having some particular qualification which fits it to give better results in certain places than other brands we produce. When you buy Elk Brand Fire Brick you get the quality best suited for your needs. We never recommend a higher quality brick at a higher price if a moderate-priced brick fills the bill.

Our Various Brands

"Elkco"	"Keystone"	"Elk Dust"
"Elkco" Special	"M. D. Elk"	"Keystone Dust"
"Elk Steel"	"Rotex"	"Rotex Dust"
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Large stocks of various shapes always in stock at Hamilton Warehouse.

Elk Fire Brick Company
of Canada, Limited
Sun Life Building, HAMILTON, ONTARIO

Production of Rare Quality at Lowest Labor Costs

There is unusual strength, accuracy, speed, convenience and range in

AURORA
Drilling Machines

You can use them to great advantage on any work in your shop that's suitable for a machine tool of this kind. The operating is easy and the labor cost comparatively low.

Drop a line for full particulars and specifications.
Stationary Head Sizes 20"—21"
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The Aurora Tool Works
AURORA, INDIANA, U.S.A.

ROCKFORD
–the best for varied work

General manufacturing plants prefer the **Rockford Miller** because they require a machine which they can depend on to do any work within its range to the complete satisfaction of the inspection department.

Simplicity of operation and **absolute rigidity under every condition** are distinctively **Rockford** features. They have made this the very best machine for general manufacturing.

Full details on request

Rockford Milling Machine Co.
Rockford, Illinois

Agents:
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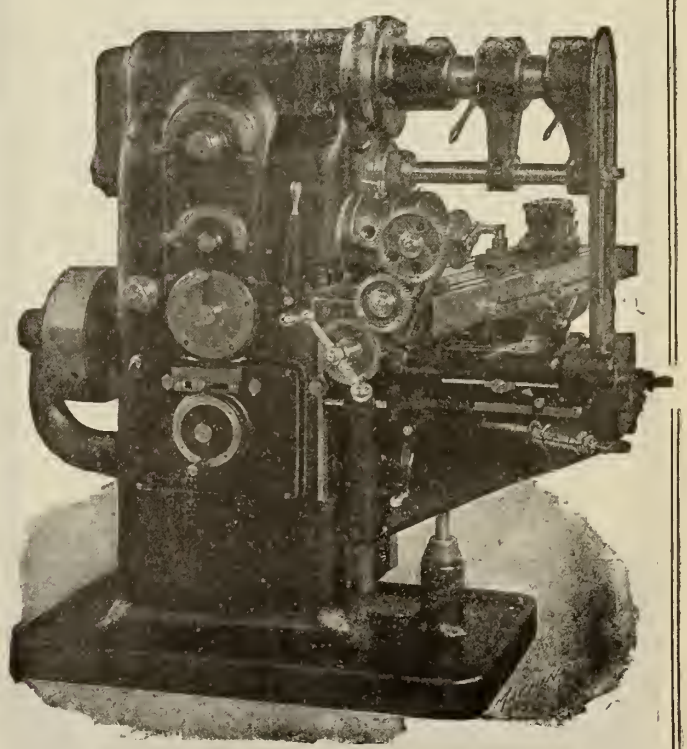

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Your Money's Worth

Never again will the Canadian Nation and People be the same careless improvident spenders of "ante bellum" days. "EFFICIENCY" and "GET YOUR MONEY'S WORTH" will be the popular motto and the successful machine shop manager must be able to see the advantage of making one pound of High Speed Tool Steel do the same work as ten pounds in forged tools: in other words he must and will

USE ARMSTRONG TOOL HOLDERS

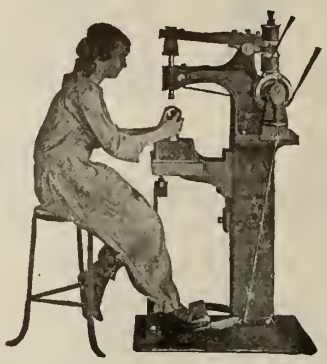
No heavy "stub-ends" to throw away. No time lost with men at the grinder while lathes stand idle. No stock of heavy sizes of steel to carry, and the blacksmith as a tool-dresser is eliminated entirely.

Armstrong Tools are great favorites with the men— a good thing to consider from a production standpoint.

Our Catalogue is of handy pocket size and will be mailed to you upon request

ARMSTRONG BROS. TOOL CO.
"THE TOOL HOLDER PEOPLE"
306 N. FRANCISCO AVE. CHICAGO, U.S.A.

The Hammer With The Human Stroke



HEADS RIVETS COLD

Heads 'em tight or loose, flush, countersunk, or finishes heads any shape desired, and at the rate of:—

A rivet a second, sizes up to 3/16".
A rivet in two seconds, size ¼" to ⅜".
A rivet in three seconds, size 7/16" to ⅝".

And on special order we build machines to handle rivets up to 1½" with proportionate rapidity.

Built in eight sizes.

Besides riveting, the High Speed Riveting Hammer does all kinds of peining, swaging, upsetting, etc.

Send us sample assembly parts with rivets or sketch of your work.

and

Let us shoulder your riveting problems.
Send for the High Speed Hammer Book.

THE HIGH SPEED HAMMER COMPANY, INC.
ROCHESTER, N.Y.

1/3 to 1/2 Reduction in Milling Cost

This will be the result of taking small milling jobs from your big millers and putting them up to

The U.S. MILLER

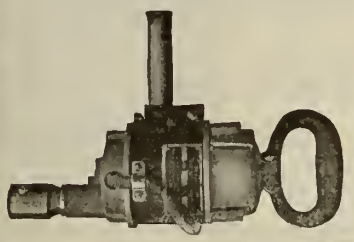
The Miller for Small Work

A small machine takes up less space, requires less power, is easier to operate and is more accurate.
The Paramount Miller of its size.
Drop us a line for full details.

United States Machine Tool Company
Cincinnati, Ohio, U.S.A.

U. S. Electric Drills and Grinders

Save Time, Labor and Money



They can be attached to any lamp socket.

For drilling in metal they are superior to any other kind of portable drill. Cost 50% less to run than air drills.

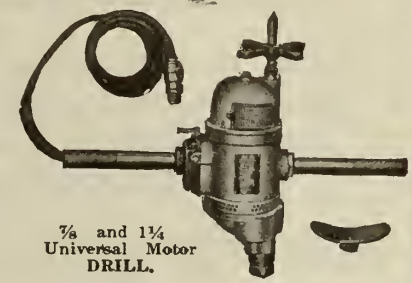
3 SIZES

3-16 in., W.G.T., 6 lbs.
¼ in., W.G.T. 9 lbs.
⅜ in., W.G.T. 12 lbs.

All motors wound for 110 or 220 volts.

Direct or alternating current.

Try a few of our Electric Drills and Grinders and you'll send us an order for more. Our guarantee protects you.



⅜ and 1¼ Universal Motor DRILL.

For Sale By

The Canadian Fairbanks-Morse Co., Limited

Montreal, St. John, N.B., Toronto, Winnipeg, Calgary, Vancouver

THE UNITED STATES ELECTRICAL TOOL CO.

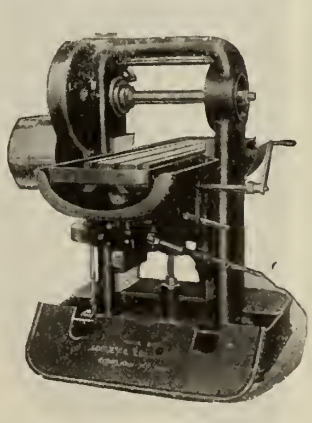
CINCINNATI, OHIO

BRIGGS MILLERS

Production Tools

Machine tools to-day are judged by their ability to do efficient work, save time, labor and expense. These have ever been the measures by which Briggs Millers have been designed and constructed. That our engineers have succeeded in meeting these requirements is evidenced by the increasing popularity of Briggs Millers.

No matter what the nature of the work or how severe the service the Briggs Miller will stand up to it. Its unusual rigidity, great strength and ability to take wide deep cuts when running at a high rate of speed, has established a wide reputation that is unexcelled. We would like to show how "Briggs" adaptability and convenience can increase output and lower costs for you. A letter will bring full details by return mail.



Gooley & Edlund, Inc.

CORTLAND, N.Y.

Canadian Representatives:
Garlock-Walker Machinery Company, Ltd., Toronto;
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Save your present hanger frames

Chapman Double Ball Bearings will fit them

As men to men

If a responsible firm said to you: "You are wasting so much power, but we can show you how to prevent it," your first inclination might be to think their claim extravagant.

But on reflection, the reputation of the house would invariably prompt you to say: "Prove it."

We make this assertion, therefore, fully conscious that the responsibility for proof is upon us. If, in your plant, you are using old-style babbitted hanger bearings we can prevent the wastage—that is, effect the saving of anywhere from 15% to 40% of the actual horsepower now consumed under load—by installing Chapman Ball Bearings. They will fit your present hanger bearings.

Further we assert that the saving in power will pay for Chapman Ball Bearings within two years. Beyond that, their "efficient" life is almost everlasting.

Write and say: "Prove its application in our plant," and we'll stand or fall on the result.

You pay for them whether you buy them or not

CHAPMAN
Double Ball Bearing
Co. of Canada, Limited

Head Office:
TORONTO
Ontario

Shaughnessy Bldg.
MONTREAL

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SCIENTIFIC LUBRICANTS for SCIENTIFIC LUBRICATION

MYSTIC
CUTTING COMPOUND

lengthens the life of your tools

You will be surprised to learn how much longer your tools hold their cutting edge when cooled with Mystic. Wherever Mystic is used, tools last longer—a big saving in these days when the cheapest tools are expensive.

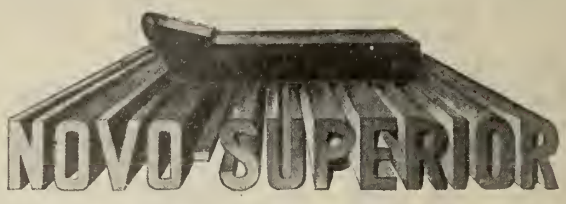
Mystic saves money in other ways. It makes faster cutting possible, and at the same time it eliminates frequent stops for grinding. A real booster of production.

It is non-gumming, non-separating, non-rusting, and low in price. From every angle the cutting compound of economy.

Say the word and we'll send you a free sample

Cataract Refining Company, Limited
Toronto, Ont.

SCIENTIFIC LUBRICANTS for SCIENTIFIC LUBRICATION



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INTRA STEEL GIBRALTAR STEEL
Tool Steel for Every Purpose
Swedish Lancashire Iron

Twist Drills, Taps, Hack Saw Blades, Milling Cutters
Files, Etc., Music Wire for Springs, Steel Balls.
Cold Rolled Tool Steel in Strips and Sheets
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STAND PIPES
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STEEL PIPES
FLUMES AND
PENSTOCKS

STRUCTURAL STEEL WORK

Machine work of all descriptions. Send us your specifications.

WILLIAM HAMILTON LIMITED
PETERBORO ONTARIO

MATTHEWS
Pittsburgh Bevel Steel Letters and Figures

Hand Made

Matthews' Letters and Figures are hand made from carefully selected tool steel. The characters are neatly formed, producing stamps that make easily read and durable marks on all classes of products. They reduce considerably the cost of high grade marking.

Try them! Mark your next order — "MATTHEWS' Letters and Figures."

JAS. H. MATTHEWS & CO.
3946 FORBES STREET PITTSBURGH, PA., U.S.A.
Steel Lettering, Dies and Stamps

The
NAZEL AIR HAMMER

NOTED FOR ITS BLOW AND CONTROL

A self-contained unit, built in three types, six sizes, arranged for belt or direct motor drive, with capacities up to 7-inch square, for all manner of jobbing, manufacturing and certain classes of die forging.

Write for catalogue.

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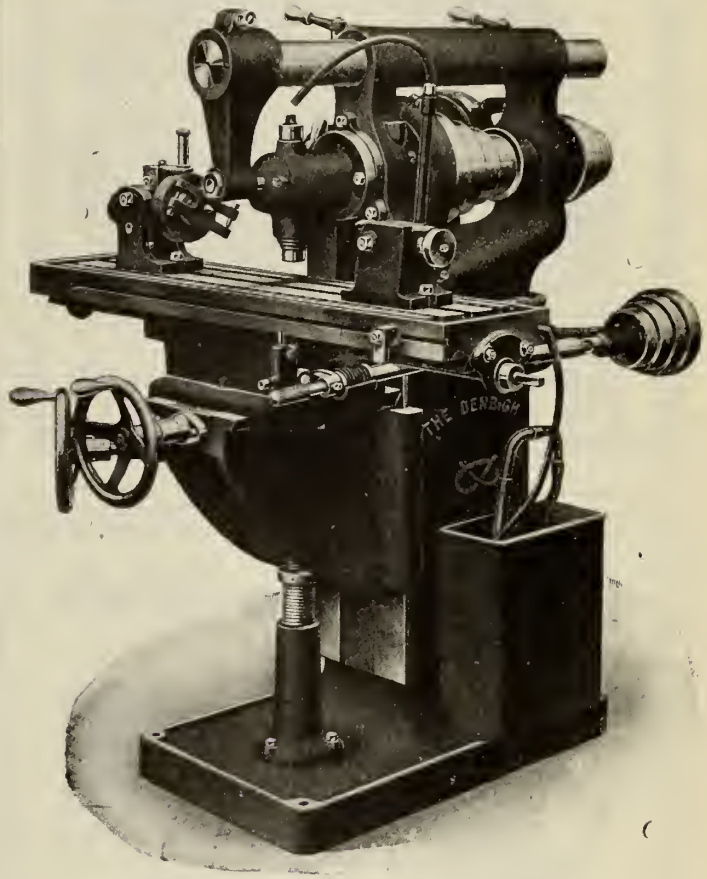
DENBIGH
Famous
MANUFACTURING MILLERS



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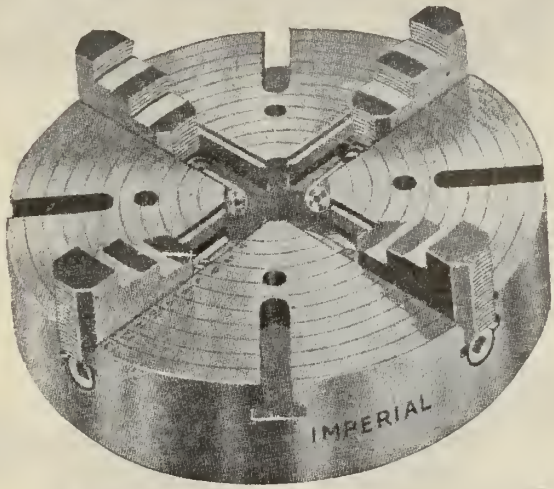

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Next time a tap breaks below the surface of a large casting, don't let some make-shift method of removing it injure the thread and waste half an hour of valuable production time. Instead—

Walton it Out in a Jiffy

And save the casting.

Special analysis steel fingers of the Walton Extractor drop into the flutes of the broken tap—and grip. Then a few turns of a wrench applied to the squared end of the Extractor backs out the buried tap.

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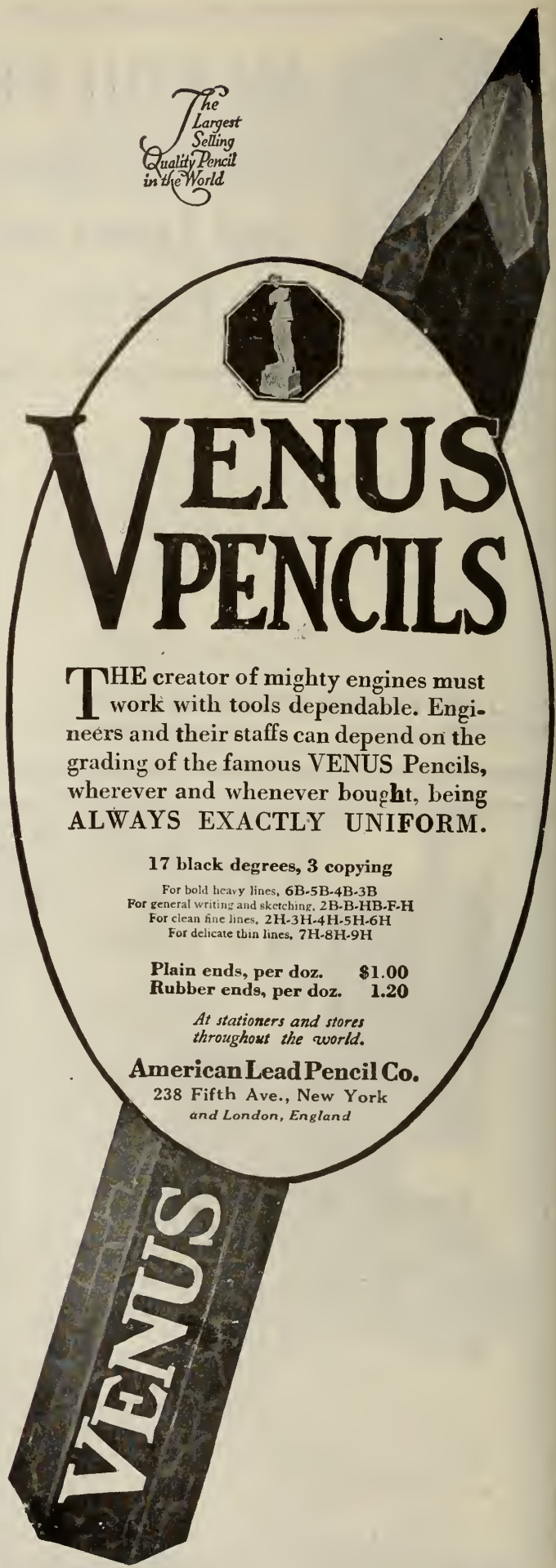

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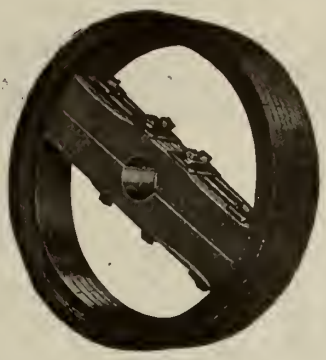

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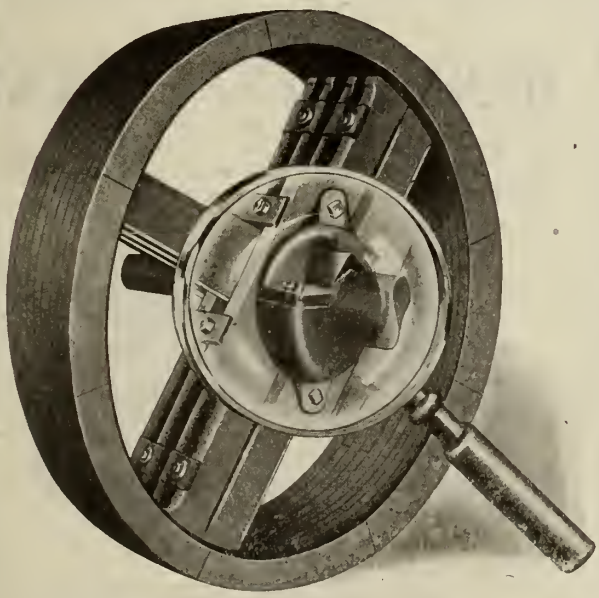
With the installation of Bernard Wood Split Pulleys you start on the road to lower overhead. Their cost is low.

Safety **Satisfaction**



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SKINNER PLANER CHUCK

It will hold the work down so it won't raise. The jaws are so arranged that we can easily change from the straight to the taper holds. That Skinner Planer Chuck is heavy and powerful. It's the chuck for holding down tough jobs like this one—" There's much more to be said about these chucks, their design, construction, finish, the material in them, etc.

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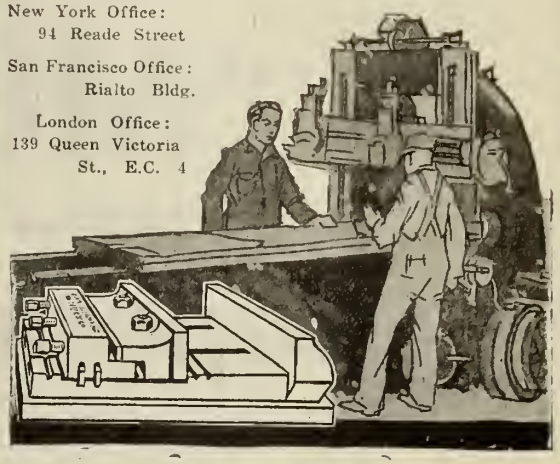
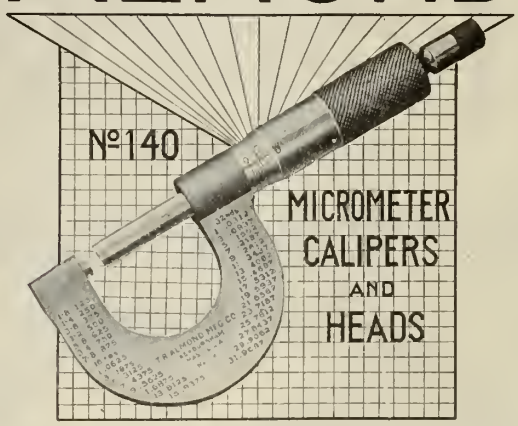


ALMOND



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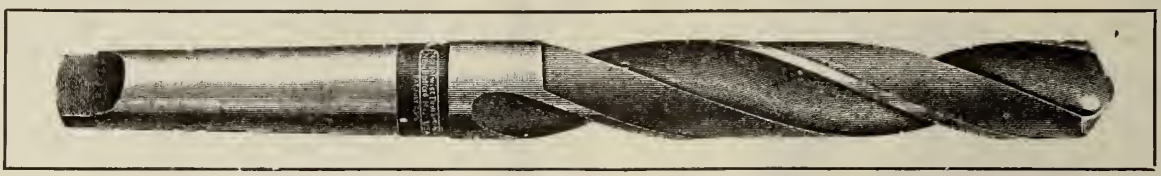

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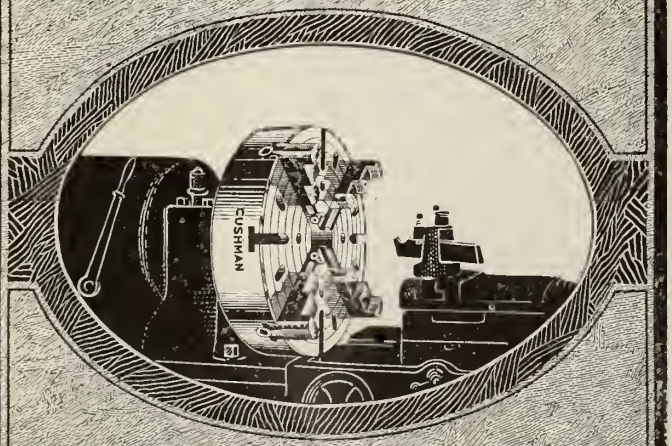

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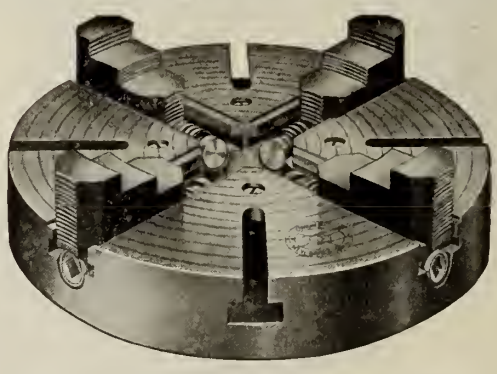
are not an experiment—they have come to stay. They are a necessity with the modern machinery and high-speed steel cutting tools.



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are well designed and have all the elements of strength and durability for which they are designed. We make other types in steel also, including the Geared Scroll Chucks and the Geared Scroll Combination—all designed for heavy work and hard usage.

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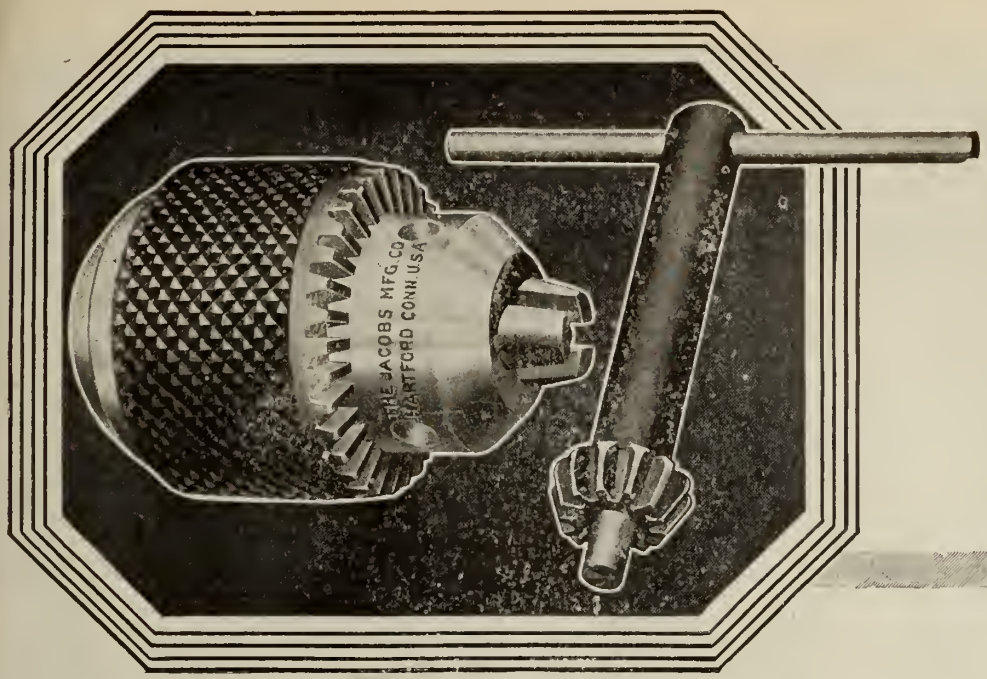
Makers of a complete line of chucks



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The man who buys holes (and *not* drills) instantly and accurately arrives at the "best buy"—

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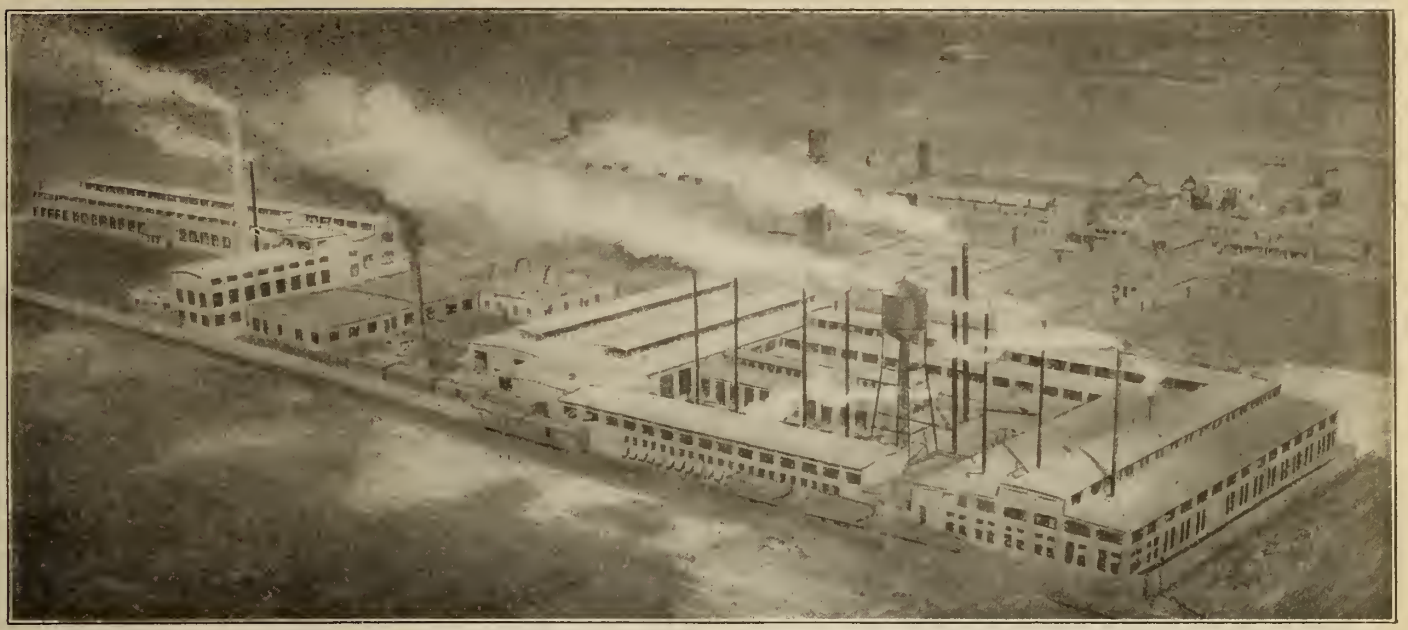
If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.



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Is all we request of users of Grinding Wheels to prove that

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Are equal in quality to the Best Imported Abrasive Wheels

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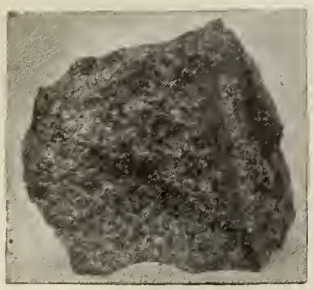

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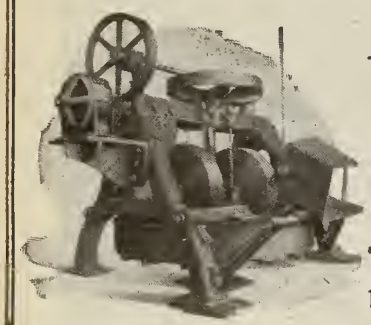

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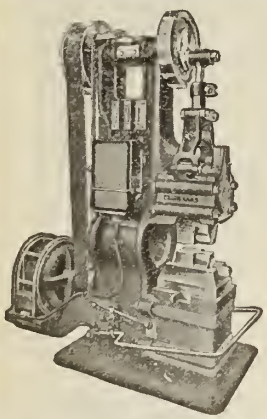

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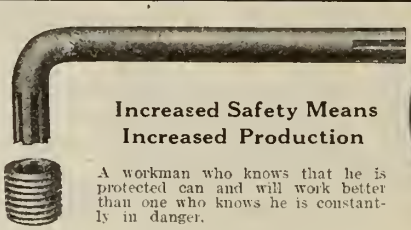

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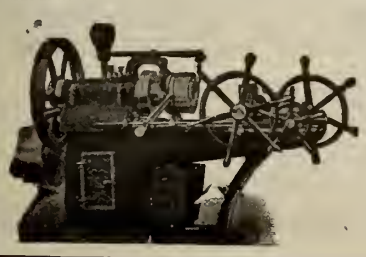

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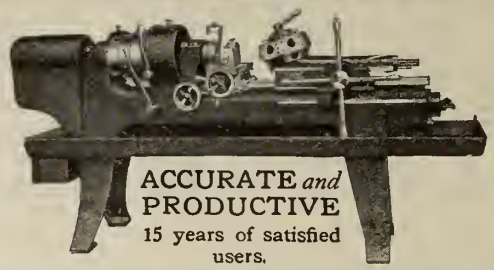

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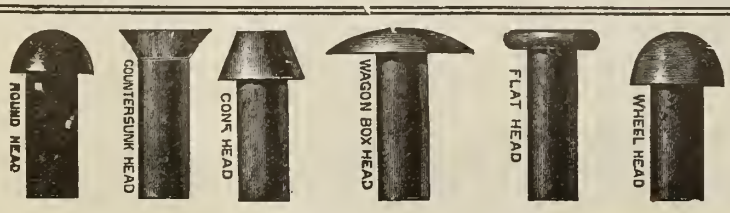

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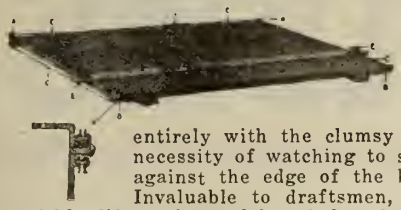

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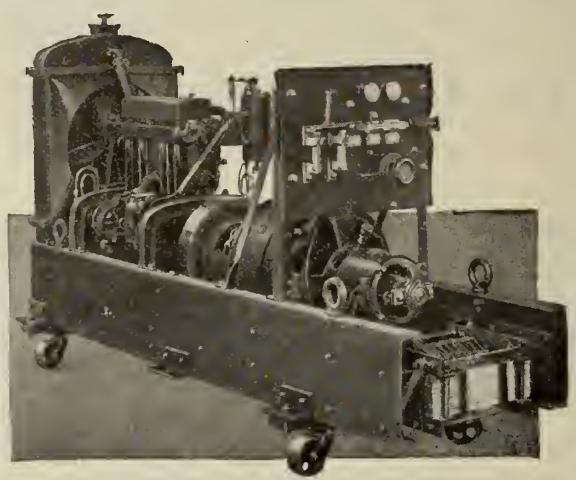

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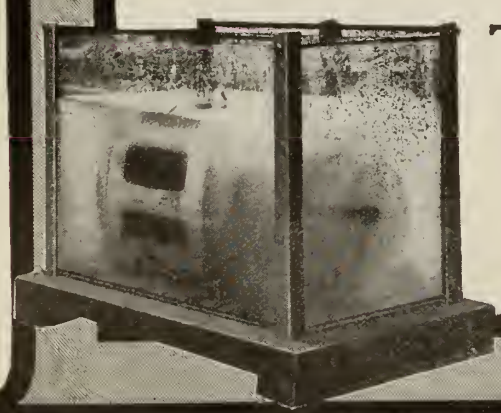

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Mesta Machine Co., Pittshurgh, Pa.

CASTINGS, ELECTRIC AND ALLOY STEEL
Can. Elec. Castings Co. Ltd., Orillia, Ont

CARRIERS
COUPLING BOLTS
John Morrow Screw & Nut Co., Ingersoll
Alexander Fleck, Ltd., Ottawa.
Greenleafs Ltd., Belleville, Ont.
St. Lawrence Welding Co., Montreal.
Tallman Brass & Metal Co., Hamilton.

CASTINGS, BENCH LEG.
Brown & Sharpe Mfg. Co., Providence, R.I.

CASTINGS, BRASS AND IRON
Algoma Steel Corp., Sault Ste. Marie.
International Machinery and Supply Co., Ltd., Montreal, Que.

CASTINGS, BUILDING
Katie Foundry, Galt. Ont.

CASTINGS, GRAY IRON
Bernard Industrial Co., A., Fortierville, Q.
Brown & Sharpe Mfg. Co., Providence, R.I.
Brown Bocca Co., Ltd., Hamilton.
Can. Elec. Castings Co, Ltd., Orillia, Ont
Alexander Fleck, Ltd., Ottawa.
Gardner & Son, Robt., Montreal.
Hull Iron & Steel Foundries, Ltd., Hull
International Malleable Iron Co., Guelph
Kennedy & Sons, Ltd., Wm., Owen Sound.
Katie Foundry, Ltd., Galt, Ont.
Hamilton Co., Wm., Peterboro.

CASTINGS, PLUMBERS'
Katie Foundry, Galt. Ont.

CASTINGS, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville

CASTINGS, HARDWARE
Katie Foundry, Galt, Ont.

CASTINGS, STEEL CHROME AND MANGANESE STEEL
Thos. Davidson Mfg. Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont
Hull Iron & Steel Foundries, Ltd., Hull.
Kennedy & Sons, Ltd. Owen Sound

CASTINGS, MALLEABLE
International Malleable Iron Co., Guelph

CASTINGS, NICKEL STEEL
Hull Iron & Steel Foundries, Ltd. Hull.

CEMENT, ELASTIC IRON AND FURNACE
Warminton Co., J. N., Montreal.

CEMENT MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal
Gardner, Robt., & Son, Montreal.

CEMENT HANDLING MACHINERY
Can. Link-Belt Co., Toronto, Ont.

CEMENT TOOLS
Atkins & Co., E. C., Hamilton, Ont.

CENTERING MACHINES
Victoria Foundry Co., Ottawa. Ont.

CENTRE REAMERS
Bertram & Sons Co., John, Dundas.
Butterfield & Co., Inc., Rock Island, Que
Gardner, Robt. & Son, Montreal.
Hurlburt, Rogers Mch. Co., South Sudbury, Mass.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co., of Canada, Galt, Ont.

CHAIN, WELDED COIL
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

CHAIN BLOCKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford Chain Block & Mfg. Co., Phila., Pa.
Garlock-Walker Machy. Co., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & HoistCo., Herbert, Niagara Falls, Ont.
Oliver Engineering Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Jones & Glassco, Montreal, Que.

CHAINS, AGRICULTURAL
Morse Chain Co., Ithaca, New York.

CHAINS, AUTOMOBILE ENGINE
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.

CHAINS, BICYCLE, DRIVE AND BLOCK
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAINS, FOR ELEVATORS AND CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAIN, MALLEABLE, DETACHABLE AND RIVETED
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAINS, POWER TRANSMISSION
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, New York.
Glasgow, N.S.

CHAINS, SPROCKET WHEEL
Can. Link-Belt Co., Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAIN DRIVES
Can. Link-Belt Co., Toronto, Ont.
Coventry Chain Co., Coventry, England.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

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National Acme Co., Cleveland, Ohio.
Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont.

CHEMISTS
Toronto Testing Lab'tory, Ltd., Toronto

CHUCKS, AERO, AUTOMATIC
Garvin Machine Co., New York.

CHUCKS, CENTERING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKS, COLLET, AIR
Elliott & Whitehall Mach. & Tool Co. Galt, Ont.
Smalley-General Co., Inc., Bay City, Mich.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, LATHE AND UNIVERSAL
Aikenhead Hardware Co., Toronto, Ont.
Almond Mfg. Co., Ashburnham, Mass.
Bertram & Sons Co., John, Dundas.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt., & Son, Montreal.
Garlock-Walker Mach'y Co., Toronto.
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Chicago, Ill.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Jacobs Mfg. Co., Hartford, Conn.
Ker & Goodwin Machine Co., Ltd.
Knight Metal Products, Toronto.
Modern Tool Co., Erie, Pa.
Rice Lewis & Son, Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Aikenhead Hardware Co., Toronto, Ont
Can. Blower & Forge Co., Kitchener.

CHUCKS, FRICTION AND TAP
Victor Tool Co., Waynesboro, Pa.

CHUCKS, MACHINE MILLING
Hoggson & Pettis Mfg. Co., New Haven Conn.

CHUCKS, MAGNETIC
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

CHUCKS, RING WHEEL
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.

CHUCKS, WHEEL, CAR
Hoggson & Pettis Mfg. Co., New Haven Conn.

CHUCKING MACHINES
Barber Mchy. Co., Ltd., Toronto, Ont
Brown & Sharpe Mfg. Co., Providence, R.I.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Windsor, Vt.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Wood Turret Mach. Co., Brazil, Ind.
Williams Mchy Co., A. R., Toronto, Ont.

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Williams & Co., J. H., Brooklyn, N.Y

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Elk Fire Brick Co., Can., Ltd., Hamilton, Ont.

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Oakley Chemical Co., New York, N.Y.

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Oakley Chemical Co., New York.

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Gisholt Machine Co., Madison, Wis.
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Wright Mfg. Co., Lisbon, Ohio.

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Bernard Industrial Co., A., Fortierville, Q
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Carlyle Johnson Mach. Co., Manchester, Conn.
Positive Clutch & Pulley Wks., Aurora Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.

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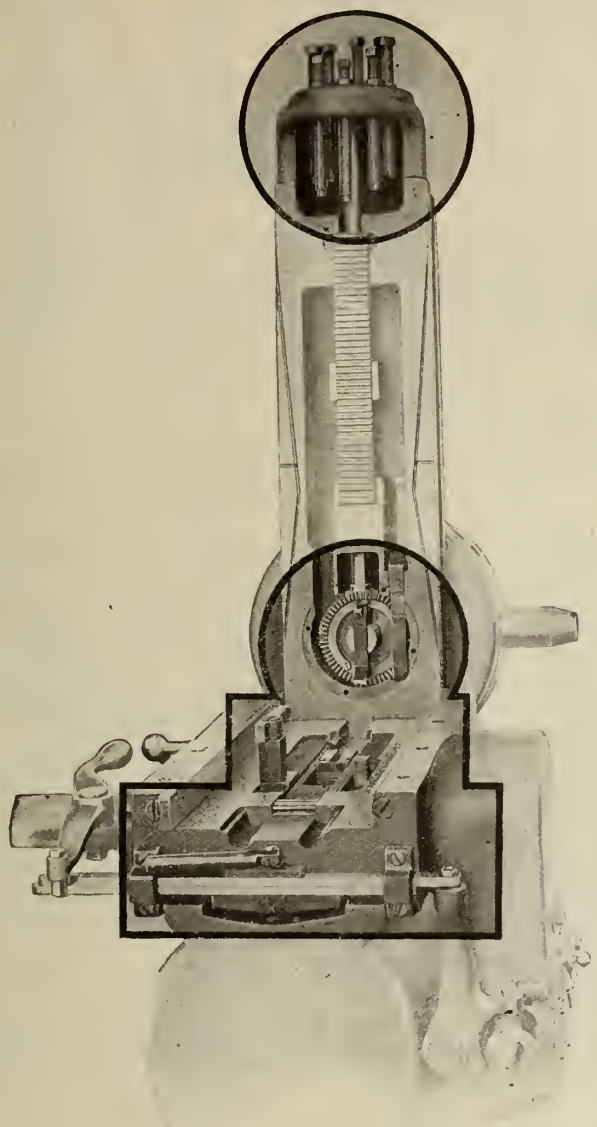
Can. Link-Belt Co., Toronto, Ont.
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Nova Scotia Steel & Coal Co., New



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TURRET SLIDE FEATURES

Individual stop screws shown in circle, one for each turret position, obviate exact setting of each tool.

In addition to a positive lock by means of a taper pin which aligns the turret holes with the spindle, the larger machines are automatically clamped as the turret is moved forward, by a tapered bushing controlled by the rocker arm shown in the centre of the large bevel gear.

These features of rugged construction and practical design, combined with automatic feeding and chucking of stock and centralization of all levers—points vital to production, make these machines the choice of the discriminating manufacturer who must have high production and accuracy.

BROWN & SHARPE MFG. CO.

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No. 6

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This machine is the largest in our line of five, each of which is constructed with that same care and attention to detail for which Brown & Sharpe is known throughout the world.

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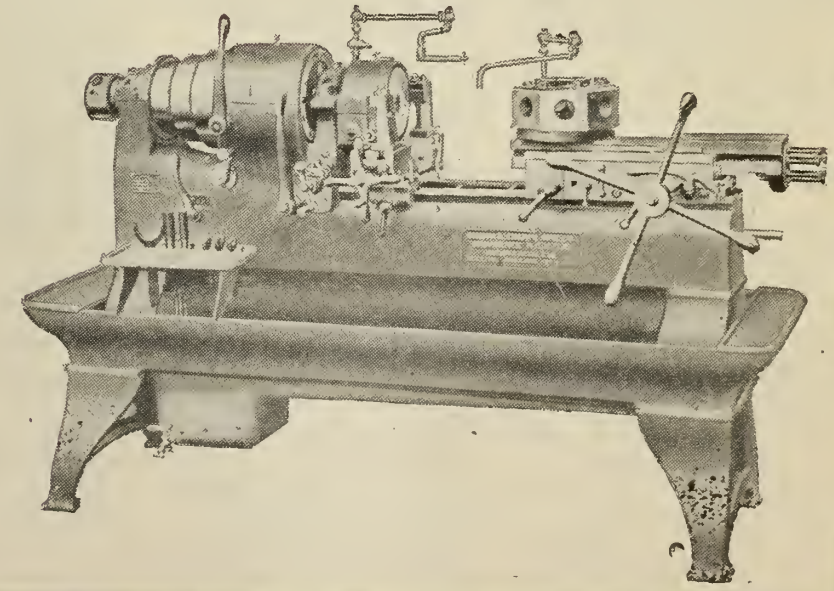

If interested tear out this page and place with letters to be answered

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Can. Driver-Harris Co., Ltd., Walkerville.
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MacGovern & Co., Montreal, Que.
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MacGovern & Co., Montreal, Que.
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Globe Engineering Co., Hamilton, Ont.
Homer & Wilson, Hamilton, Ont.
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St. Lawrence Welding Co., Montreal.
Victoria Foundry Co., Ottawa.

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Canadian Mead-Morrison Co., Limited, Montreal, Que.

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Brown's Copper and Brass Rolling Mills, New Toronto.
Brown's Copper and Brass Rolling Mills, New Toronto.

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Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.

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Ford-Smith Machine Co., Hamilton, Ont.
Foster Machine Co., Elkhart, Ind.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams Mchy Co., A. R., Toronto, Ont.

COUPLINGS, FRICTION
Bernard Industrial Co., The A., Fortierville, Que.
Can. Link-Belt Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Int. Machinery & Supply Co., Ltd., Montreal, Que.

COILING MACHINERY, WIRE AND SPRING
Garlock-Walker Machinery Co., Toronto.

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Hanna & Co., M. A., Cleveland, O.

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Gardiner, Robt. & Son, Montreal.
Independent Pneumatic Tool Co., Chicago

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Northern Crane Works, Walkerville.

CRANES, OVERHEAD, HAND AND ELECTRIC
Volta Manufacturing Co., Welland, Ont.

CUPS, OIL
Can. Winkley Co., Ltd., Windsor, Ont.

COVERS, OIL HOLE
Can. Winkley Co., Ltd., Windsor, Ont.

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Canadian Mead-Morrison Co., Limited, Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.

CRANE RUNWAYS
MacKinnon Steel Co., Sherbrooke, Que.

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Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Morris Crane and Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Petrie, Ltd., H. W., Toronto.

CRANES, TRAVELLING, ELECTRIC AND HAND POWER
Can. Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Machy. Co., St. Louis.
Dominion Bridge Co., Montreal.
Hepburn, John T., Ltd., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Niles-Bement-Pond Co., New York.
Northern Crane Works, Walkerville.
Oliver Engineering Co., Montreal.

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Canada Found's & Forgings Ltd., Welland
Williams & Co., J. H., Brooklyn, N.Y.

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Can. Link-Belt Co., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CRIMPS, LEATHER
Graton & Knight Mfg. Co., Worcester, Mass.

CRUSHERS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Elec. Steel & Metals, Welland, Ont.

CUPOLAS
Can. Blower & Forge Co., Kitchener.
Northern Crane Works, Walkerville.

CURB PUMPS FOR OIL, GASOLINE
Bowser Co., Ltd., S. F., Toronto, Ont.

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CUTTERS, BOLT
See Bolt Cutters.

CUTTERS, GEARS
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Fellows Gear Shaper Co., Springfield, Vt.

CUTTERS, FLUE
Cleveland Pneumatic Tool Co., Toronto.

CUTTER HEADS
Oliver Machinery Co. Grand Rapids, Mich

CUTTERS, PIPE (See Pipe Cutters)

CUTTERS, MILLING
Becker Milling Mach. Co., Boston, Mass.
Boker & Co., Inc., H., Montreal, Que.
Butterfield & Co., Rock Island, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
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Cleveland Twist Drill Co., Cleveland.
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Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Illinois Tool Works, Chicago, Ill.
Ingersoll Mache, Co., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Whitney Mfg. Co., Hartford, Conn.
Wilt Twist Drill Co., Walkerville, Ont.

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Cleveland Milling Machine Co., Cleveland.

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Bertram & Sons Co., John, Dundas.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Foss Mchy & S'ply Co., Geo. F., Montreal
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield, Mass
Hurlburt, Rogers Machy. Co., South Sudbury, Mass.
Hall & Sons, John H., Brantford, Ont.
Kennedy & Sons, Wm., Owen Sound.
Lyman Tube & Supply Co., Montreal, Que.
Niles-Bement-Pond Co., New York, N.Y.
Prest-O-Lite Co., Inc., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Tabor Mfg. Co., Philadelphia, Pa.
Wells Bros. of Can., Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

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Cataract Refining Co., Ltd., Toronto.
Swan & Finch, Inc., New York.

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Smalley General Co., Inc., Bay City, Mich

CYLINDERS, AUTOMATIC REBORING JIGS AND REAMERS
Kelley Reamer Co., Cleveland, O.

DEHUMIDIFYING
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Dominion Bridge Co., Montreal.
Hepburn Co., Ltd., J. T., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

DERRICK HOISTS
Canadian Mead-Morrison Co., Limited, Montreal, Que.

DIAMOND (BORTZ)
Furniss, Clarke & Co., Montreal, Que.

DIAMOND TOOLS
Ford-Smith Machine Co., Hamilton, Ont.
Furniss, Clarke & Co., Montreal, Que.
Joyce-Koebel Co., Inc., New York City.
Wheel Trueing Tool Co., Detroit.
Petrie, Ltd., H. W., Toronto.

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Wheel Trueing Tool Co., Detroit.

DIAMONDS, BLACK AND ROUGH
Joyce, Koebel & Co., Inc., New York.
Wheel Trueing Tool Co., Windsor, Ont.

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Hoggson & Pettis Mfg. Co., New Haven, Conn.

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Petrie, Ltd., H. W., Toronto.

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A. B. Jardine & Co., Ltd., Hespeler, Ont.
Wells Brothers Co., of Canada, Galt.

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Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt. & Son, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Jones & Lamson, Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.
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Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Rickert-Shafer Co., Erie, Pa.
Stoll Co., Inc., D. H., Buffalo, N.Y.
U. S. Ordnance, Toronto, Ont.
Wells Brothers of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

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Kimber & Hillier Mfg., Co., St. Catharines, Ont.

DIES, DROP FORGE.
Kimber & Hillier Mfg., Co., St. Catharines, Ont.

DIES, METAL STAMPING
Crescent Mche, Co., Ltd., Montreal, P.Q.
Elliott & Whitehall, Galt, Ont.

DIES, PIPE THREADING
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Crescent Mche. Co., Ltd., Montreal, P.Q.
Landis Machine Co., Waynesboro, Pa.

DIES, THREADING
Butterfield & Co., Inc., Rock Island, Que.
Crescent Machine Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

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Becker Milling Machine Co., Boston
Garvin Machine Co., New York.
Jackson Machine Tool Co, Jackson, Mich.
Kimber & Hillier Mfg., Co., St. Catharines, Ont.
Pratt & Whitney Co., Dundas, Ont.
Walcott Lathe Co., Jackson, Mich

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Butterfield & Co., Rock Island, Que.
Firth & Sons, Thos., Montreal, Que.
Landis Machine Co., Waynesboro, Pa.
Wells Brothers Co. of Canada, Galt.

DIE HEADS
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Canada, Galt, Ont.

DIES, SELF-OPENING
Geometric Tool Co., New Haven.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Wells Brothers Co. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.

DIE FILING MACHINES
Oliver Mach. Co., Grand Rapids, Mich.

DIE STEEL, HOT AND COLD WORK
Armstrong-Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.
Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.

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Wells Bros. Co. of Can., Galt, Ont.

DIES, SHEET METAL WORKING
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada
Globe Engineering Co., Hamilton, Ont.
Stoll Co., D. H., Buffalo, N.Y.

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A. B. Jardine & Co., Ltd., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
National-Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros., Co., of Can., Galt, Ont

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Graton & Knight Mfg. Co., Worcester, Mass.
Swedish Steel & Importing Co., Montreal.

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Butterfield & Co., Rock Island, Que.
Can. Blower & Forge Co., Kitchener.
A. B. Jardine & Co., Hespeler, Ont.
Pratt & Whitney Co., Dundas, Ont.
Sturtevant Co., B. F., Galt, Ont.

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Hughes, Owens Co., Ltd., Montreal, Que.

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Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
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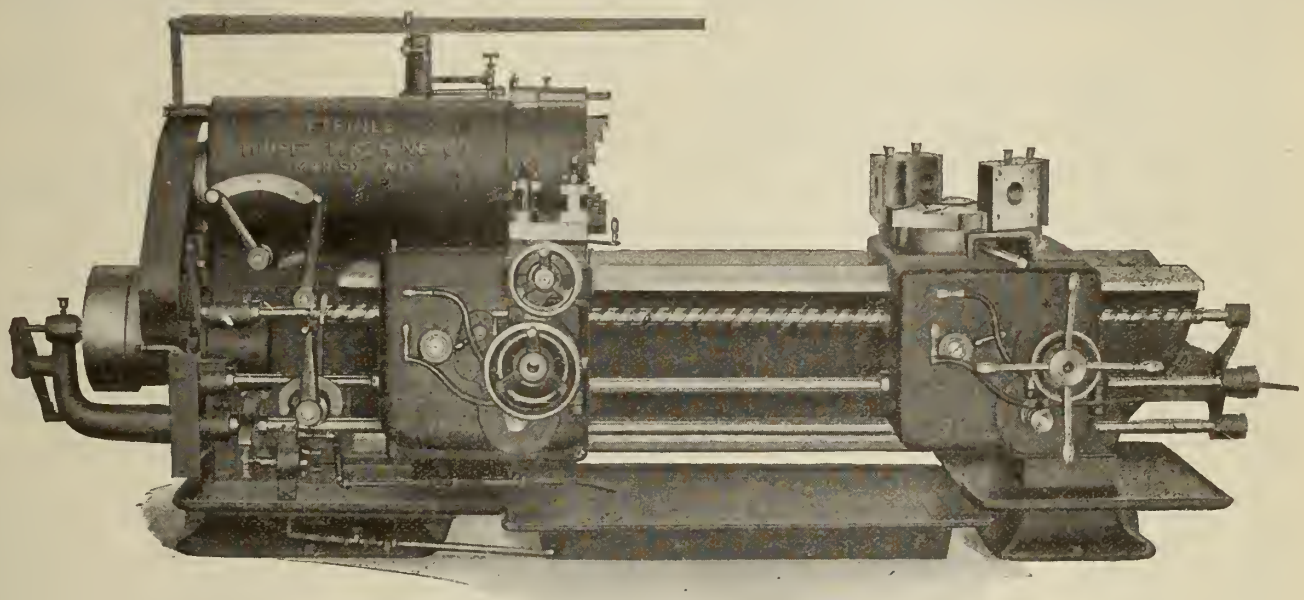

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Garvin Machine Co., New York.
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Can. Steel Foundries, Ltd., Montreal.
Dom. Found. & Steel, Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Williams & Co., J. H., Brooklyn, N.Y.

GEAR BLANKS, CAST
Katz Foundry, Galt, Ont.

GEAR BLANKS, RAWHIDE
Lyman Tube & Supply Co., Montreal, Que.

GEAR BOXES ,REDUCTION
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEAR SHAPERS AND CUTTERS
Fellows Gear & Shaper Co., Springfield, V.

GEAR-CUTTING MACHINERY
Bilton Mach. Tool Co., Bridgeport, Conn.
Fellows Gear & Shaper Co., Springfield, V.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
A. R. Williams Machy. Co., Toronto.

GEAR-TESTING MACHINE
Gisholt Machine Co., Madison, Wis.

GEARS, CHAIN
Morse Chain Co., Ithaca, New York.
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, COMPENSATING
Morse Chain Co., Ithaca, New York.
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, CUT, MORTISE, ANGLE, WORM
Can. Link-Belt Co., Toronto, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Dominion Bridge Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Elliott & Whitehall, Galt, Ont.
Gardner, Robt., & Son, Montreal.
Hamilton Gear & Machine Co., Toronto.
Hull Iron & Steel Found., Ltd., Hull, Q.
Jones & Glassco, Montreal.
Wm. Kennedy & Sons, Ltd., Owen Sound, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia.
Victoria Foundry Co., Ottawa.

GEARS, RAWHIDE
Gardner, Robt., & Son, Montreal.
Grant Gear Works, Boston, Mass.
Hamilton Gear & Machine Co., Toronto.
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia.
A. R. Williams Machy. Co., Toronto.

GENERATORS, GEAR
Fellows Gear & Shaper Co., Springfield, V.

GEARS, SILENT CHAIN
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, SPRING
Morse Chain Co., Ithaca, New York.

GEARS, SPUN, BENCH, SPIRAL
Brown & Sharpe Mfg. Co., Providence, R.I.

GENERAL MACHINE WORK
Elliott & Whitehall, Galt, Ont.
St Lawrence Welding Co, Ltd., Montreal

GENERATORS AND CONVERTORS
Northern Elec. Co., Ltd., Montreal, P.Q.

GENERATORS, MOTOR
MacGovern & Co., Montreal.
Northern Elec. Co., Ltd., Montreal, P.Q.
Sturtevant Co., B. F., Galt, Ont.
U. S. Ordnance, Toronto, Ont.

GENERATORS, STEAM TURBO
Can. Link-Belt Co., Ltd., Toronto, Ont.

GILDING
Brown's Copper and Brass Rolling Mills, New Toronto.

GLOVES, ASBESTOS, ACID PROOF, WATERPROOF, ETC.
Strong, Kennard & Nutt Co., Cleveland.

GLUE HEATERS
Oliver Machinery Co., Grand Rapids, Mich

GLASSES, SAFETY
Strong, Kennard & Nutt Co., Cleveland.
Willson & Co., Inc., T. A., Reading, Pa.

GRAPHITE
Aikenhead Hardware, Ltd., Toronto.
Rice Lewis & Son, Toronto.

GOGGLES
Consolidated Optical Co., Toronto.
Standard Optical Co., Geneva, N.Y.
Strong, Kennard & Nutt Co., Cleveland.
Welding & Supplies Co., Montreal.

GRAB BUCKETS—CLAMSHELL and ORANGE PEEL
Canadian Mead-Morrison Co., Limited, Montreal, Que.

GRAVITY CARRIERS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

GREASE CUPS, PRESSED STEEL, BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES (See Lubricants)

GRINDERS, AUTOMATIC KNIFE
Canada Machinery Corp., Galt, Ont.
Foss Mchry. & S'ply Co., G. F., Montreal
Garlock-Walker Machinery Co., Toronto.

GRINDERS, CENTRE COLUMN, PEDESTAL AND BENCH
Can. Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Haskins & Co., R. C., Chicago, Ill.
Wisconsin Electric Co., Inc., Racine, Wis.
Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto.
Katie Foundry, Galt, Ont.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford.
Niles-Bement-Pond Co., New York, N.Y.
Perfect Machine Co., Galt, Ont.
United States Elec. Tool Co., Cincinnati.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, CUTTER
Brown & Sharpe Mfg. Co., Providence, R.I.
Cincinnati Milling Mach. Co., Cincinnati.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Globe Engineering Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield, M.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Norton Co., Worcester, Mass.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, DIE AND CHASER
Haskins & Co., R. C., Chicago, Ill.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
National-Acme Co., Cleveland, Ohio.

GRINDERS, DISK
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., E. C., Hamilton, Ont.
Ford-Smith Mach. Co., Hamilton.
Gardner Machine Co., Beloit, Wis.
Heald Machine Co., Worcester, Mass.

GRINDERS, FLEXIBLE CASTING
Manhattan Machine & Tool Co., Grand Rapids, Mich.

GRINDERS, DRILL
Aikenhead Hardware Co., Toronto.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield,
Petrie, Ltd., H. W., Toronto.
United States Elec. Tool Co., Cincinnati.
Wells Bros. of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, CYLINDER, INTERNAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I
Foss Mchy. & S'ply Co., G. F., Montreal.
Greenfield Machine Co., Greenfield, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, PORTABLE, ELECTRIC HAND, TOOL POST, FLOOR AND BENCH
Baird Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Ford-Smith Mach. Co., Hamilton, Ont.
Haskins & Co., R. C., Chicago, Ill.
Grant Mfg. & Mach. Co., Bridgeport, Con
Garlock-Walker Machinery Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Independent Pneumatic Tool Co., Chicago
Petrie, Ltd., H. W., Toronto.
United States Elec. Tool Co., Cincinnati
Wisconsin Electric Co., Inc., Racine, Wis.
Williams Mchy Co., A. R., Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.

GRINDERS, MANUFACTURING
Barber Mchy. Co., Ltd., Toronto, Ont.
Universal Grinding Mach. Co., Fitchburg, Mass.

GRINDERS, HOLE, HOLE AND AND DEEP HOLE
Barber Mchy. Co., Ltd., Toronto, Ont.
Bryant Chucking Grinder Co., Springfield, Vermont.
Heald Machine Co., Worcester, Mass.

GRINDERS, PLAIN CYLINDRICAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Fitchburg Grinding Mach. Co., Fitchburg, Mass.

GRINDERS, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal.
Cleveland Pneumatic Tool Co., Toronto.
Garlock-Walker Machinery Co., Toronto.
Heald Machine Co., Worcester, Mass.
Independent Pneumatic Tool Co., Chicago
MacGovern & Co., Montreal, Que.

GRINDERS, PROFILE
Cleveland Milling Machine Co, Cleveland.

GRINDERS, ROTARY SURFACE
Brown & Sharpe Mfg. Co., Providence, R.I
Bristol Machine Tool Co., Bristol, Conn.
Manhattan Machine & Tool Co., Grand Rapids, Mich.

GRINDERS, TOOL AND HOLDER
Armstrong Bros. Tool Co., Chicago.
W. F. & John Barnes Co., Rockford, Ill.
Blount & Co., J. G., Everet, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I
Ford-Smith Machine Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield.
National-Acme Co., Cleveland, Ohio.
Tabor Mfg. Co., Philadelphia, Pa.
Wells Bros. of Canada, Galt, Ont.

GRINDERS, UNIVERSAL, PLAIN
Barber Mchy. Co., Ltd., Toronto, Ont.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Modern Tool Co., Erie, Pa.
Norton Co., Worcester, Mass.
Williams Mchy Co. Ltd., A. R., Montreal

GRINDERS, VERTICAL, SURFACE
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Co., Montreal.
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Norton Co., Worcester, Mass.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDING DISCS
Atkins & Co., E. C., Hamilton, Ont.
Wausau Abrasives Co., Chicago, Ill.

GRINDING AND POLISHING MACHINES, PORTABLE, PNEUMATIC AND SPRING FRAME
Can. Fairbanks-Morse Co., Montreal.
Cincinnati Elec. Tool Co., Cincinnati, O.
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal.
Garvin Machine Co., New York.
Garlock-Walker Machy. Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Haskins & Co., R. C., Chicago, Ill.
Hall & Sons, John H., Brantford, Ont.
Niles-Bement-Pond Co., New York, N.Y.
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Wisconsin Electric Co., Racine, Wis.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDING MACHINES, CAR WHEEL, CUTTER, CYLINDRICAL, CRANKSHAFT
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I
Norton Co., Worcester, Mass.

GRINDING WHEELS
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Brantford Emery Wheel Co., Brantford.
Can. Fairbanks-Morse Co., Montreal.
Carborundum Co., Niagara Falls, N.Y.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Mchy. & S'ply Co. G. F., Montreal.
Norton Co., Worcester, Mass.

GRINDING WHEEL DRESSER
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.

GUARDS, WINDOW AND MACHINE
Canada Machinery Corp., Galt, Ont.
Canada Wire & Iron Goods Co., Hamilton
Dennis Wire & Iron Works, London, Ont.
B. Greening Wire Co., Hamilton, Ont.
Page Steel & Wire Co., Adrian, Mich.
St Lawrence Welding Co, Ltd., Montreal
Strong, Kennard & Nutt Co., Cleveland.

GUTTERS AND SKYLIGHTS
H. H. Robertson, Ltd., Sarnia, Ont.

HACK SAW BLADES
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Boker & Co., Inc., H., Montreal, Que.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Wks., Buffalo.
Ford-Smith Machine Co., Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Plewes, Ltd., Winnipeg, Man.
Pilot Steel & Tool Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Racine Tool & Machine Co., Racine, Wis.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
L. S. Starrett Co., Athol, Mass.
Standard Machy. & Supplies, Montreal.
Victor Saw Works, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.
Williams Mchy Co., A. R., Toronto, Ont.

HANDLES, BALANCE, CRANK AND MACHINE
Williams & Co., J. H., Brooklyn, N.Y.

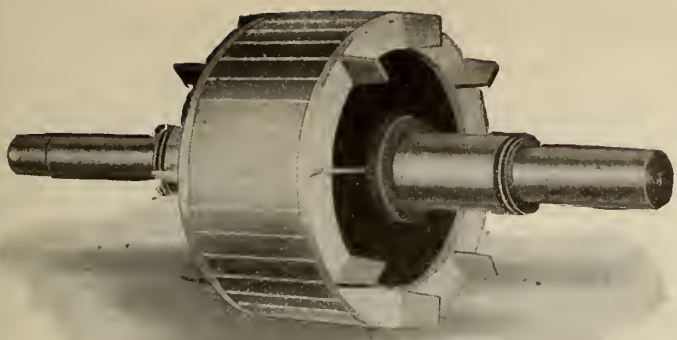
HANGERS, SHAFT
Can. Link-Belt Co., Ltd., Toronto, Ont.

HACK SAW FRAMES
Aikenhead Hardware Co., Toronto.
Atkins & Co., E. C., Hamilton, Ont.
Can. Fairbanks-Morse Co., Montreal.
Ford-Smith Machine Co., Hamilton, Ont.
Garvin Machine Co., New York City.
Victor Saw Works, Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.

HACK SAWS, POWER
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Wks., Buffalo.
Foss Mchy. & S'ply Co., G. F., Montreal.
Ford-Smith Machine Co., Hamilton.
Perfect Machine Co., Galt, Ont.
Starrett Co., L. S., Athol, Mass.
Victor Saw Works, Hamilton, Ont.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

HAMMERS, FORGING
Nazel Eng. & Mach. Wks., Philadelphia.

HAMMERS, ELECTRIC
Haskins & Co., R. C., Chicago, Ill.



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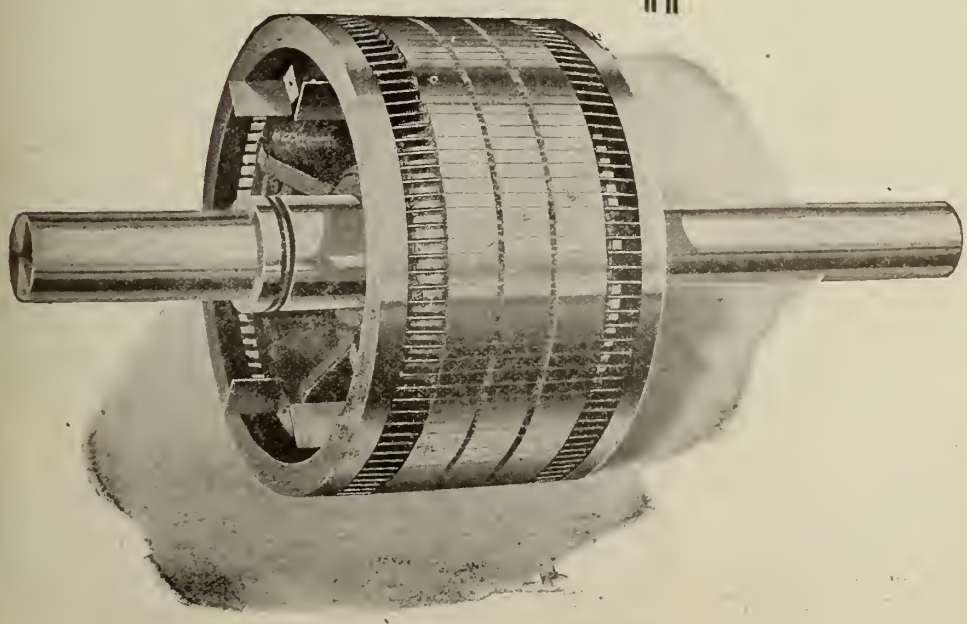

If interested tear out this page and place with letters to be answered

HAMMERS (DROP), MOTOR AND BELT DRIVEN
Beaudry & Co., Boston, Mass.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton.
Can. Billings & Spencer, Ltd., Welland.
Canada Machinery Corp., Galt, Ont.
High Speed Hammer Co., Rochester, N.Y
Jardine & Co., A. B., Hespeler, Ont.
Niles-Bement-Pond Co., New York, N.Y
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
United Hammer Co., Boston, Mass.
Williams Mchy Co, Ltd., A. R., Montreal

HAMMERS, HELVE POWER
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
West Tire Setter Co., Rochester, N.Y.
Williams Mchy Co, Ltd., A. R., Montreal

HAMMERS, CHIPPING, CAULKING, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Nazel Eng. & Mach. Wks., Philadelphia

HAMMERS, MARKING
Matthews & Co., Jas. H., Pittsburgh, Pa

HAMMERS, NAIL MACHINE
Rice Lewis & Son, Toronto, Ont.
United Hammer Co., Boston, Mass

HAMMERS, POWER
Nazel Eng. & Mach. Wks., Philadelphia

HAMMERS, STEAM
Canada Machinery Corp., Galt, Ont.
Niles-Bement-Pond Co., New York

HAND PLANERS
Oliver Mchry. Co., Grand Rapids, Mich.

HAND PLANING AND JOINTING MACHINERY
Oliver Engineering Co., Montreal, P.Q

HAND LEATHERS OR PADS
Graton & Knight Mfg. Co., Montreal

HANGERS
Brown & Sharpe Mfg. Co., Providence, R.I

HANGERS, SHAFT
Algoma Steel Corp., Sault Ste. Marie.
Chapman Double Ball Bearing Co., Toronto.
Gray Ball Bearing Co., Ltd., Toronto.
Baird Machine Co., Bridgeport, Conn.
Can. S K F Co., Toronto, Ont.
Gardner & Son, Robt., Montreal.
Jones & Glassco, Montreal.
Williams Mchy Co, Ltd., A. R., Montreal

HARDNESS TESTING INSTRUMENTS
Shore Instrument & Mfg. Co., New York.

HEAD, AUXILIARY
Hoefer Mfg. Co., Freeport, Ill.

HEATING AND VENTILATING ENGINEERS
Can. Blower & Forge Co., Kitchener, Ont.
Sheldons, Ltd., Galt, Ontario.
Sturtevant Co., B. F., Galt, Ont.

HEAT TREATMENT OF STEEL
Gray Ball Bearing Co., Ltd., Toronto.

HEAT GAUGES, HARDENING AND ANNEALING
Shore Instrument & Mfg. Co., New York

HELMETS, SANDBLAST, AMMONIA
Strong, Kennard & Nutt Co., Cleveland

HIGH SPEED STEEL
See Steel.

HINGE MACHINERY
Baird Machine Co., Bridgeport, Conn.

HINGES
Butterfield & Co., Inc., Rock Island, Que.
London Bolt & Hinge Wks., London, Ont

HOBS
Greenfield Tap & Die Co., Greenfield, Mass.
Pratt & Whitney Co., Dundas, Ont.
Taylor, J. A. M., 318 Stair Bldg., Toronto
Wells Bros. of Canada Galt, Ont.

HOISTING MACHINERY
Canadian Mead-Morrison Co., Limited, Montreal, Que.

HOISTS, AIR
Can. Ingersoll-Rand Co., Ltd., Sherbrooke
Morris Crane & Hoist Co., Herbert. Niagara Falls, Ont.

HOISTS, CHAIN AND PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Ford Chain Block & Mfg., Philadelphia.
Independent Pneumatic Tool Co., Chicago
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert. Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.
Williams Mchy Co, Ltd., A. R., Montreal

HOISTS, ELEC., STATIONARY, MONO RAIL
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
A. Beatty & Sons, Ltd., Welland, Can
Oliver Engineering Co., Montreal.
Volta Mfg. Co., Welland, Ont.

HOISTS, ELECTRICAL
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Montreal, Que.
Electric Steels & Metals Ltd., Welland
Kennedy & Sons, Owen Sound, Ont.
Morris Crane & Hoist Co., Herbert. Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

HOLDERS, STEEL DIE FOR MARKING
Matthews & Co., Jas. H., Pittsburgh, Pa.

HOLDERS, ELECTRIC
Electric Steels & Metals, Ltd., Welland

HOOKS, BELT LACING
Clipper Belt Lacer Co., Grand Rapids.

HOPPERS
MacKinnon Steel Co., Ltd., Sherbrooke.
Dominion Bridge Co., Montreal, Que.
William Hamilton Co., Peterboro, Ont.
Toronto Iron Works, Ltd., Toronto, Ont.

HOSE, FIRE PROTECTION
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal

HOSE, PNEUMATIC
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Gutta Percha & Rubber, Ltd., Toronto.
Independent Pneumatic Tool Co., Chicago.
Quaker City Rubber Co., Philadelphia, Pa.
Wells Bros. Co. of Canada, Galt, Ont.

HOSE, ALL KINDS
Goodyear Tire & Rubber Co., of Canada, Ltd., Toronto.
Gutta Percha & Rubber, Ltd., Toronto.
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.

HOSE, SAND BLAST
Pangborn Corporation, Hagerstown, Md.
Goodyear Tire & Rubber Co. of Can., Ltd. Toronto
Quaker City Rubber Co., Philadelphia, Pa.
Intern'l. Machine Tool Co., Indianapolis.

HOSE, STEAM, SUCTION AND WATER
Gutta Percha & Rubber, Ltd., Toronto.
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.

HUMIDIFIERS
Sturtevant Co., B. F., Galt, Ont.

HYDRAULIC ACCUMULATORS
Dom. Steel Products Co., Ltd., Brantford.

HYDRAULIC MACHINERY
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Machinery Co., Toronto
Dom. Steel Products Co., Ltd., Brantford.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
West Tire Setter Co., Rochester, N.Y.
Victoria Foundry Co., Ottawa.

HYDRAULIC TURBINES
Que.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,

HYDROMETERS, HYGROMETERS,

HYGRODIKS
Taylor Instrument Co., Rochester, N.Y.

INDICATORS, SPEED
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol, Mass.

INDEX CENTRES
Brown & Sharpe Mfg. Co., Providence, R.I.
Dickow, Fred. C., Chicago, Ill.
Ford-Smith Machine Co., Hamilton, Ont.
Garvin Machine Co., New York.
Petrie, Ltd., H. W., Toronto.

INDICATING INSTRUMENTS
Taylor Instrument Co., Rochester, N.Y

INDICATING SCALES
Can. Kron Scale Co., Montreal.

INDUSTRIAL SITES
City of St. Johns, Quebec.

INGOTS, BRASS, BRONZE, GUN METAL, PHOSPHOR
Thomas Moore & Son, Montreal.

INGOTS, FORGING AND ROLLING
Electric Steel & Metals Co., Welland.

INSULATING COMPOUNDS
Robertson Co., Ltd., H. H., Sarnia, Ont.

INSTRUMENTS, ENGINEERING
Consolidated Optical Co., Toronto.

IRON ORE
Hanna & Co., M. A. Cleveland, O.

IRON, WROUGHT, ROLLED, PIG
Swedish Steel & Impt. Co., Ltd., Montreal

JACKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Engineering Co.
Morris Crane & Hoist Co., Herbert. Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Norton, A. O., Coaticook, Que.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.

JACKS, PIT AND TRACK
Canadian Fairbanks-Morse Co., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Northern Crane Works, Walkerville.

JAWS, FACE PLATE
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford
Skinner Chuck Co., New Britain, Conn.

JOINTERS
Gray Ball Bearing Co., Ltd., Toronto.

JIGS, TOOLS, ETC.
Brown Engineering Corp., Toronto.
Crescent Mach. Co., Ltd., Montreal, P.Q.
Elliott & Whitehall Mach. & Tool Co., Galt.
Gisholt Machine Co., Madison, Wis.
Globe Engineering Co., Ltd., Hamilton.
Homer & Wilson, Hamilton, Ont.
Jones & Lamson, Springfield, Vt.
Toronto Tool Co., Toronto, Ont.

JOURNAL WEDGES
Canada Foundries & Forgings, Welland.

KEY SEATERS
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Morton Mfg. Co., Muskegon Heights, M.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.

KEYS, MACHINE
Whitney Mfg. Co., Hartford, Conn.
Williams & Co., J. H., Brooklyn, N.Y.

KILNS
Can. Blower & Forge Co., Kitchener, Ont.
General Combustion Co., Ltd., Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont
MacKinnon Steel Co., Sherbrooke, Que.
Sturtevant Co., B. F., Galt, Ont.

KNIVES, MACHINE
Atkins & Co., E. C., Hamilton, Ont.

KNIFE GRINDERS
Gray Ball Bearing Co., Ltd., Toronto.

LABELS AND TAGS
Matthews & Co., Jas. H., Pittsburgh, Pa

LABORATORIES, INSPECTION AND TESTING (see Chemists)

LADLES, FOUNDRY
Northern Crane Works, Walkerville.

LACING MACHINES
Clipper Belt Lacer Co., Grand Rapids, M.

LAG SCREW GIMLET POINTERS
National Machy. Co., Tiffin, Ohio.

LATH
Robertson, Ltd., H. H., Sarnia, Ont.

LATHES, CHUCKING
Acme Machine Tool Co., Cincinnati, Ohio
Petrie, Ltd., H. W., Toronto.
Wood Turret Machine Co., Brazil, Ind.

LATHE CHUCKS (See Chucks)

LATHE DOGS AND ATTACHMENTS
Armstrong Bros. Tool Co., Chicago.
Hendey Machine Co., Torrington, Conn.
Williams & Co., J. H., Brooklyn, N.Y.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.
Wood Turret Machine Co., Brazil, Ind.

LATHES, AXLE
Barber Mchy. Co., Ltd., Toronto, Ont.
Betts Mach. Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.

LATHES, BORING
Barber Mchy. Co., Ltd., Toronto, Ont.
Bridgeford Mach. Tool Works, Rochester
Canada Machinery Corp., Galt, Ont.
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J. G. Blount & Co., Everett, Mass.
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Geo. F. Foss Machy. & Supply Co., Montreal.
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Hardinge Bros., Chicago, Ill.
Pratt & Whitney Co., Dundas, Ont.
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Hardinge Bros., Chicago, Ill.
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Garvin Machine Co., New York.
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Smalley-General Co., Inc., Bay City, Mich.
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A. R. Williams Machy. Co., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.
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LATHES, FOOT POWER
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LATHES, HORIZONTAL
Intern'l. Mchy. Supplies Ltd., Montreal
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Elliott & Whitehall, Galt, Ont.

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Wells Bros. of Canada, Galt, Ont.

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Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Toronto, Ont.
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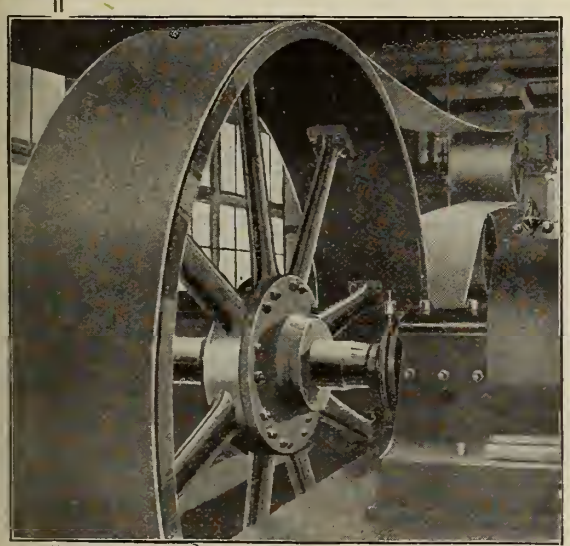

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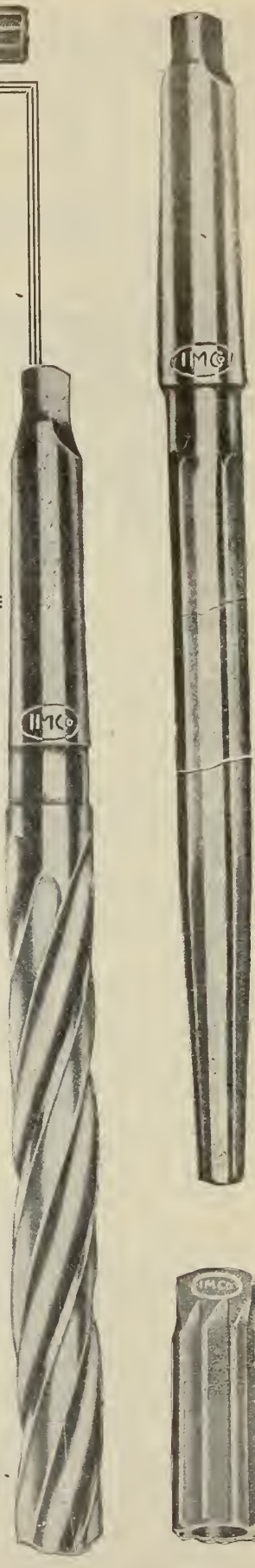
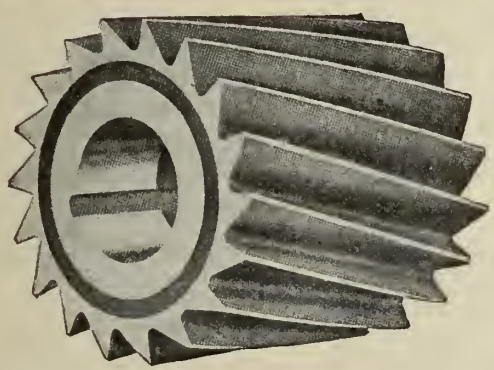
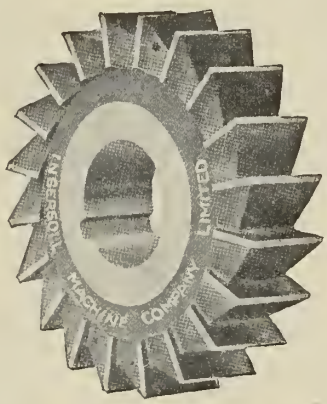
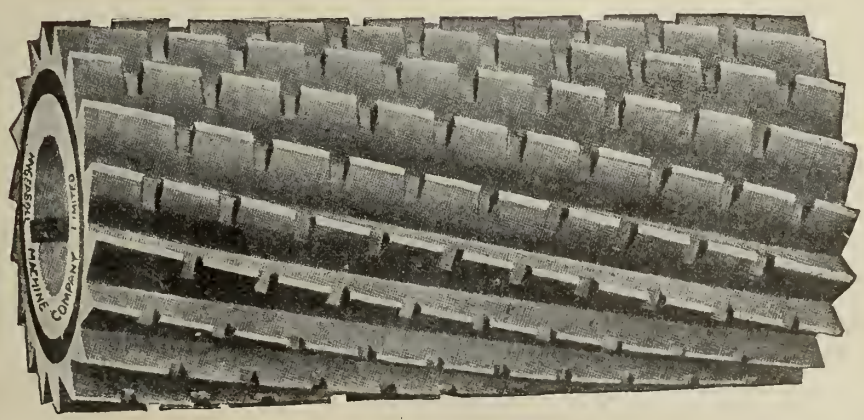
—Tools with a splendid reputation for workmanship, for material, for long-run economy.

"IMCO" TOOLS









Ingersoll Machine Co., Limited

Ingersoll, Ontario

American Plant: American Machine Products Co., Inc.
DETROIT, Michigan

IMCO TOOLS

PIPE TOOLS AND DIES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE CUTTERS AND REAMERS
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE STOCKS AND THREADERS
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE TAPS AND VISES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE WRENCHES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PISTON AND PISTON RING MACHINES
National Acme Co., Windsor, Vt.

PLANER BOLTS
Atkins & Co., E. C., Hamilton, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont.

PLANER JACKS
Armstrong Bros. Tool Co., Chicago.

PLANERS, STANDARD AND ROTARY
Betts Machine Co., Rochester, N.Y.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Oliver Machy. Co., Grand Rapids, Mich.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal
Gardner & Son, Robt., Montreal.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Moston Mfg. Co., Muskegon Heights, Mich.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.

PLANING AND SHAPING MACHINERY
Barber Mchy. Co., Ltd., Toronto, Ont
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal
Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
Niles-Bement-Pond Co., New York.
Ohio Mach. Tool Co., Kenton, Ohio.
Perrin, Ltd., William, Toronto.
Williams Mchy Co. Ltd., A. R., Montreal

PLANER-SHAPER, COMBINED OPEN SIDE
Lyad-Farquhar Co., Boston.
Petrie, Ltd., H. W., Toronto.

POWER HAMMERS
Quickwork Co., St. Marys, Ohio.

PLANING MILL EXHAUSTERS
Can. Blower & Forge Co., Kitchener, Ont.
MacGovern & Co., Montreal, Que.
Niles-Bement-Pond Co., New York.
Sturtevant Co., B. F., Galt, Ont.

PLATES, Q.M., SHEARED AND CHEQUERED
Peckovers, Ltd., Toronto, Ont.

PLATING, PLANTS & SUPPLIES
Can. Hanson Van Winkle Co., Ltd., Toronto, Ont.

PLIERS
Aikenhead Hardware Co., Toronto.
Can. Billings & Spencer, Ltd., Welland.
Peck, Stow & Wilcox Co., Southington, Ct.
Rice Lewis & Son, Toronto, Ont.

PNEUMATIC TOOLS
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland P'matic Tool Co., Can., Toronto.
Curtis Pneumatic Machy. Co., St. Louis.
Garlock-Walker Machy. Co., Toronto.
Int. Mach. & Supply Co., Ltd., Montreal
Independent Pneumatic Tool Co., Chicago

POWER CRANES, HAND
MacKinnon Steel Co., Sherbrooke, Que.

POLISHING MACHINES
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto.

POLISHING PLATES
Greenfield Tap & Die Corp., Greenfield
Petrie, Ltd., H. W., Toronto.
Wells Bros. of Canada, Galt, Ont.

POLISHING PAPER
H. H. Barton & Son Co., Philadelphia

POTS AND KETTLES, CAST STEEL
Ellco. Steel & Metals, Welland, Ont.

POWER HOUSE CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
St Lawrence Welding Co, Ltd., Montreal

PORTABLE MACHINERY
Haskins & Co., R. C., Chicago, Ill.

POWER TRANSMISSION MCHY.
Petrie, Ltd., H. W., Toronto.

PRESSED STEEL PARTS
Gray Ball Bearing Co., Ltd., Toronto.

PRESSERS, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Metalwood Mfg. Co., Detroit, Mich.
Petrie, Ltd., H. W., Toronto.

PRESSES, BROACHING, FORGING AND FLANGING
Atlass Press Co., Kalamazoo, Mich.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Dom. Steel Products Co., Ltd., Brantford
Metalwood Mfg. Co., Detroit, Mich
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
Stoll Co., D. H., Buffalo, N.Y.
Williams Mchy Co., Ltd., A. R., Montreal

PRESSES, CAM, TOGGLE, EYELET
Baird Machine Co., Bridgeport, Conn.
Bliss Co., E. W., Brooklyn, N.Y.
Toledo Machine & Tool Co., Toledo.
Stoll Co., D. H., Buffalo, N.Y.

PRESSES, FILTER
Perrin, Ltd., William R., Toronto.
Smalley-General Co., Inc., Bay City, Mich.

PRESSES, PNEUMATIC
Barber Mchy. Co., Ltd., Toronto, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Metalwood Mfg. Co., Detroit, Mich.
Toledo Machine & Tool Co., Toledo.

PRESSES, DROP AND FORGING
Barber Mchy. Co., Ltd., Toronto, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton.
Can. Fairbanks-Morse Co., Montreal.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co, Toledo.
U. S. Ordnance, Toronto, Ont.

PRESSES, HYDRAULIC
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Dom. Steel Products Co., Ltd., Brantford
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
Stoll Co., Inc., D. H., Buffalo, N.Y.
U. S. Ordnance, Toronto, Ont.
West Tire Setter Co., Rochester, N.Y.
Williams Machy. Co., A. R., Toronto.

PRESSES, HYDRO-PNEUMATIC
Eastern Production Co., Detroit, Mich.

PRESSES, BALING
Perrin, Ltd., William R., Toronto.

PRESSES, POWER
Baird Machine Co., Bridgeport, Conn
Barber Mchy. Co., Ltd., Toronto, Ont
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Ont
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo.
U. S. Ordnance, Toronto, Ont.
Williams Machy. Co., A. R., Toronto.

PRESSES, SPRING FOOT
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Ont.
Toledo Machine & Tool Co., Toledo.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal

PRESSES, SCREW
Barnes & Co., W. F. & Jno., Rockford, Ill
Bliss Co., E. W., Brooklyn, N.Y.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.

PRESSES, SEAL
Hoggson & Pettis Mfg. Co., New Haven, Conn.

PRESSES, TIRE
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,

PRESSES, TRIMMING
Bliss Co., E. W., Brooklyn, N.Y.
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.

PROJECTORS, FLOOD LIGHTING
Lyman Tube & Supply Co., Montreal, Que

PROPELLERS
Kennedy & Sons, Wm., Owen Sound.

PROTECTIVE COATINGS
H. H. Robertson, Ltd., Sarnia, Ont.

PSYCROMETERS, SLING
Taylor Instrument Co., Rochester, N.Y.

PULLEYS
Algoma Steel Corp., Sault Ste. Marie, Ont
American Pulley Co., Philadelphia.
Baird Machine Co., Bridgeport, Conn.
Bernard Industrial Co., Fortierville, Que.
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Ford-Smith Machine Co., Hamilton, Ont.
Kennedy & Sons, Ltd., W., Owen Sound.
Positive Clutch & Pulley Works Ltd., Toronto.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.

PULLEYS, STEEL SASH, STEEL BELT
American Pulley Co., Philadelphia, Pa.

PULLEYS, FRICTION, CLUTCH
American Pulley Co., Philadelphia, Pa.
Baird Machine Co., Bridgeport, Conn.
Bernard Industrial Co., A., Fortierville, Q
Can. Link-Belt Co., Toronto, Ont.
Carlyle Johnson Mch. Co., Manchester, Ct.
Positive Clutch & Pulley Works, Toronto.
Jones & Glassco, Montreal.
Petrie, Ltd., H. W., Toronto.

PULP MILL MACHINERY
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
MacKinnon Steel Co., Sherbrooke, Que.

PUMPS, AIR LIFT
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,

PUMPS, BOILER FEED
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,

PUMPS, CENTRIFUGAL
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Ingersoll-Rand Co., Montreal, Que.
Darling Bros., Ltd., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

PUMPS, FUEL OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Darling Bros., Ltd., Montreal, Que.
Trahern Pump Co., Rockford, Ill.

PUMPS, GEARED
Darling Bros., Ltd., Montreal, Que.
Globe Engineering Co., Hamilton, Ont.

PUMPS, HIGH PRESSURE
Perrin, Ltd., William R., Toronto.

PUMPS, HYDRAULIC
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Clarke & Co., Furniss, Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Darling Bros., Ltd., Montreal, Que.
Ellco. Steel & Metals, Welland, Ont.
Metalwood Mfg. Co., Detroit, Mich.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

PUMPS, LUBRICATING, OIL STORAGE
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, RETURN AIR
Can. Ingersoll-Rand Co. Ltd., Sherbrooke,

PUMPS, SPECIAL
Ellco. Steel & Metals, Welland, Ont.

PUMPS, RUBBER CEMENT
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, KEROSENE, OIL, SELF-MEASURING
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, LUBRICANT, OIL, WATER
Darling Bros., Ltd., Montreal, Que.
Trahern Pump Co., Rockford, Ill.

PUMPS — ROTARY
General Combustion Co., Ltd., Montreal, Que.

PUMP LEATHERS
Graton & Knight Mfg. Co., Worcester.

PUNCHES AND DIES
Atkins & Co., Ltd., Wm., Sheffield, Eng.
E. W. Bliss Co, Brooklyn, N.Y.
Boker & Co., Inc., H, Montreal, Que.
Brown, Boggs Co., Ltd., Hamilton, Can.
Can. Blower & Forge Co., Kitchener, Ont.
Crescent Mach. Co., Ltd., Montreal, P.Q.
Can. Fairbanks-Morse Co., Montreal.
Elliott & Whitehall Machine and Tool Co., Galt, Ont.
Gardner & Son, Robert, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Marshall, Son & Blunney, Toronto.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Williams Mchy Co., A. R., Toronto, Ont.

PUNCHES, POWER
John Bertram & Sons Co., Dundas, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd, Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
A. B. Jardine & Co., Hespeler, Ont.
Long & Allstatter, Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
D. H. Stoll Co., Buffalo, N.Y.
Williams Mchy Co., A. R., Toronto, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertrams, Ltd., Edinburgh, Scotland.
Bertrams & Sons, John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton, Ont.
Garlock-Walker Mach'y. Co., Toronto.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

PYROMETERS
Bristol Co., Waterbury, Conn.
Shore Instrument & Mfg. Co., New York
Taylor Instrument Co., Rochester, N.Y.
U.S. Ordnance, Toronto, Ont.

QUARTERING MACHINES
Bertram & Sons, John, Dundas, Ont.
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Niles-Bement-Pond Co., New York.

QUARRY HOISTS
Canadian Mead-Morrison Co., Limited, Montreal, Que.

RAIL BENDERS
Algoma Steel Corp., Sault Ste. Marie, O.

PUNCHES, HAND
Niles-Bement-Pond Co., New York.

RAILROAD TOOLS
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Petrie Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

RASPS
Atkins & Co., Ltd., Wm., Sheffield, Eng
Marshall, Son & Bunney, Toronto.

RAWHIDE PINIONS (See Gears)

REAMERS
Butterfield & Co., Inc., Rock Island, Que.

REAMERS, ADJUSTABLE
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Elliott & Whitehall Machine and Tool Co., Galt, Ont.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Machy. Co., Ingersoll, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Plewes, Ltd., Winnipeg, Man.
Pratt & Whitney Co., Dundas, Ont.
The Kelly Reamer Co., Cleveland, O.
J. A. M. Taylor, 315 Stair Bldg., Toronto.
Wells Bros. of Can., Galt, Ont

REAMERS, BRIDGE, EXPANDING AND HIGH SPEED
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Aikenhead Hardware Co., Toronto.
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Elliott & Whitehall Machine and Tool Co., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Lyman Tube & Supply Co., Montreal, Que
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Samuel Osborne, Ltd., Montreal, P.Q.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
U.S. Ordnance, Toronto, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, STEEL TAPER AND SELF-FEEDING
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
A. B. Jardine & Co., Hespeler, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, CHUCKING
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que
Elliott & Whitehall Machine and Tool Co., Galt, Ont.
Greenfield Tap & Die Corp., Greenfield
Ingersoll Machy. Co., Ingersoll, Ont.
Marshall, Son & Bunney, Toronto.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wells Bros. of Canada, Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, HAND
Butterfield & Co., Inc., Rock Island, Que.
Elliott & Whitehall, Galt, Ont.
Greenfield Tap & Die Corp., Greenfield.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wells Bros. of Can., Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, PIN
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Morrow Screw & Nut Co., John, Ingersoll
Wells Bros. of Can., Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMER FLUTING MACHINES
Garvin Machine Co., New York.

REAMING MACHINES, PNEUMATIC
Cleveland Pneumatic Co. of Can., Toronto
Garlock-Walker Machinery Co., Toronto.

RECORDING INTRUMENTS
Bristol Co., Waterbury, Conn.
Gisholt Machine Co., Madison, Wis.
Taylor Instrument Co., Rochester, N.Y.

REELS, WIRE AND TEXTILE MFG.
American Pulley Co., Philadelphia, Pa.

REGULATORS, AUTOMATIC
Electric Steels & Metals, Ltd., Welland.

REGULATORS, PRESSURE, TEMPERATURE
Can. Fairbanks-Morse Co., Montreal.
Taylor Instrument Co., Rochester, N.Y.

REPAIR WORK — SAWS
Atkins & Co., E. C., Hamilton, Ont.

REPAIR WORK, ALL KINDS
Ellco. Steel & Metals, Welland, Ont.
St Lawrence Welding Co, Ltd., Montreal

RESPIRATORS
Strong, Kennard & Nutt Co., Cleveland.

RIVETS,
Aikenhead Hardware Co., Toronto, Ont.
Parmenter & Bulloch Co., Gananoque.
Rice, Lewis & Son, Toronto.
Steel Co. of Canada, Ltd., Hamilton.

RIVETERS, PNEUMATIC, HYDRAULIC, HAMMER, COMPRESSION
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Montreal.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.

RIVETING MACHINES, ELASTIC, ROTARY BLOW
Grant Mfg. & Machine Co., Bridgeport.
High-Speed Hammer Co., Rochester.
Petrie, Ltd., H. W., Toronto.
F. B. Shuster Co., New Haven, Conn.

ROAD BUILDING EQUIPMENT
Can. Ingersoll-Rand Co., Ltd., Sherbrooke.

ROAD-MAKING MACHINERY
G. F. Foss Mchy & Sply. Co., Montreal.

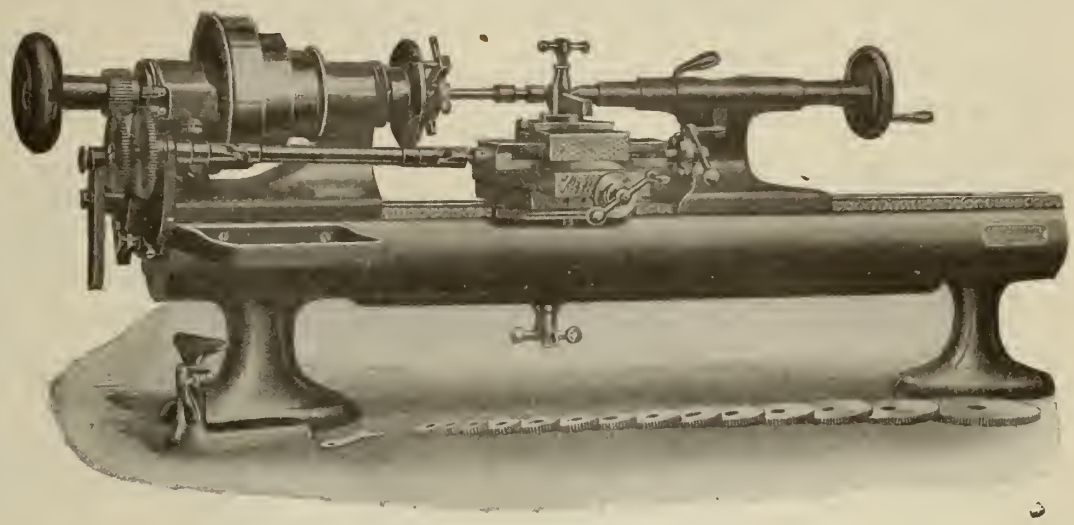
RODS, ROPE AND SPRING
Page Steel & Wire Co., Adrian, Mich.

RODS, PURE NICKEL, MONEL METAL, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville.

ROLL ENGRAVING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CATARACT BENCH LATHES AND ATTACHMENTS

Cataract Bench Lathes are finely constructed precision tools, with responsive controls, simple adjustments and numerous convenient attachments adapting them to a wide variety of work. **Study this illustration.** Note the base, the circular bed, the sliding tool post, massive head stock (indicating strength), range of gears, special tailstock, arrangement of gears.



Hardinge Bros., 1770 Bertau Avenue, Chicago, Ill.

Canadian Representatives: Garlock-Walker Machinery Company, Limited
Montreal - Toronto - Winnipeg

The Landis for Motor Parts

The quality of the finish alone will determine the life of a motor. One imperfectly finished part may cause the failure of the whole mechanism; possibly with disastrous results.

LANDIS finished motor parts—valves, valve stems, pistons, piston pins, cranks, shafts and axles—are quality parts, accurate and reliable.

LANDIS cylindrical grinding machine output is very close to perfection. These machines possess all the refinements of thirty years of continuous development: they are accurate, powerful and speedy producers.

Particular manufacturers have standardized on LANDIS finished parts.

LANDIS TOOL COMPANY

WAYNESBORO, PA.

LANDIS

ROLLER CHAINS
Can. Link-Belt Co., Toronto.
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que

ROLLS, BENDING, STRAIGHTENING
John Bertram & Sons Co., Dundas.
Brown, Boggs Co., Ltd., Hamilton.
Can. Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto
Niles-Bement-Pond Co., New York.
Petrie Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo, O.

ROLLS CRUSHING
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

ROLLS AND TABLES
Elec. Steel & Metals, Welland, Ont.

ROOFING
H. H. Robertson, Ltd., Sarnia, Ont.

ROPE, GALX, MONEL METAL, BRONZE, TILLER AND SASH CORD
Can. Driver-Harris Co., Ltd., Walkerville

ROTARY SHEARS
The Quickwork Co., St. Mary's, Ohio.

ROOF COOLERS
Electric Steels & Metals, Ltd., Welland

ROLLING MACHINES, SHEET METAL
Manhattan Machine & Tool Co., Grand Rapids, Mich.

ROLLING MILL MACHINERY
Dom. Steel Products Co., Ltd., Brantford
Mesta Machine Co., Pittsburgh, Pa.

ROLL LATHES
Mesta Machine Co., Pittsburgh, Pa.

ROLLS, BENDING, STRAIGHTENING
Manhattan Machine & Tool Co., Grand Rapids, Mich.

ROLLS, CRUSHING
Can. Link-Belt Co., Toronto.

ROLL ENGRAVINGS
Hoggson & Pettis Mfg. Co., New Haven, Conn.

RUBBER MFRS.' SUPPIES
Hoggson & Pettis Mfg. Co., New Haven, Conn.

RUBBER MOULDS AND CORES
Elliott & Whitehall, Galt, Ont.

RUBBER MILL DRIVES
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dom. Steel Products Co., Ltd., Brantford
Can. Link-Belt Co., Toronto.

RUBBER MILL MACHINERY
Bertrams Ltd., Edinburgh, Scotland.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dom. Steel Products Co., Ltd., Brantford

RUBBER MOULDS & CORES
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

RUBBER PRODUCTS, MECHANICAL
Dunlop Tire & Rubber Goods Co., Ltd., Montreal.

RUBBING BRICKS
Dominion Abrasive Co., Mimico, Ont.

RULES
Brown & Sharpe Mfg. Co., Providence.
James Chesterman & Co., Ltd., Sheffield
Rice, Lewis & Son, Toronto.
L. S. Starrett Co., Athol, Mass.

RULES, STEEL, STRAIGHT, AND FOLDING
Lufkin Rule Co. of Can., Windsor.

RULES, BOXWOOD, FOLDING
Lufkin Rule Co. of Can., Windsor.

RULES, BOARD AND LONG
Lufkin Rule Co. of Can., Windsor.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N.Y.

SAW MILL CONVEYORS
Can. Link-Belt Co., Toronto.
Petrie, Ltd., H. W., Toronto.

SAFETY DEVICES
Strong, Kennard & Nutt Co., Cleveland

SAND MILLS
Frost Mfg. Co., Chicago, Ill.

SAND-BLAST EQUIPMENT
SAND BLAST SUPPLIES AND ACCESSORIES
Pangborn Corporation, Hagerstown, Md.
Lawrence Welding Co. Ltd., Montreal

SAFETY APPLIANCES
Strong, Kennard & Nutt Co., Cleveland.

SAFETY APPLIANCE GOGGLES
T. A. Wilson Co., Inc., Reading, Pa.

SAND BLAST ABRASIVES
Pangborn Corporation, Hagerstown, Md.

SAND MIXING MACHINERY
Frost Mfg. Co., Chicago, Ill.

SANITARY DRINKING FOUNTAINS
Pure Sanitary Drinking Fountain Co., Haydenville.

SANDING MACHINES
Canada Machinery Corp., Galt.

SAW MILL MACHINERY
Can. Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt.
Robert Gardner & Son, Montreal.
Curtis Pneumatic Machy Co., St. Louis
A. R. Williams Machy. Co., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

SASH SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

SAWS FOR EVERY USE
Atkins & Co., E. C., Hamilton, Ont.

SAWS, CIRCULAR METAL
Atkins & Co., E. C., Hamilton, Ont.
Wm. Atkins & Co., Ltd., Sheffield, Eng.
Hunter Saw & Machine Co., Pittsburgh.
Marshal, Son & Bunney, Toronto.
Plewes Ltd., Winnipeg, Man.
Simonds Mfg. Co., Fitchburgh, Mass.
Tabor Mfg. Co., Philadelphia, Pa.

SAWS, HACK (See Hack Saws)
SAW GUARDS
Atkins & Co., E. C., Hamilton, Ont.

SAWS, METAL, HACK AND BAND
Atkins & Co., E. C., Hamilton, Ont.

SAWS, SILVER STEEL
E. C. Atkins & Co., Inc., Indianapolis.

SAW SHARPENERS
Greenfield Tap & Die Corp., Greenfield.
Hunter Saw & Machine Co., Pittsburgh.
Wells Bros. of Can., Galt, Ont.

SAWS, SLITTING
J. A. M. Taylor, Stair Bldg., Toronto.
Atkins & Co., E. C., Hamilton, Ont.
Elliott & Whitehall Machine and Tool Co., Galt, Ont.

SAWS — HIGH-SPEED FRICTION
Atkins & Co., E. C., Hamilton, Ont.

SAWS — PATTERN SHOP
Atkins & Co., E. C., Hamilton, Ont.

SAWS — SWING
Atkins & Co., E. C., Hamilton, Ont.

SCALES
Can. Kron Scale Co., Montreal, P.Q.
U. S. Ordnance, Toronto, Ont.

SCALES, MECHANICS'
Lufkin Rule Co. of Can., Windsor.

SCLEROSCOPES
Shore Instrument & Mfg. Co., New York.
U. S. Ordnance, Toronto, Ont.

SCREENING MACHINERY
Can. Link-Belt Co., Toronto.

SCREW EXTRACTORS
Cleveland Twist Drill Co., Cleveland.

SCREW MACHINES, HAND, AUTOMATIC
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Ltd., Toronto
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield.
A. B. Jardine & Co., Hespeler.
National Acme Co, Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
U. S. Ordnance, Toronto, Ont.
Warner & Swasey Co., Cleveland, O.
Wells Bros. of Can., Galt, Ont.
Wood Turret Mach. Co., Brazil, Ind.

SCREWS, MACHINE, SET, CAP AND SPECIAL
Galt Machine Screw Co., Galt.
John Morrow Screw & Nut Co., Ingersoll.
National Acme Co. Montreal.
Rice Lewis & Son, Toronto.
Steel Co. of Canada, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.

SCREW COLLARS
Galt Machine Screw Co., Ltd., Galt, Ont.
John Morrow Screw & Nut Co., Ingersoll.

SCREW MACHINES, PLAIN WIRE FEED
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.

SCREW PLATES
Butterfield & Co., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
A. B. Jardine & Co., Hespeler.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto.
J. A. M. Taylor, Stair Bldg., Toronto.
Wells Bros. of Can., Galt.
Wilkinson & Kompass, Hamilton.

SCREWS, SAFETY SET
Galt Machine Screw Co., Ltd., Galt, Ont.

SCREW SLOTTERS
Butterfield & Co., Inc., Rock Island, Que.
Garvin Machine Co., New York.
National Acme Co., Cleveland, O.
Pratt & Whitney Co., Dundas, Ont.

SEPARATORS, MOISTENERS AND OIL FOR COMPRESSED AIR
Pangborn Corporation, Hagerstown, Md.

SELF-OPENING DIES
See Dies.

SEPARATORS, SAND
Pangborn Corporation, Hagerstown, Md.

SET SCREWS, SAFETY
Aikenhead Hardware Co., Toronto.
Bristol Co., Waterbury, Conn.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wilkinson & Kompass, Hamilton.

SHANKS, STRAIGHT AND TAPER
Jacobs Mfg. Co., Hartford, Conn.

SHAPERS
Barber Mchy. Co., Ltd., Toronto, Ont.
John Bertram & Sons Co., Dundas.
Can. Fairbanks-Morse Co., Montreal.
Canadian Machinery Corp., Galt.
Geo. F. Foss Mchy. & Sply. Co., Montreal
Robt. Gardner & Son, Montreal.
Garlock-Walker Mach'y. Co., Toronto.
Hendey Machine Co., Torrington, Conn.
Milwaukee Shaper Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto.
Rae Mach. Tool Co., Hamilton.
Standard Equipment & Tool Wks., Montreal.
U. S. Ordnance, Toronto, Ont.
Walcott Lathe Co., Jackson, Mich.
Williams Mchy Co., A. R., Toronto, Ont.

SHAPERS, GEAR
Fellows Gear & Shaper Co., Springfield, V.
Knigh Metal Products, Toronto.

SHAFTING
Algoma Steel Corp., Sault Ste. Marie, O.
Can. Fairbanks-Morse Co., Montreal.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Jones & Glassco, Montreal.
Niles-Bement-Pond Co., New York.
Can. Drawn Steel Co., Hamilton.
Peckovers, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas.
Rice, Lewis & Son, Toronto.
A. R. Williams Machy. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

SHARPENING STONES
Norton Co, Worcester, Mass.
Rice, Lewis & Son, Toronto.

SHEARING MACHINES, ANGLE IRON, BAR AND GATE
John Bertram & Sons Co., Dundas.
Bertrams Ltd., Edinburgh, Scotland.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
A. B. Jardine & Co., Hespeler, Ont.
Long & Allstatter Co., Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo, O.

SHEARS, POWER
John Bertram & Sons Co., Dundas.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton.
Can Blower & Forge Co, Kitchener.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Long & Allstatler, Hamilton, Ohio.
A. B. Jardine & Co., Hespeler, Ont.
National Machy. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
H. D. Stoll Co., Inc., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Williams, White & Co., Moline, Ill.
Williams Mchy Co., A. R., Toronto, Ont.

SHEARS, ROTARY
The Quickwork Co., St Mary's, Ohio.

SHEARS, PNEUMATIC
Toledo Machine & Tool Co., Toledo, Ohio

SHEARS, PLATE CUTTING, SLITTING
Dom. Steel Products Co., Ltd., Brantford.
Quickwork Co., St. Mary's, Ohio.

SHEARS, SPLITTING
Dom. Steel Products Co., Ltd., Brantford.
Peck, Stow & Wilcox Co., Southington.

SHEARS, IRREGULAR AND CIRCLE CUTTING
The Quickwork Co., St. Mary's, Ohio.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEET METAL MACHINERY
Peck, Stow & Wilcox Co., Southington, C.

SHEARS, SERPENTINE
The Quickwork Co., St. Mary's, Ohio.

SHEARS, SQUARING
Brown, Boggs & Co., Hamilton, Ont.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEETS, STEEL, BLACK AND GALVANIZED
Benjamin & Co., M. & L., Samuel, Toronto, Ont.
Dominion Sheet Metal Corp., Hamilton.

SHEET METAL WORKING MACHINERY
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEET METAL WORKING TOOLS
Baird Machine Co., Bridgeport, Conn.
Barber Mchy. Co., Ltd., Toronto, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton.
Peck, Stow & Wilcox Co., Southington, C.
Petrie, Ltd., H. W., Toronto.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEETS, CRUCIBLE, CAST
British Smelting & Refining Co., Ltd., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.

SHEETS, BLACK AUTO AND GALVANIZED
Peckovers, Ltd., Toronto, Ont.

SHEETS, NICKEL, RESIST. ALLOY
Can. Driver-Harris Co., Ltd., Walkerville.

SHELVING, STEEL
Dennis Wire & Iron Works, London.

SHIPYARD MACHINERY, SHOP FURNITURE
Dennis Wire & Iron Works, London.

SIDE TOOLS
Armstrong Bros. Tool Co., Chicago.
J. H. Williams & Co., Brooklyn, N.Y.

SILENT CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.

SLEDGES
Aikenhead Hardware Co., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont

SLEDGES, CAST IRON
Katie Foundry, Galt, Ont.

SLICING CLAMPS
Peck, Stow & Wilcox Co., Southington, Conn.

SLINGS, CHAINS
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

SLOTTERS
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
National-Acme Co., Cleveland, Ohio.
Niles-Bement-Pond Co., New York.

SMOKESTACKS
William Hamilton Co., Peterboro, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
St Lawrence Welding Co, Ltd., Montreal

SNIPS, TINNERS AND SHEET METAL WORKERS
Kearney & Trecker Co., Milwaukee, Wis.
J. Morrow Screw & Nut Co., Ingersoll, Ont.

SOCKETS
Brown & Sharpe Mfg. Co., Providence.
Butterfield & Co., Inc., Rock Island, Que
Cleveland Twist Drill Co., Cleveland.
Keystone Mfg. Co., Buffalo, N.Y.
Modern Tool Co., Erie, Pa.
J. Morrow Screw & Nut Co., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

SOIL PIPE FITTINGS, CAST IRON
Katie Foundry, Galt, Ont.

SOLDERING IRONS
Aikenhead Hardware Co., Toronto, Ont.
Brown, Boggs & Co., Hamilton, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.

SOLDER
British Smelting & Refining Co., Ltd., Montreal, Que.
Aikenhead Hardware Co., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Tallman Brass & Metal Co., Hamilton.

SPELTER
British Smelting & Refining Co., Ltd., Montreal, Que.

SPEED REDUCING GEARS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.

SPRINGS, MACHINERY
Barnes, Wallace Co., Bristol, Conn.
Can. Steel Foundries, Ltd., Montreal.
Cleveland Wire Spring Co., Cleveland.
Dunbar Bros. Co., Bristol, Conn.
Garlock-Walker Machinery Co., Toronto.

SPECIAL MACHINERY
Baird Machine Co., Bridgeport, Conn.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram, John, & Sons Co., Dundas.
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada.
Brown Engineering Corp., Toronto, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Globe Engineering Co., Ltd., Hamilton.
Gooley & Edlund, Inc., Courtland, N.Y.
John H. Hall & Sons, Brantford.
A. B. Jardine & Co., Hespeler, Ont.
Katie Foundry, Galt, Ont.
Ker & Goodwin Machine Co., Ltd., Brantford, Ont.
National-Acme Co., Cleveland, Ohio.
Mesta Machine Co., Pittsburgh, Pa.
Rae Mach. Tool Co., Hamilton.
Stoll Co., D. H., Buffalo, N.Y.
Victoria Foundry Co., Ottawa, Ont.
William R. Perrin, Ltd., Toronto.

SPECIAL TOOLS, MACHINERY
Crescent Mche. Co., Ltd., Montreal, Que.
Globe Engineering Co., Ltd., Hamilton.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Wilton & Mfg. Co., Boston, Mass.

SPRING COILING AND WINDING MACHINERY
Baird Machine Co., Bridgeport, Conn.
Garvin Machine Co., New York.

SPRING MAKING MACHINERY (AUTOMATIC)
Baird Machine Co., Bridgeport, Conn.

SPRINGS, SPIRAL, TOOL
The Dunbar Bros. Co., Bristol, Conn.

SPROCKETS, COMPENSATING
Morse Chain Co., Ithaca, New York.

SPROCKETS, SPRING
Morse Chain Co., Ithaca, New York.

SPROCKETS, CHAIN
Can Link-Belt Co., Toronto, Ont.
Grant Gear Works, Boston, Mass.
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia.

SPRINGS FOR TOYS AND ELECTRIC DEVICES
The Dunbar Bros. Co., Bristol, Conn.

SPROCKET WHEELS, CAST
Can. Link Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Ltd., Montreal

SQUARES
Peck, Stow & Wilcox Co., Southington, Conn.

Gear Cutting With the "IFS" Left Out

The Gear Shaper Way

A production manufacturer knows that he will secure good gears IF he has an accurate cutter, an accurate machine and a machine working on the correct principle. The whole question of good gears is resolved in this one little word "IF."

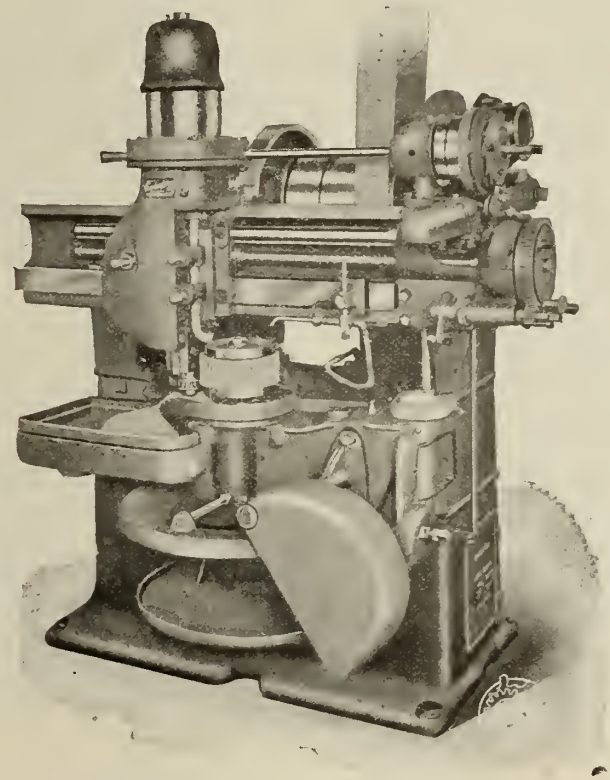
When the Gear Shaper was originally designed, the question of "IF" was taken into consideration and every possible means known to mechanical engineering was employed to eliminate the "IFS" from gear cutting.

That we have been successful in solving the problem is evidenced by the fact that each ensuing year sees a larger number of manufacturers adopting the Gear Shaper method.

How the Gear Shaper has accomplished this is clearly explained in our general catalog "Commercial Gear Cutting," which is a treatise on the subject of:—

Gear Cutting with the "IFS" Left Out.

Send for your copy to-day.



The Fellows Gear Shaper—the machine which has taken the "IFS" out of gear cutting

The Fellows Gear Shaper Company

Springfield, Vermont, U.S.A.

FOREIGN AGENTS:—Alfred Herbert, Limited, Coventry, England; Société Anonyme Alfred Herbert, Paris, France; Societa Anonima Italiana Alfred Herbert, Milan, Italy; Alfred Herbert, Limited, Yokohama, Japan; Societe Anonyme Alfred Herbert, Barcelona, Spain; Societe Anonyme Belge Alfred Herbert, Brussels, Belgium; Alfred Herbert, Limited, Calcutta, India.

If interested tear out this page and place with letters to be answered

SAFETY CYLINDERS
Oliver Mach. Co., Grand Rapids, Mich.

SANDERS
Oliver Mach. Co., Grand Rapids, Mich.

SAW BENCHES
Oliver Mach. Co., Grand Rapids, Mich.

SAW GUARDS
Oliver Mach. Co., Grand Rapids, Mich.

SAWS SWING
Oliver Mach. Co., Grand Rapids, Mich.

STAYBOLT TOPS
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

STAIRS, IRON
Canada Wire & Iron Goods Co., Hamilton, Ont.

STAMPINGS, SHEET BRASS, COPPER, ALUMINUM AND STEEL
Dom. Forge & Stamping Co., Walkerville
Globe Engineering Co., Hamilton, Ont.
Homer & Wilson, Hamilton, Ont.

STAMPING MACHINERY
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs, & Co., Hamilton, Can
Canada Machinery Corp., Galt, Ont.

STAMPS AND DIES, STEEL
Hoggson & Pettis Mfg. Co., New Haven Conn.

STAMPS, STEEL ALPHABET, FIGURES
Hoggson & Pettis Mfg. Co., New Haven Conn.
Matthews, Jas. H & Co., Hartford, Conn.

SAFETY CYLINDERS
Oliver Mach. Co., Grand Rapids, Mich

STEAM APPLIANCES
Darling Bros., Ltd., Montreal, Quebec.

STEAM SEPARATORS AND TRAPS
Can. Fairbanks-Morse Co., Montreal

STEAM HOISTING ENGINES
Canadian Mead-Morrison Co., Limited, Montreal, Que.

STEAM TURBINES
General Combustion Co., Ltd., Montreal, Que.
Sturtevant Co., B. F., Galt, Ont.

STEEL BALLS
See Balls Steel.

STEEL, CRUCIBLE TOOL
Atkins & Co., Ltd., Wm. Sheffield, Eng
Baines & David, Toronto.
Illingworth Steel Co., John, New York
Kayser-Ellison & Co., Ltd., Montreal
Marshall, Son & Bunney, Toronto.

STEEL, CARBON, FERRO-TUNGSTEN
Armstrong, Whitworth of Can., Montreal
Atkins & Co., Ltd., Wm., Sheffield, Eng
Baines & David, Toronto.
Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal
Latrobe Electric Steel Co., Latrobe, Pa
Lincoln Electric Co. of Canada, Ltd Toronto, Ont.
Marshall, Son & Bunney, Toronto.
Peckovers, Ltd., Toronto, Ont.
Samuel Osborne (Can.), Ltd., Montreal
Vanadium-Alloys Steel Co., Pittsburgh

STEEL CASTINGS
Davidson Mfg. Co., Ltd., Montreal, Que.

STEEL CHROME VANADIUM
Kayser-Ellison & Co., Ltd., Montreal
Norton, Ralph B., Agent, Montreal.
Atkins & Co., Ltd., Wm. Sheffield, Eng
Marshall, Son & Bunney, Toronto.

STEEL CHROME NICKEL
Kayser-Ellison & Co., Ltd., Montreal
Lyman Tube & Supply Co., Ltd., Montreal
Norton, Ralph B., Agent, Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng
Marshall, Son & Bunney, Toronto.

STEEL CASTINGS
Can. Elec. Steel Casting Co., Aurora, Ont
Dom. Iron & Steel, Sydney, N.S.
Jollette Steel Co., Montreal, Que.
Kennedy & Sons, Wm., Owen Sound
Electric Steel & Metals Co., Welland.
Nova Scotia Steel & Coal Co., Windsor
Swedish Crucible Steel Co., Windsor.

STEEL, COLD ROLLED
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Drawn Steel Co., Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co. Ltd., Montreal.
Union Drawn Steel Co., Hamilton, Ont.

STEEL, F. O. A. B.
Lincoln Electric Co., of Canada, Ltd., Toronto, Ont.

STEEL, NICKEL
Atkins & Co., Ltd., Wm., Sheffield, Eng
Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal
Peckovers, Ltd., Toronto, Ont.

STEEL, HIGH SPEED
Armstrong-Whitworth of Can., Montreal
Baines & David, Toronto.
Wm. Atkins & Co., Sheffield, Eng.
Baker & Co., Inc., H., Montreal, Que
Can. Fairbanks-Morse Co., Montreal
Deloro Smelting & Refining Co., Ltd Toronto, Ont.
H. A. Drury Co., Ltd., Montreal.
Firth & Sons, Thos., Montreal, Que
Hawkridge Bros. Co., Boston, Mass.
Illingworth Steel Co., J., New York
Kayser Ellison & Co., Sheffield, Eng.
Latrobe Electric Steel Co., Latrobe, Pa
Marshall, Son & Bunney, Toronto, Ont
Osborne, Samuel, Montreal, P.Q.
Plewes, Ltd, Winnipeg, Man.
Pilot Steel & Tool Co., Montreal, Que
Ralph B. Norton, Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co., Ltd Montreal.
Vanadium-Alloys Steel Co., Pittsburgh

STEEL, CHROME, MANGANESE
Jollette Steel Co., Montreal, Que.

STEEL, OPEN HEARTH
Illingworth Steel Co., John, New York

STEEL PRODUCTS AND MACHINERY
Dom. Steel Products Co., Ltd., Brantford

STEEL, ROCK DRILL
Armstrong, Whitworth of Canada, Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal
Lincoln Electric Co. of Canada, Ltd Toronto, Ont.

STEEL, SPRING AND REINFORCING
Peckovers, Ltd., Toronto, Ont.

STEEL, STRUCTURAL
Algoma Steel Corp., Sault Ste. Marie
Dom. Iron & Steel Co., Sydney, N.S.
MacKinnon Steel Co., Sherbrooke, Que.
Peckovers, Ltd., Toronto, Ont.

STEEL, TOOL
Armstrong, Whitworth of Can., Montreal
Atkins & Co., Wm., Sheffield, Eng.
Baines & David, Toronto.
Can. Fairbanks-Morse Co., Montreal.
Drury Co., H. A., Montreal, Que.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.
Firth & Sons, Thos., Montreal, Que.
Hawkridge Bros. Co., Boston, Mass.
Kayser-Ellison & Co., Ltd., Montreal.
Lincoln Electric Co., of Canada, Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Ltd., Montreal
Marshall, Son & Bunney, Toronto, Ont.
Latrobe Electric Steel Co., Latrobe, Pa.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son Toronto, Ont.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL, VANADIUM
Wm. Atkins & Co., Ltd., Sheffield, Eng.
Armstrong, Whitworth of Can., Montreal.
Drury, H. A., Co., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.
Wells Bros. of Can. Galt, Ont.

STEEL WELDING
Peckovers, Ltd., Toronto, Ont.

"STELLITE"
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.

STENCILS
Hoggson & Pettis Mfg. Co., New Haven, Conn.

STOCK RACKS FOR BARS, PIPING, ETC.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

STOCKS AND DIES
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

STOCKS, PIPE
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Wells Bros., Co., of Canada, Galt, Ont.

STONES, COMMUTATORS
Lyman Tube & Supply Co., Ltd., Montreal

STRAIGHTENING MACHINERY
Baird Machinery Co., Bridgeport, Conn.
Bertrams, Ltd., Edinburgh, Scotland.

STRAND
Dom. Steel Products Co., Ltd., Brantford.
Page Steel & Wire Co., Adrian, Mich.

STRIP STEEL
Peckovers, Ltd., Toronto, Ont.

SURFACE PLATES
Brown & Sharpe Mfg. Co., Providence, R.I.

STRUCTURAL STEEL WORKS
William Hamilton Co., Peterboro, Ont.

SUPPLIES, RUBBER MFRS.
Hoggson & Pettis Mfg. Co., New Haven, Conn.

SWITCHBOARDS
Northern Electric Co., Ltd., Montreal Que

SWITCHES, RAILWAY
Can. Steel Foundries, Ltd., Montreal.

TABLES, DRAWING
Economy Drawing Table Co., Adrian, Mich.

TABLES, SAND-BLAST
Pangborn Corporation, Hagerstown, Md.

TAPPING MACHINES (PNEUMATIC)
Cleveland Pneumatic Tool Co., Toronto.

TANKS, AIR, EXPANSION
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, GASOLINE, KEROSENE AND OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. John Wood Mfg. Co., Ltd., Toronto
Dominion Bridge Co., Montreal, Que.
Dom. Forge & Stamping Co., Walkerville.
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal, Que
Marshall, Son & Bunney, Toronto.
U. S. Ordnance, Toronto, Ont.

TANKS, LEAD LINED
Can. Hanson Van Winkle Co., Ltd.,

TANKS, LUBRICATING, OIL STORAGE
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, PNEUMATIC AND CLOSET
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, RUBBER CEMENT
Bowser Co., Ltd., S. F., Toronto, Ont.
St. Lawrence Welding Co, Ltd., Montreal

TANKS, STEEL, WATER PRESSURE
Bowser Co., Ltd., S. F., Toronto, Ont.
Dominion Bridge Co., Montreal, Quebec.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal, Que.
Toronto Iron Works, Ltd, Toronto.

TANK WAGONS
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal.
Toronto Iron Works, Ltd., Toronto.

TANKS, WELDED
Can. John Wood Mfg. Co., Ltd., Toronto
Can. Hanson Van Winkle Co., Ltd.,
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.

TANKS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
William Hamilton Co., Peterboro, Ont.

TAPER PINS
Gelt Machine Screw Co., Ltd., Galt, Ont.

TAPES, MEASURING
James Chesterman & Co., Ltd., Sheffield, Eng.
Rice Lewis & Son, Toronto, Ont.

TAPPING MACHINES AND ATTACHMENTS
Bertram, John & Sons Co., Dundas.
Canada Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garvin Machine Co., New York.
The Geometric Tool Co., New Haven.
I. H. Hall & Sons, Brantford, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Niles-Bement-Pond Co., New York.
Rickert-Shafer Co., Erie, Pa.
National-Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto.
L. S. Starrett Co., Athol, Mass.
Whitney Mfg. Co., Hartford, Conn.

TAPES, MEASURING, STEEL AND WOVEN
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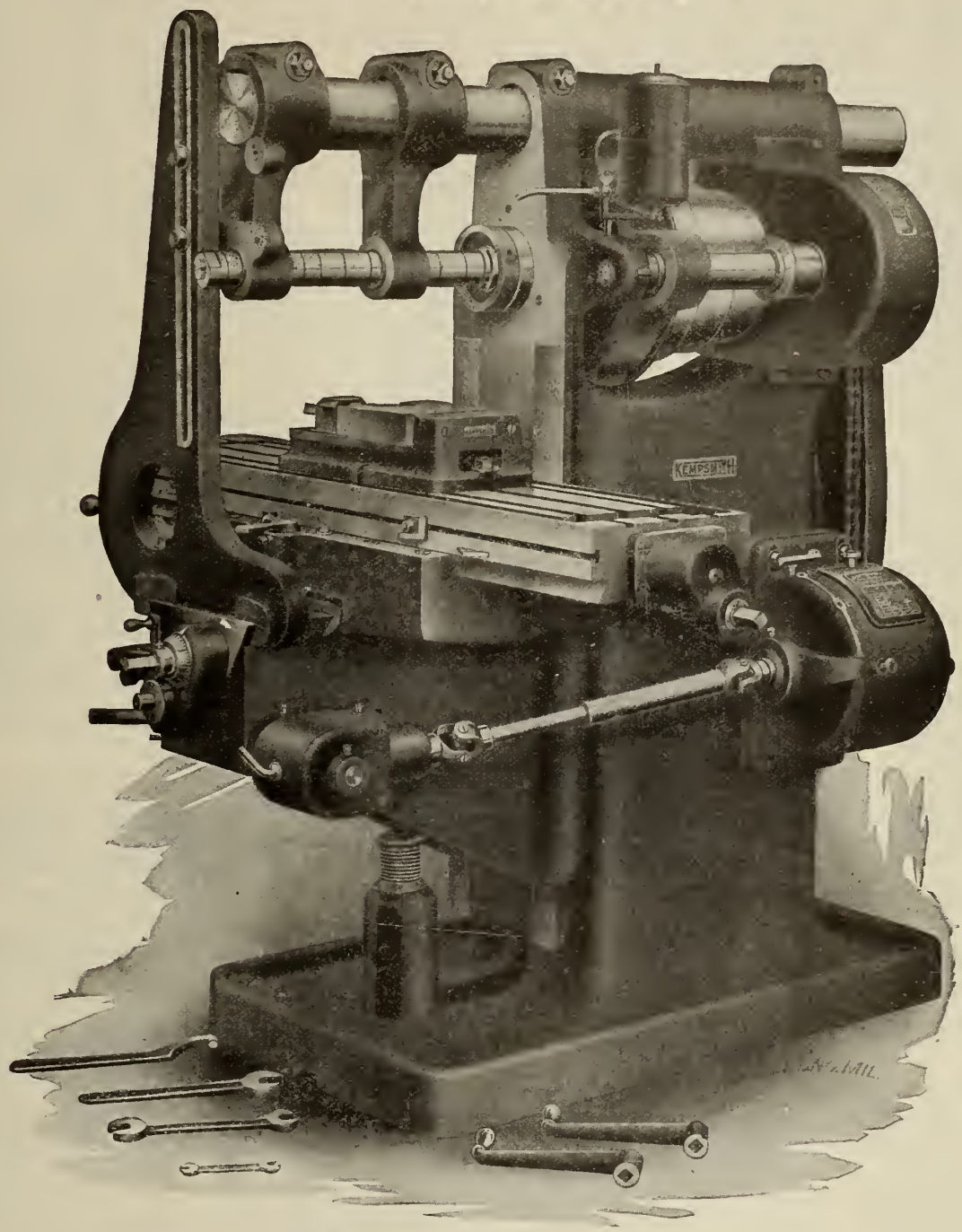

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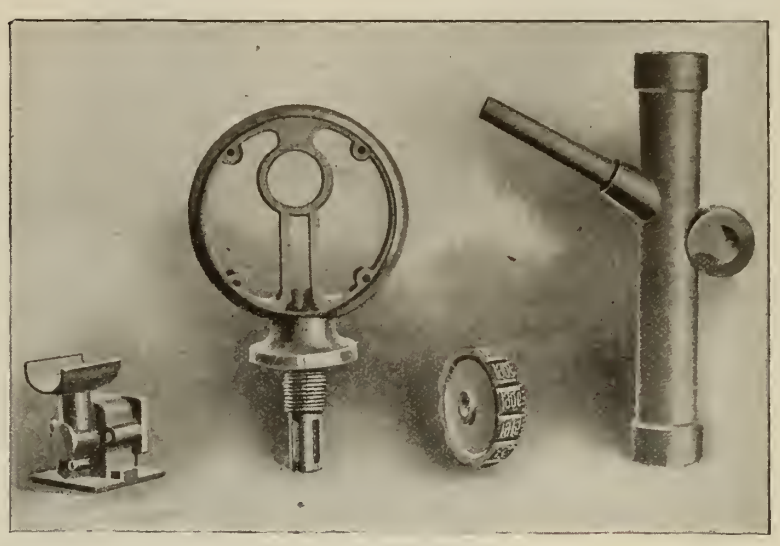

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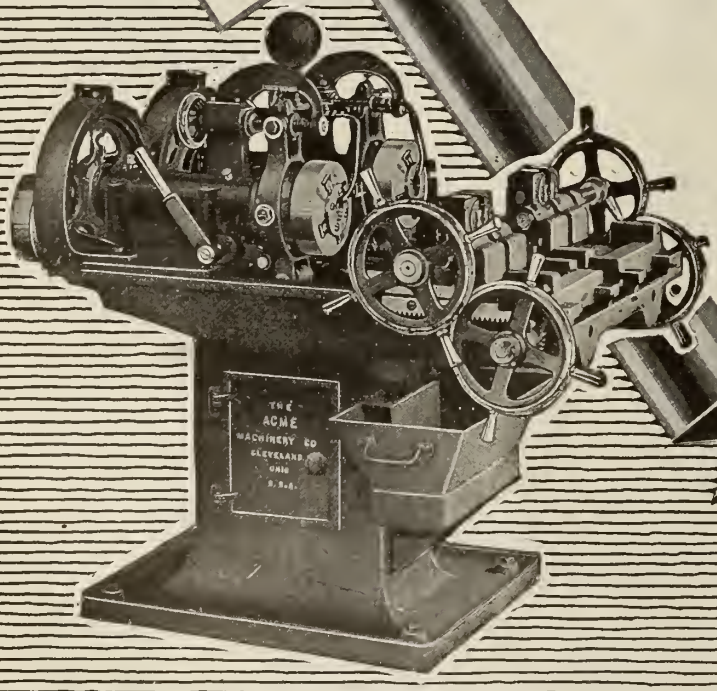

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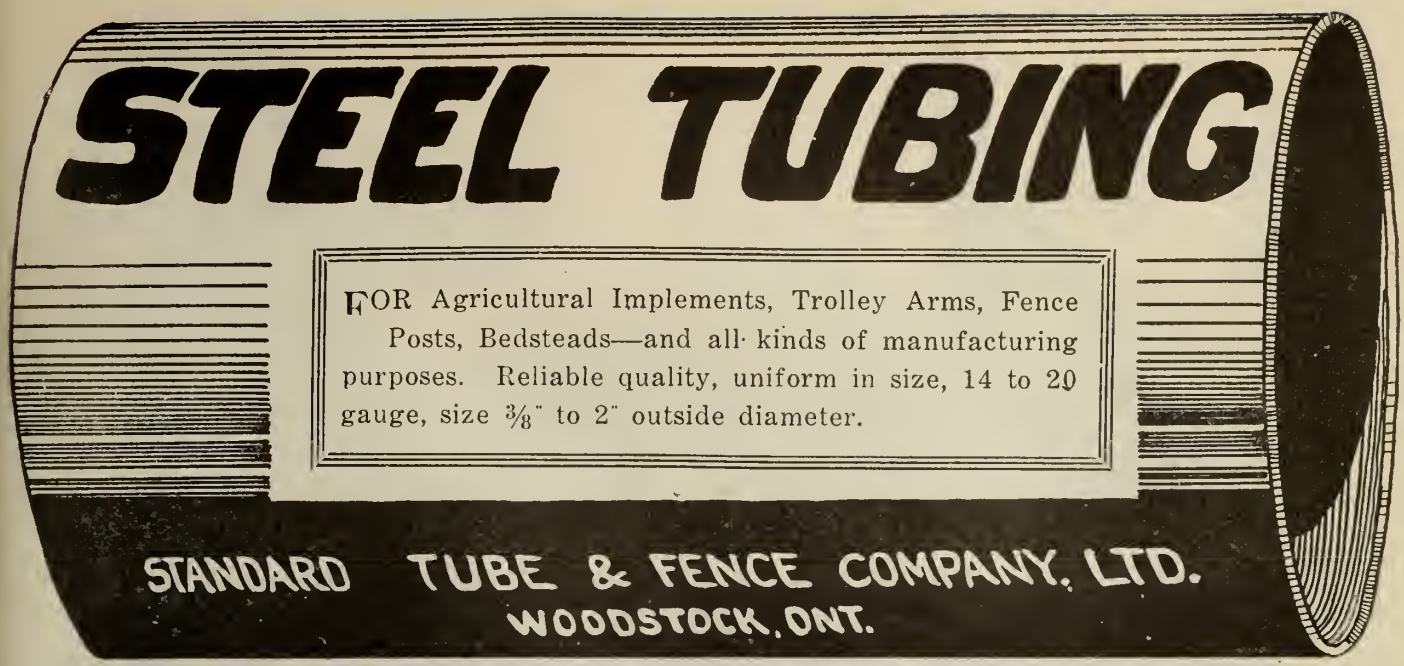
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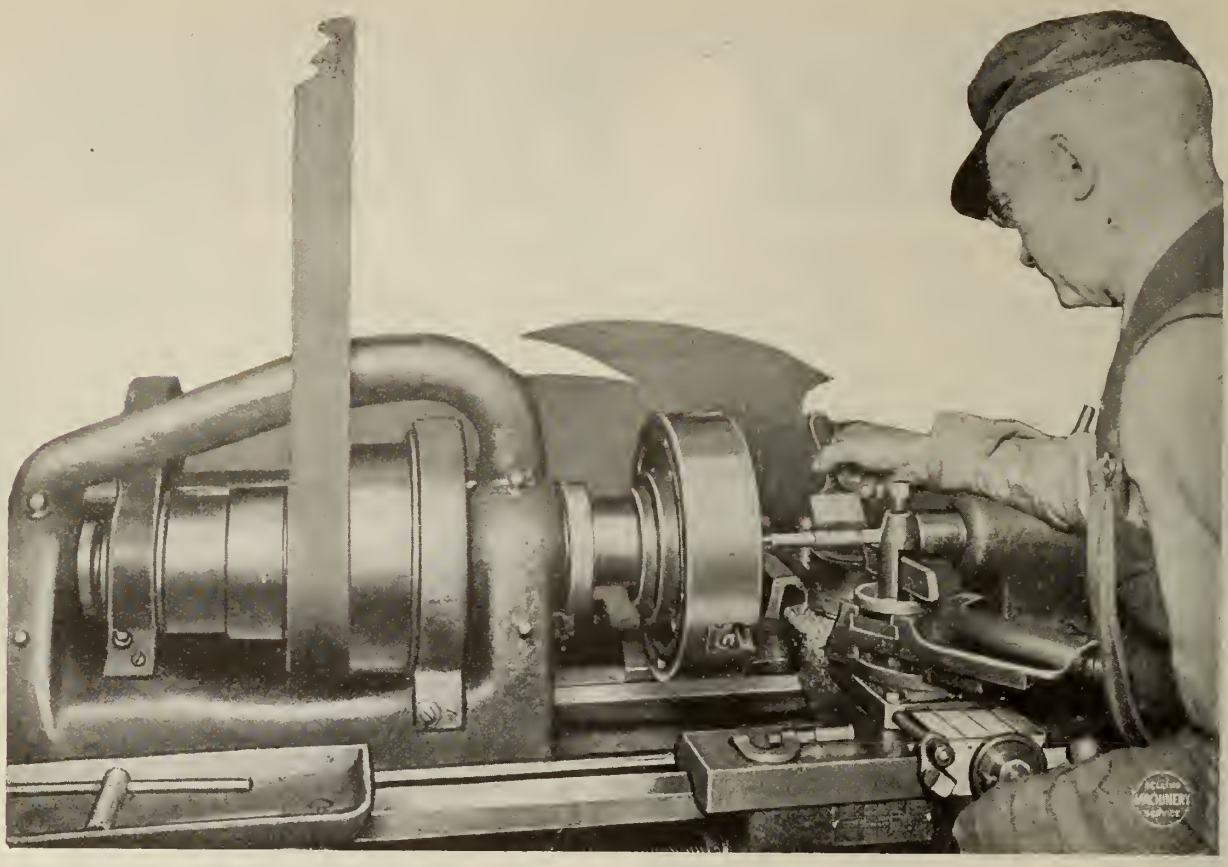

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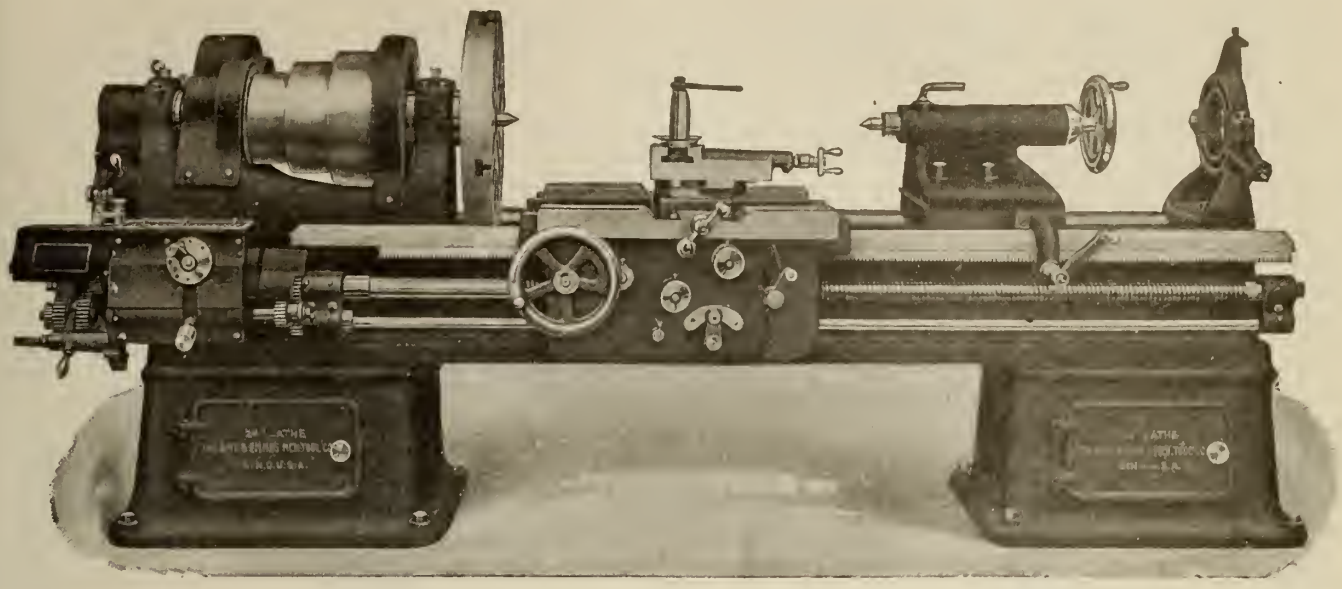

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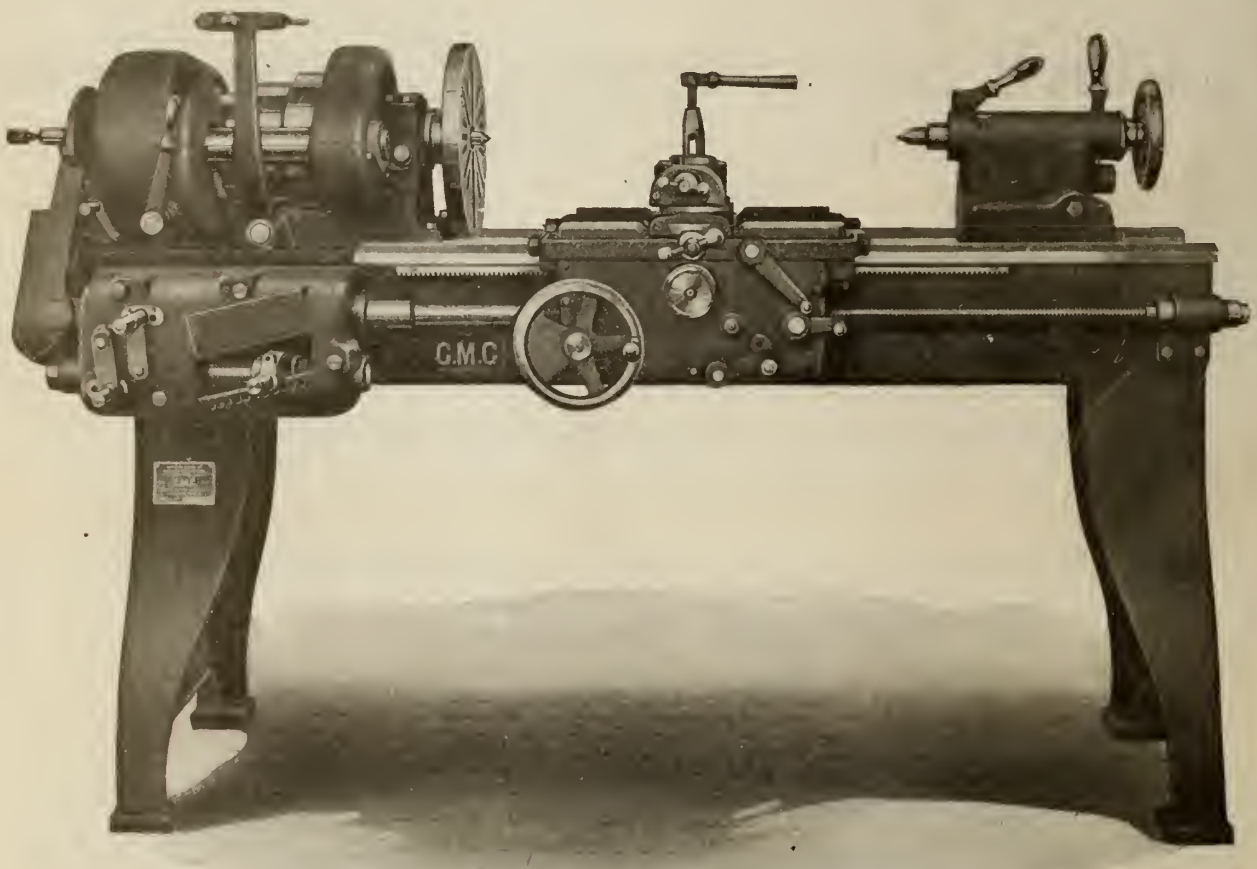

14" x 6" TOOL ROOM LATHE

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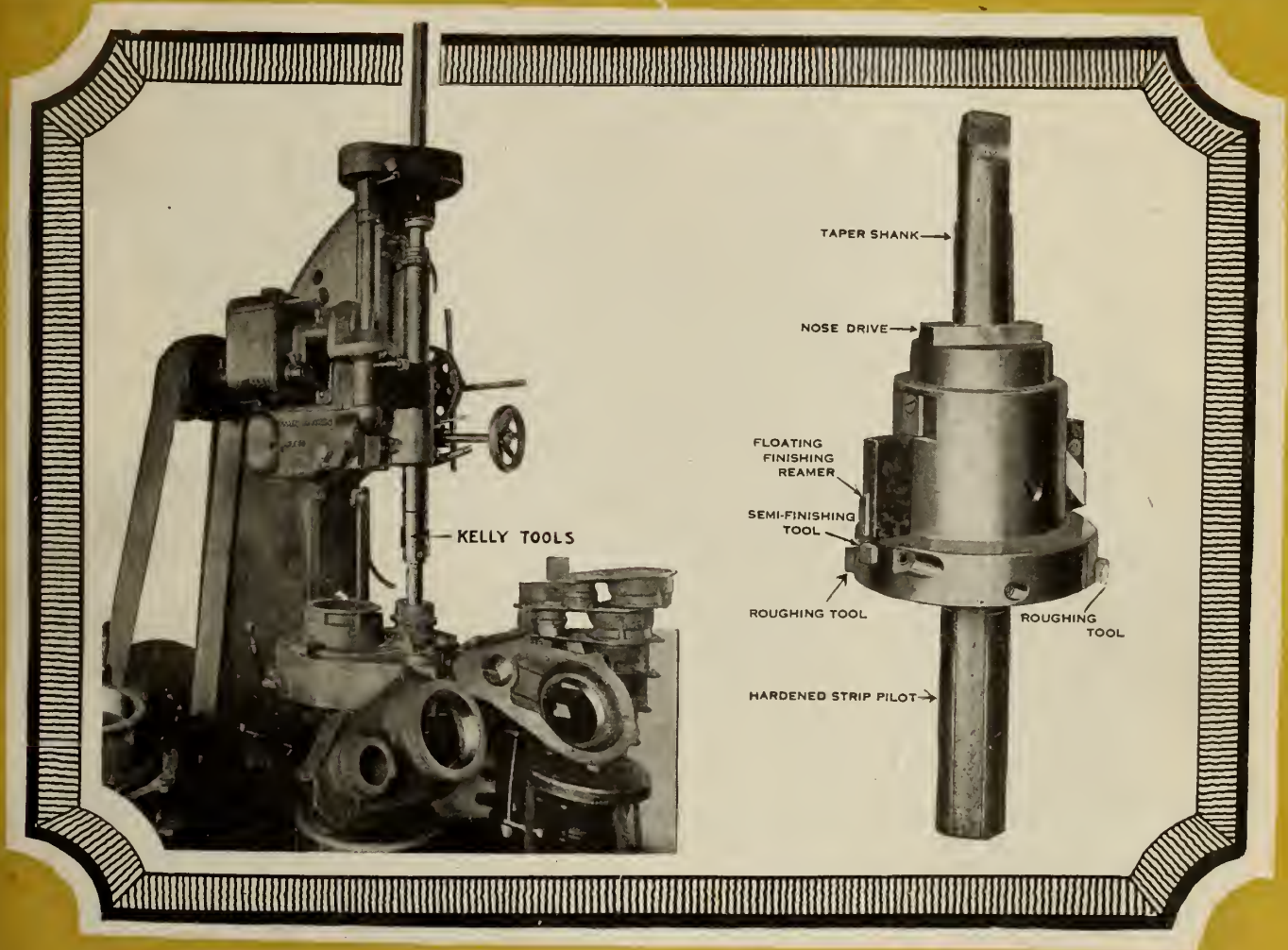

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The BERTRAM Page

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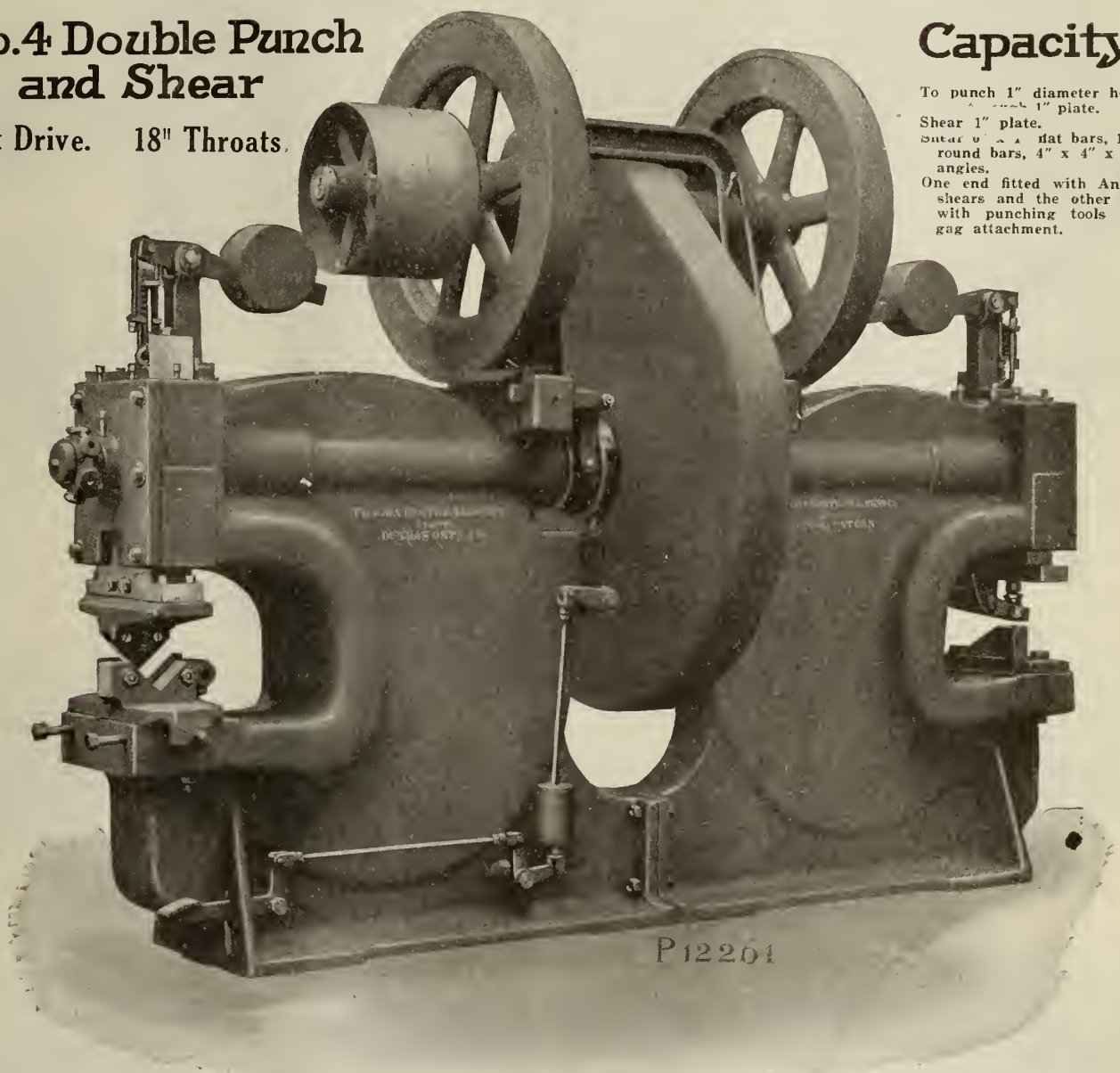

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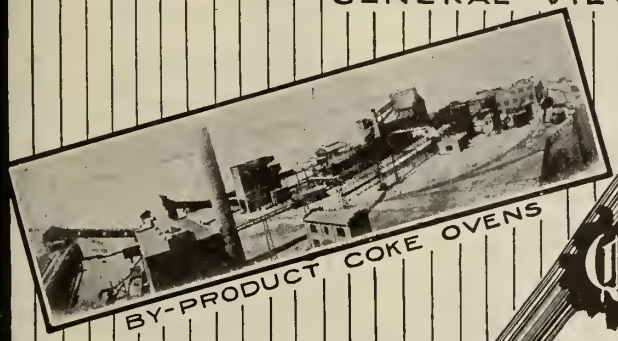

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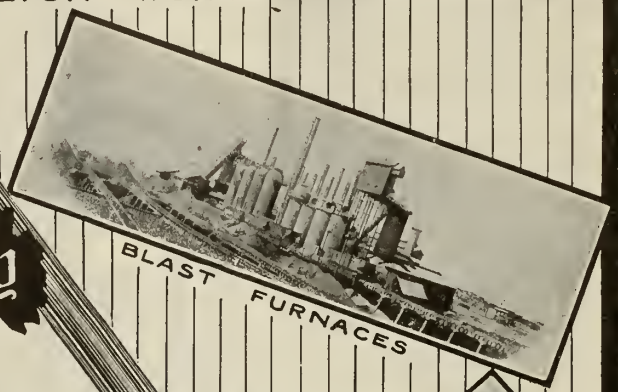

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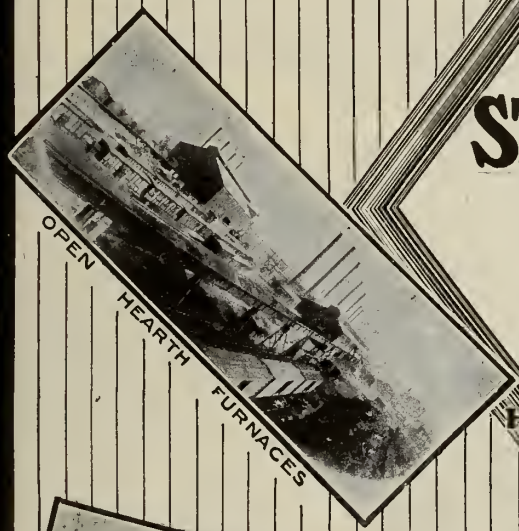

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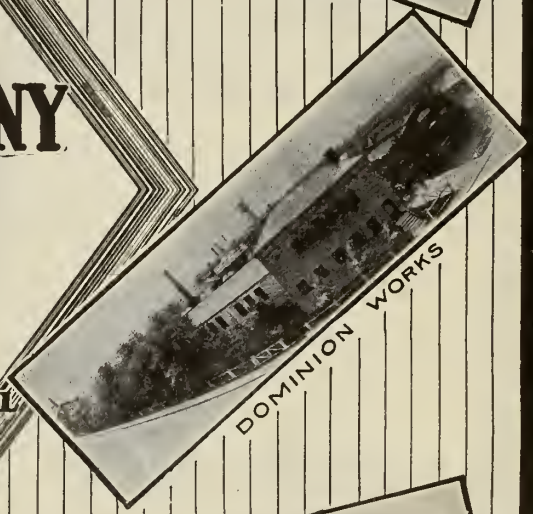

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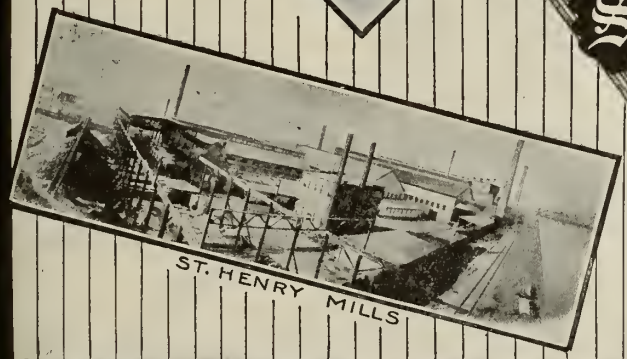

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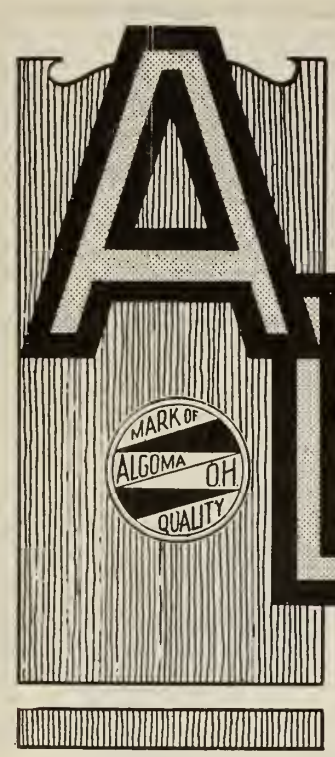

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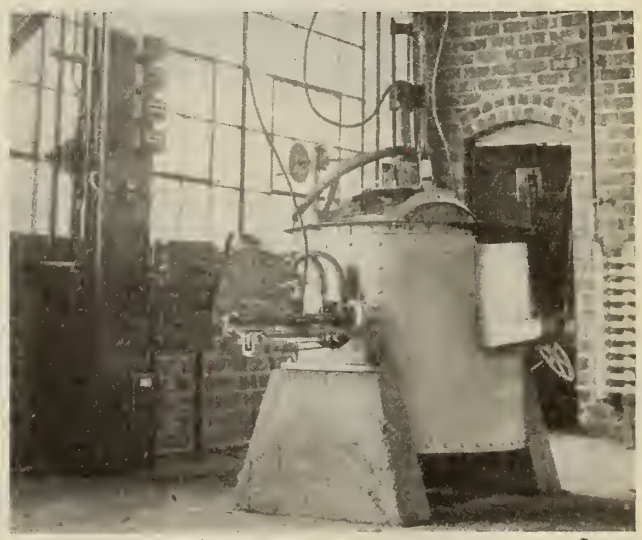

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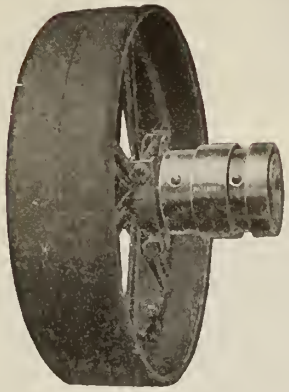

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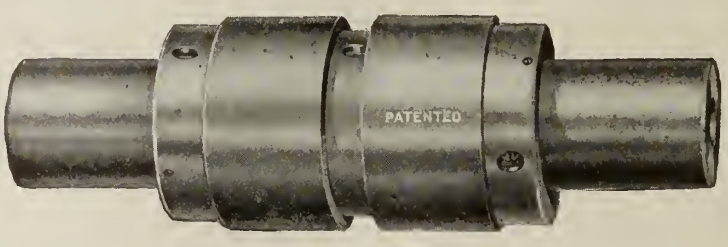

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In shops where the highest standards are maintained the stamping equipment is generally "Matthews Made."

Matthews Letters and Figures are hand made from carefully selected steel, heat treated for hardness, insuring long service under hard usage. They make deep, clean-cut impressions that outlast the product.

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Steel Lettering Dies and Stamps

The
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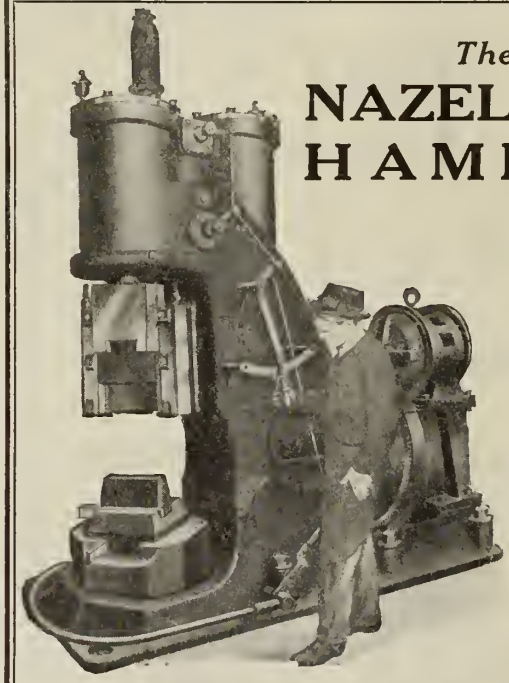

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A self-contained unit, built in three types, six sizes, arranged for belt or direct motor drive, with capacities up to 7-inch square, for all manner of jobbing, manufacturing and certain classes of die forging.

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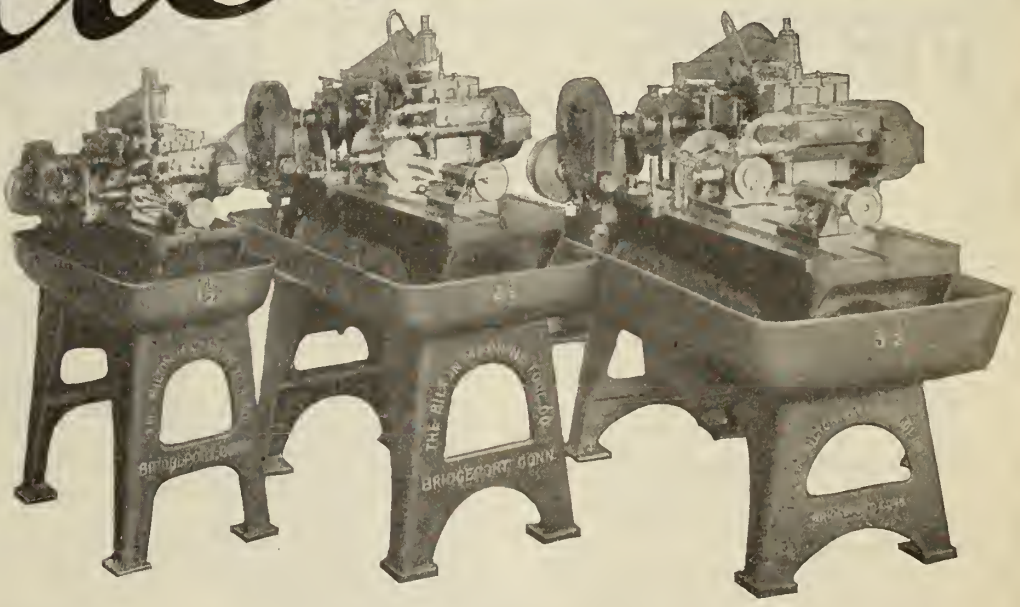

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Their adaptability is almost unlimited on small work—such as cutting spur, bevel, miter, angle gears, saws, ratchets, sprockets, cutters, knurls, taps, cylinders, form cutting, manufacturing, milling, etc.

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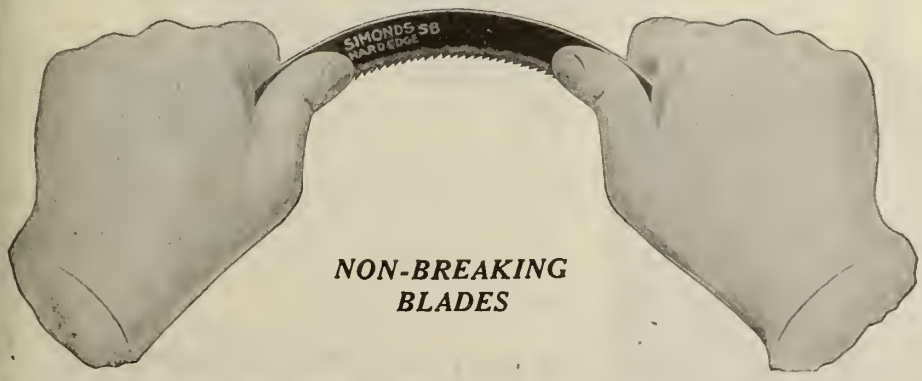

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For Machine or Hand Use
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Are you interested in a description of these furnaces? Bulletin 54 is yours for the asking.

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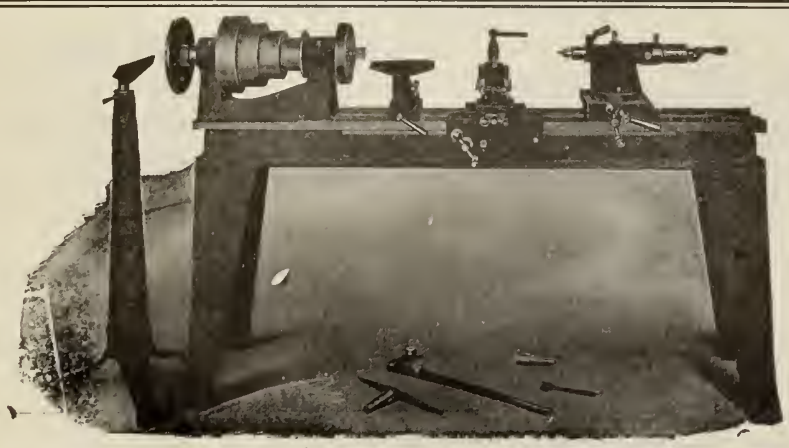

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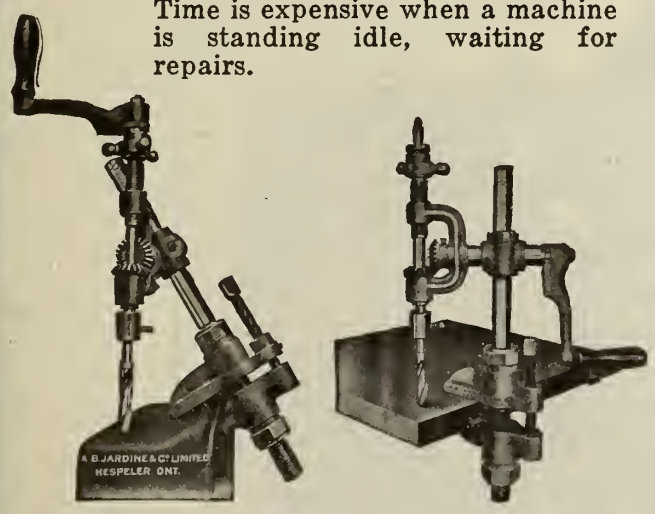
Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.



On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

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Sold by all Machinery and Supply Houses

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Stellite is revolutionizing the art of cutting metals. It is the most vital factor in modern machine shop methods.

Stellite cuts better the hotter it gets, working continuously at red heat at temperatures up to 1800° F.—far past the point where the finest steel burns and crumbles.

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THE MASTER METAL

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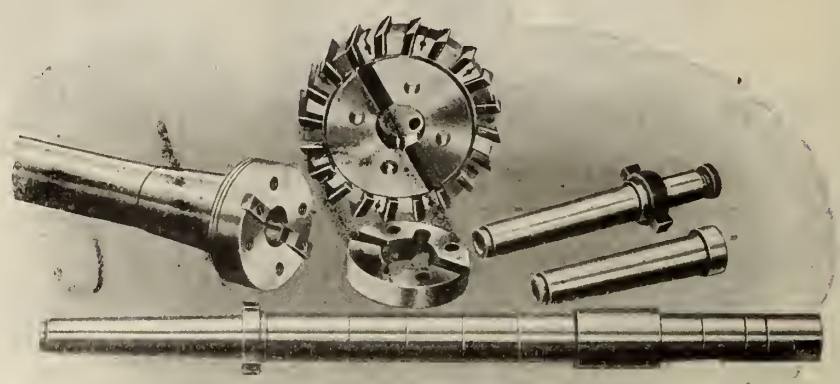
MILWAUKEE MILLING MACHINES

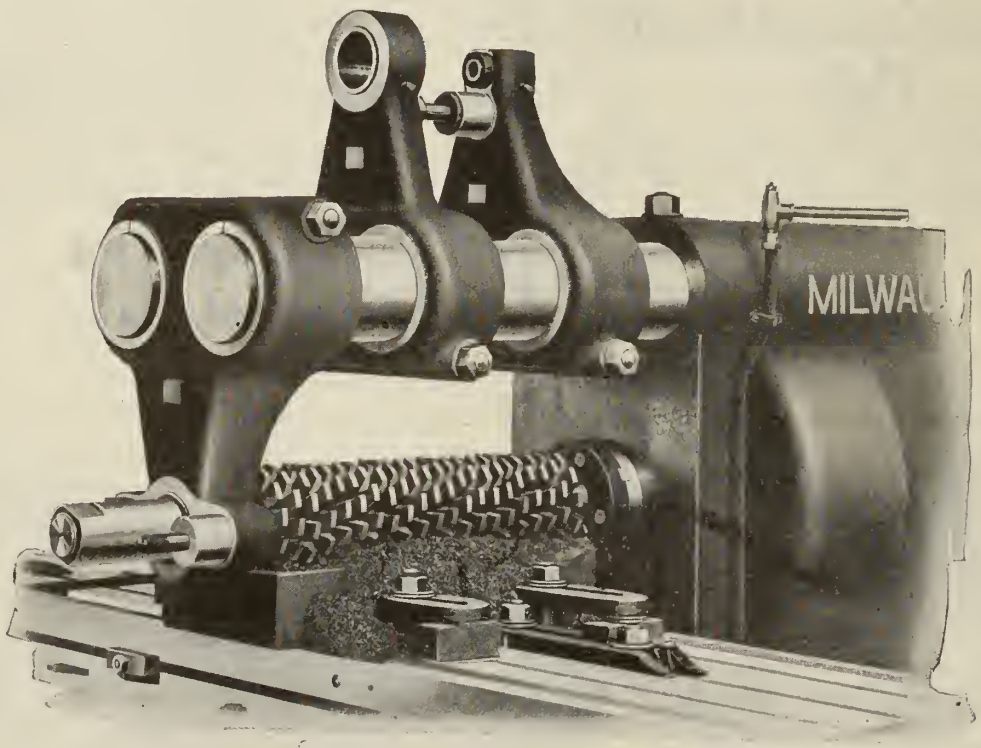


The Flanged Spindle

The flanged spindle of Milwaukee Milling Machines has proven ideal in every respect. The flange, forged on the end of spindle, carries well proportioned keys for driving large face milling cutters and the arbor drive collar. The latter has recessed notches to receive the dogs on the arbor, thus removing the strain of the cut from the taper hole in the spindle, which retains its original accuracy. The reverse for the spindle is self-contained in the machine; no overhead apparatus is necessary.

The illustration below shows a Milwaukee Milling Machine milling a rack with twenty-one 4-pitch involute gear cutters.

Write for Catalogue No. 21



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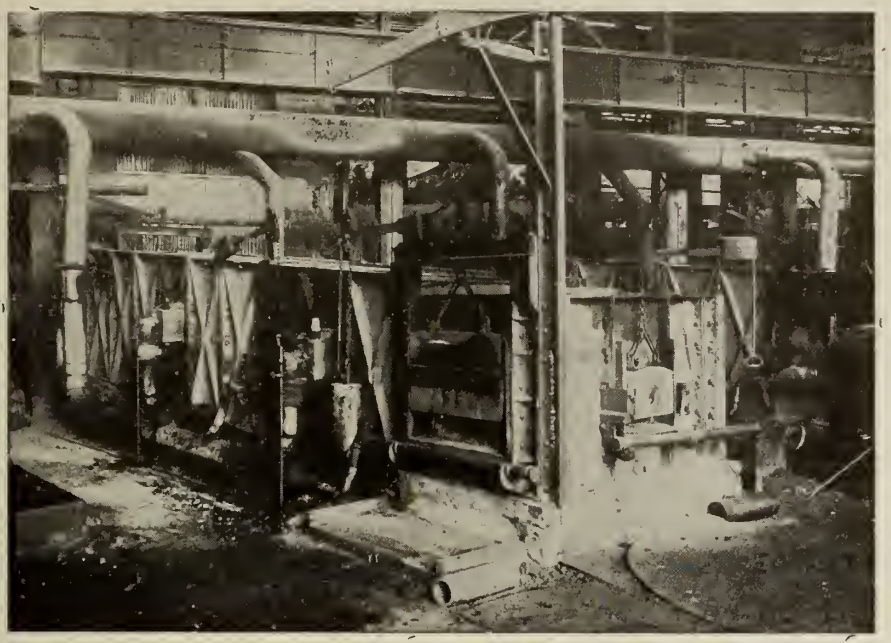
Another MECOL Furnace

demonstrated its superior features point by point to a group of men whose years of experience in the heat-treatment of metals made them appreciative judges.



We refer to the "Mecol" Furnace shown in this illustration, installed at the Pointe St. Charles Works of the Canadian Steel Foundries, Limited.

Our intimate knowledge of heat-treating methods, and our long experience in the building of efficient furnaces fit us to give helpful advice—and that we will do promptly if you

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Mechanical Engineering
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EASTERN UNIVERSAL HYDRAULIC PRESS. Supplied in 20-35 and 50 ton capacities, full hydraulic depending on no springs or weight for return of ram, delivering pressure instantly at a speed of 1½" per second return of ram 3" per second.

Length of Ram Travel .....6 in.
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Length of Table .....8 ft.
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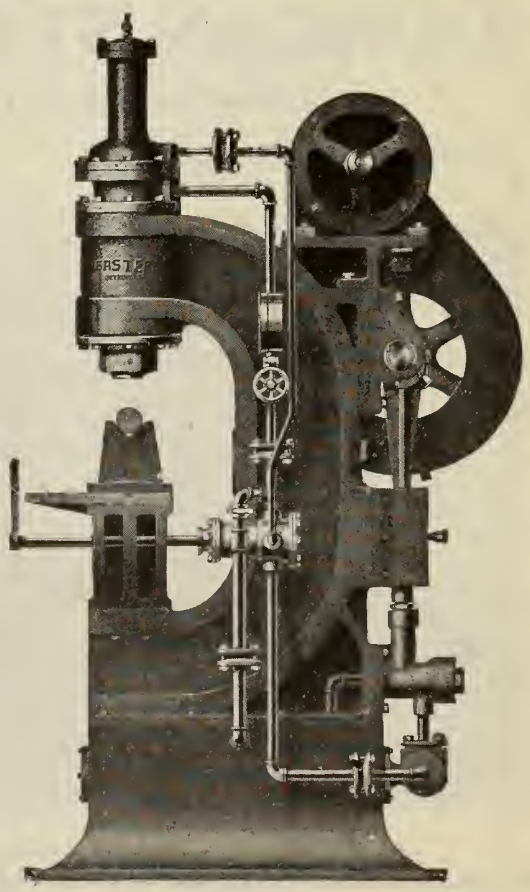

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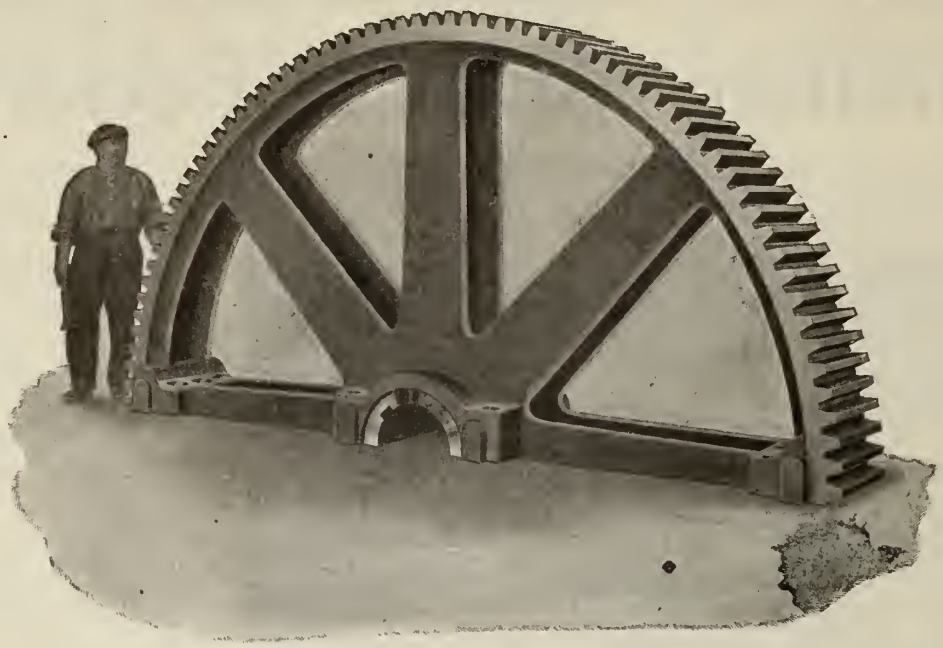

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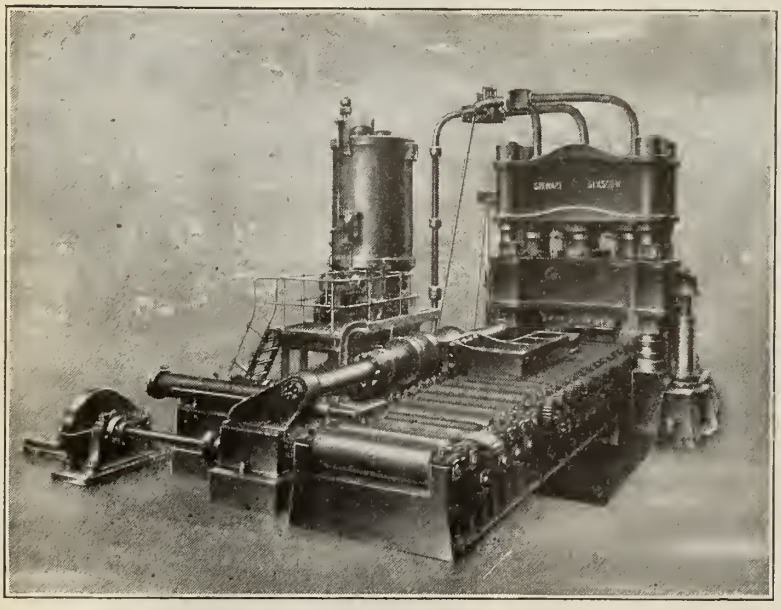

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No special vises or fixtures needed, the Universal features of these machines take care or everything, making them particularly adapted to—

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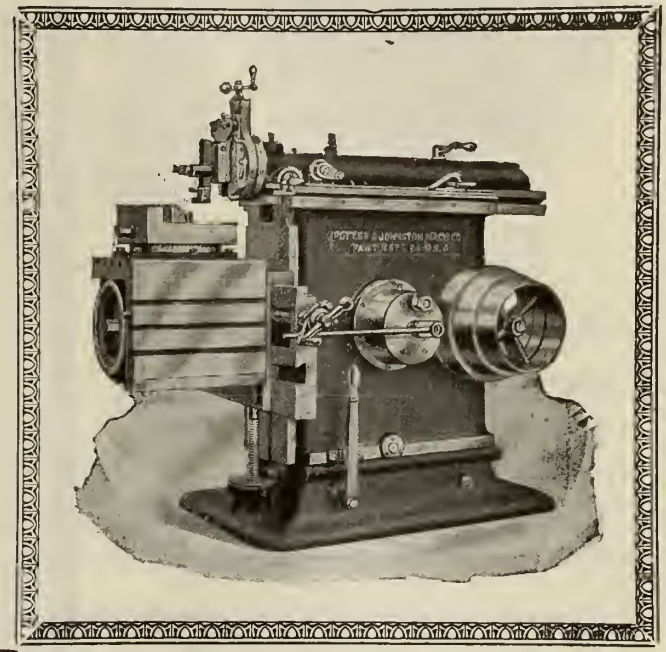

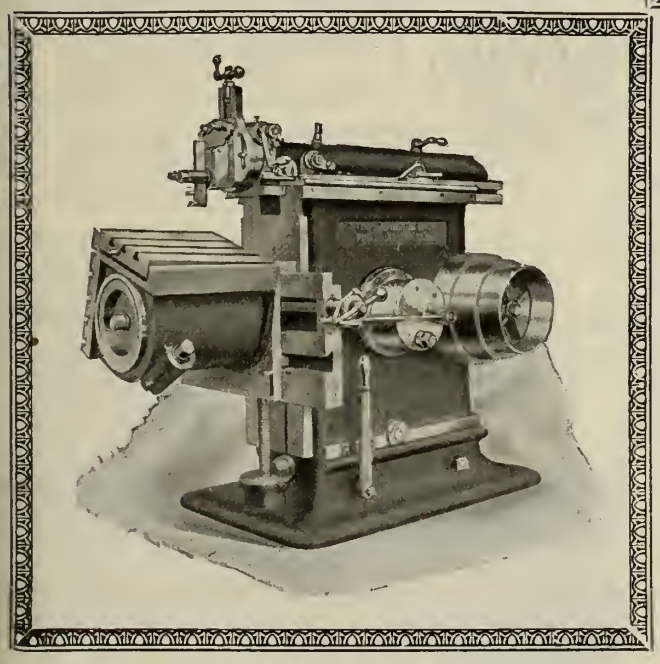

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Large Stocks maintained at convenient distributing centres throughout Canada

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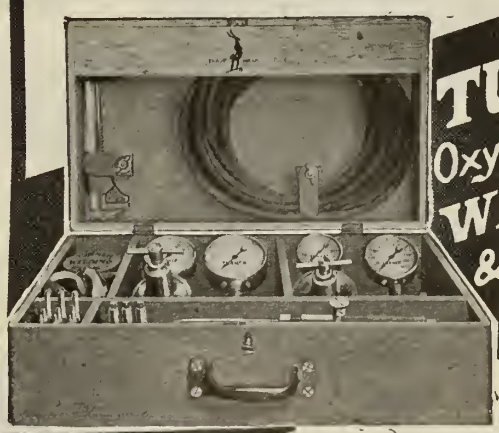

These outfits will soon pay their cost in machine parts or tools reclaimed. The sectional extensions of the torch enable the operator to adjust it to any desired length or angle. The location of valves is such that the flame is controlled by one hand, leaving the other hand free for the work at all times.

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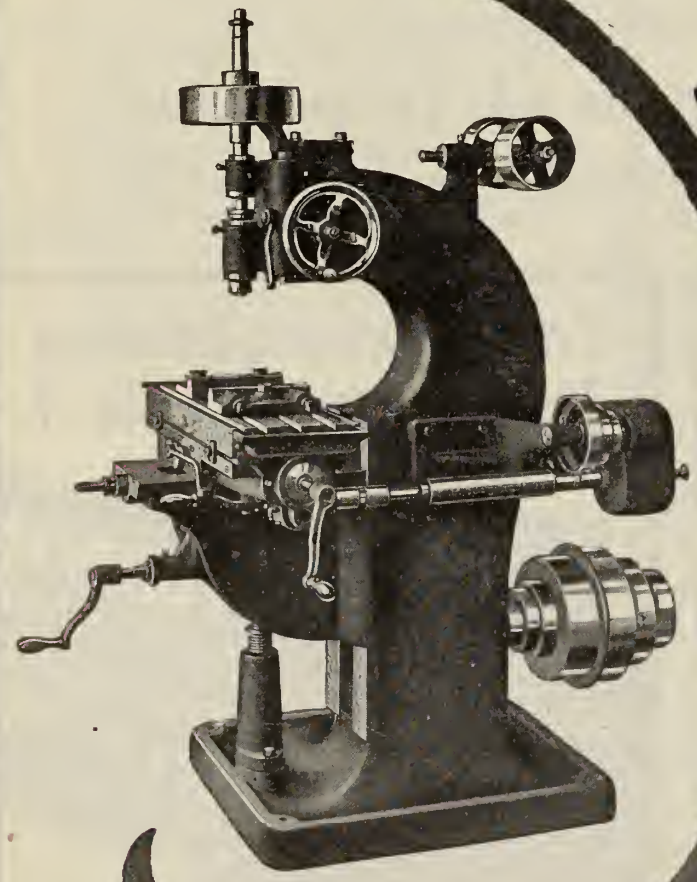
A Tool of Large Capacity



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The longitudinal table feed is controlled by the gear change box which gives six different feeds for each change of spindle speed. A stop to gauge with micrometer adjustment is used on the head to regulate the depth of cuts.

Learn all about its production capacity.

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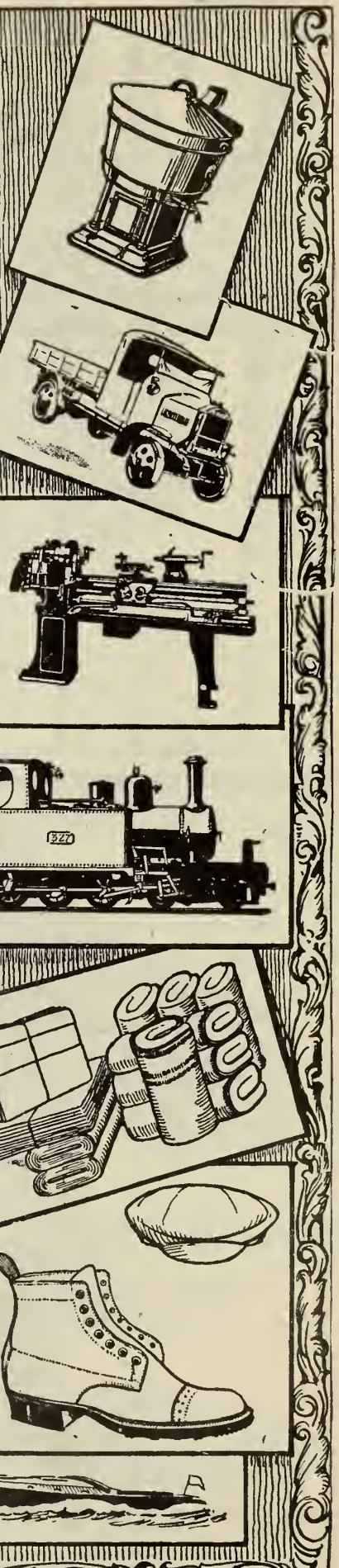

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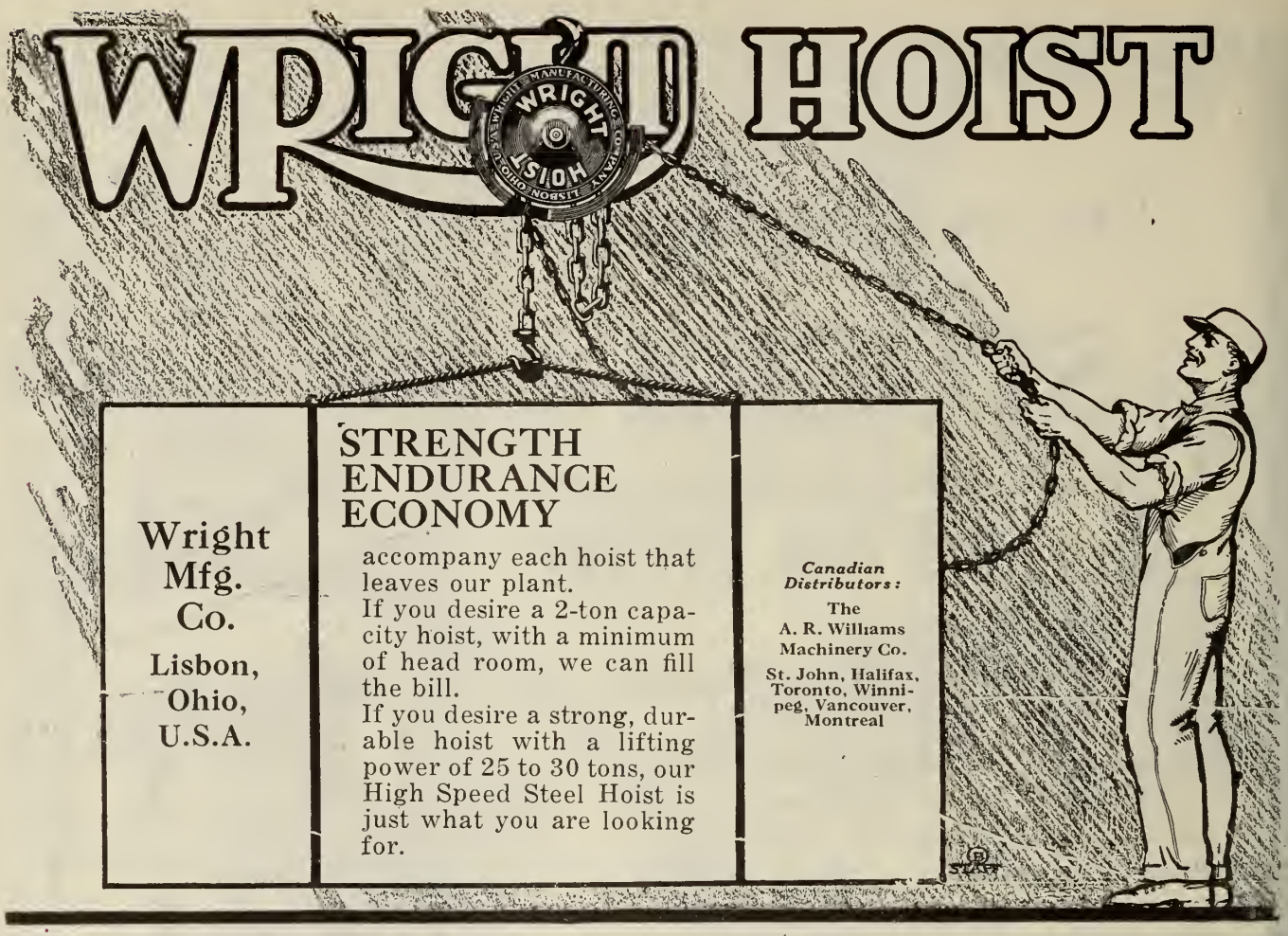

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accompany each hoist that leaves our plant.
If you desire a 2-ton capacity hoist, with a minimum of head room, we can fill the bill.
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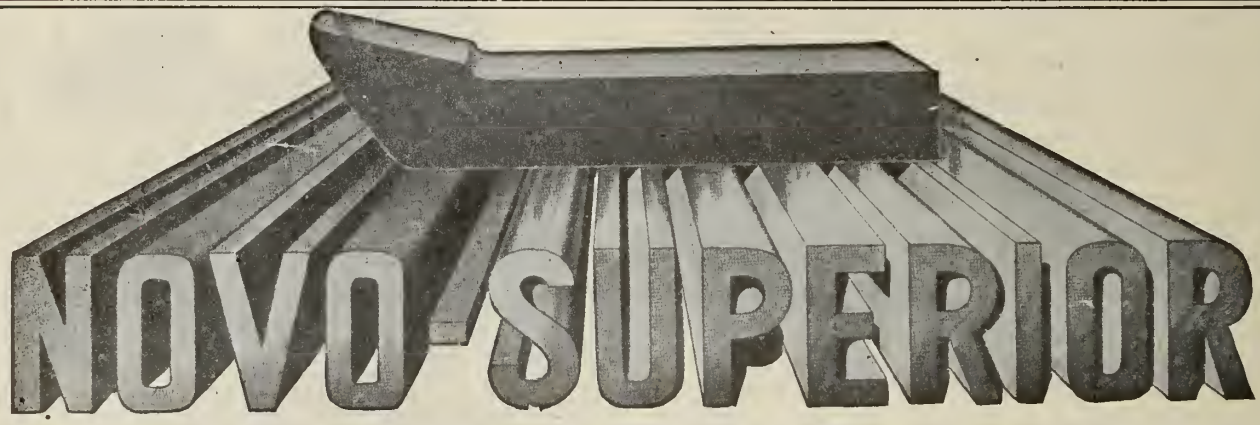

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Operating fourteen months—twenty-four hours a day—without up-keep expense

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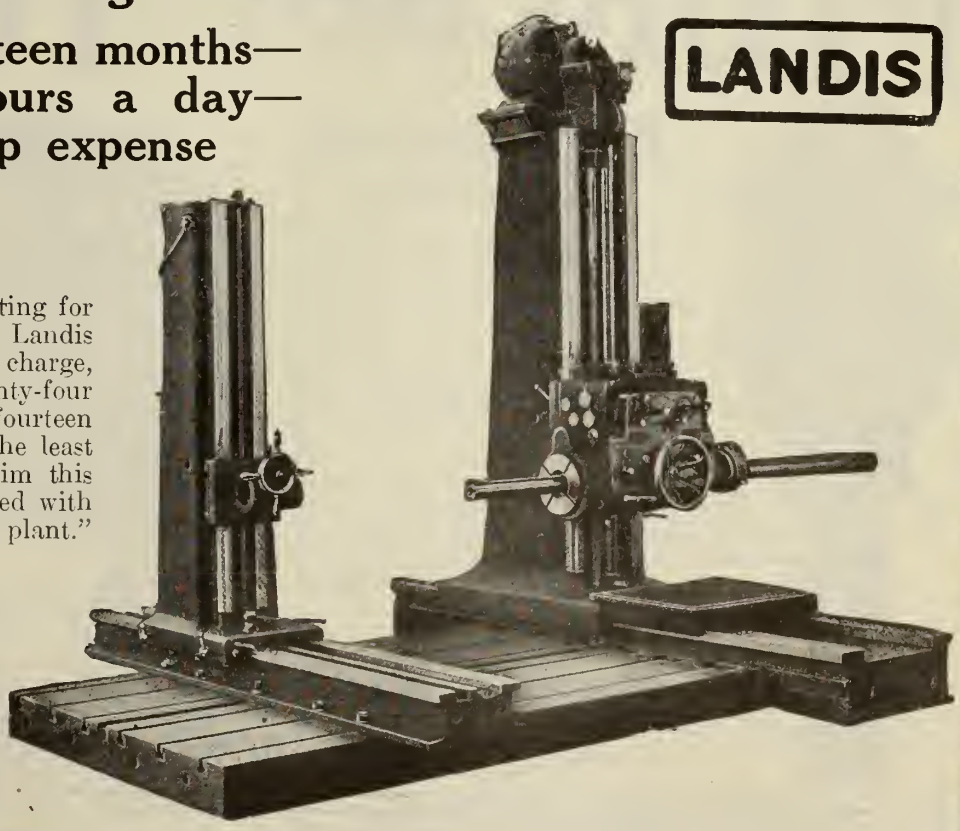

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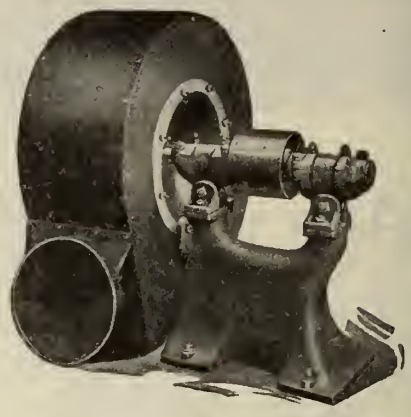
"CANADIAN" MILL EXHAUSTERS

Handle Any Material



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They are adjustable to any angle of discharge instantly — have universal type of wheel and carefully constructed self-aligning oil-ring bearings.

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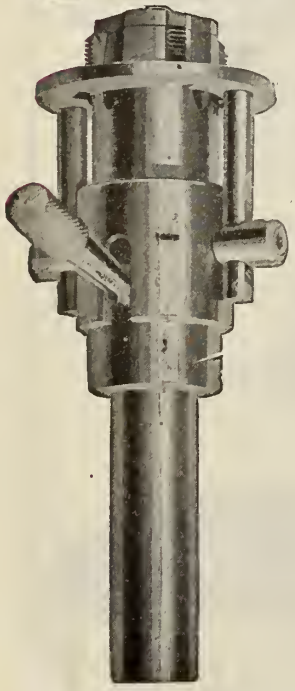

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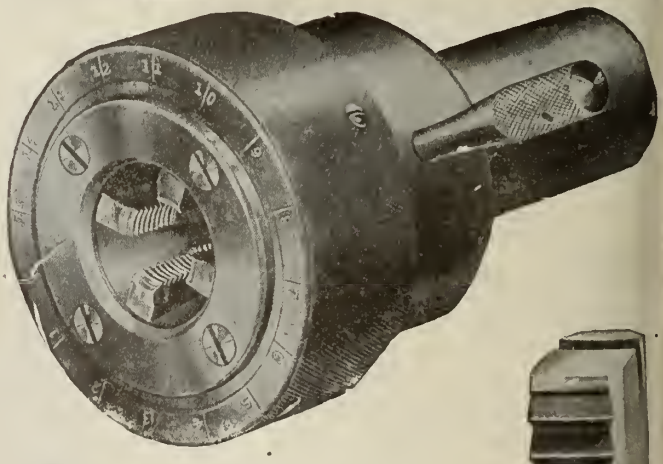

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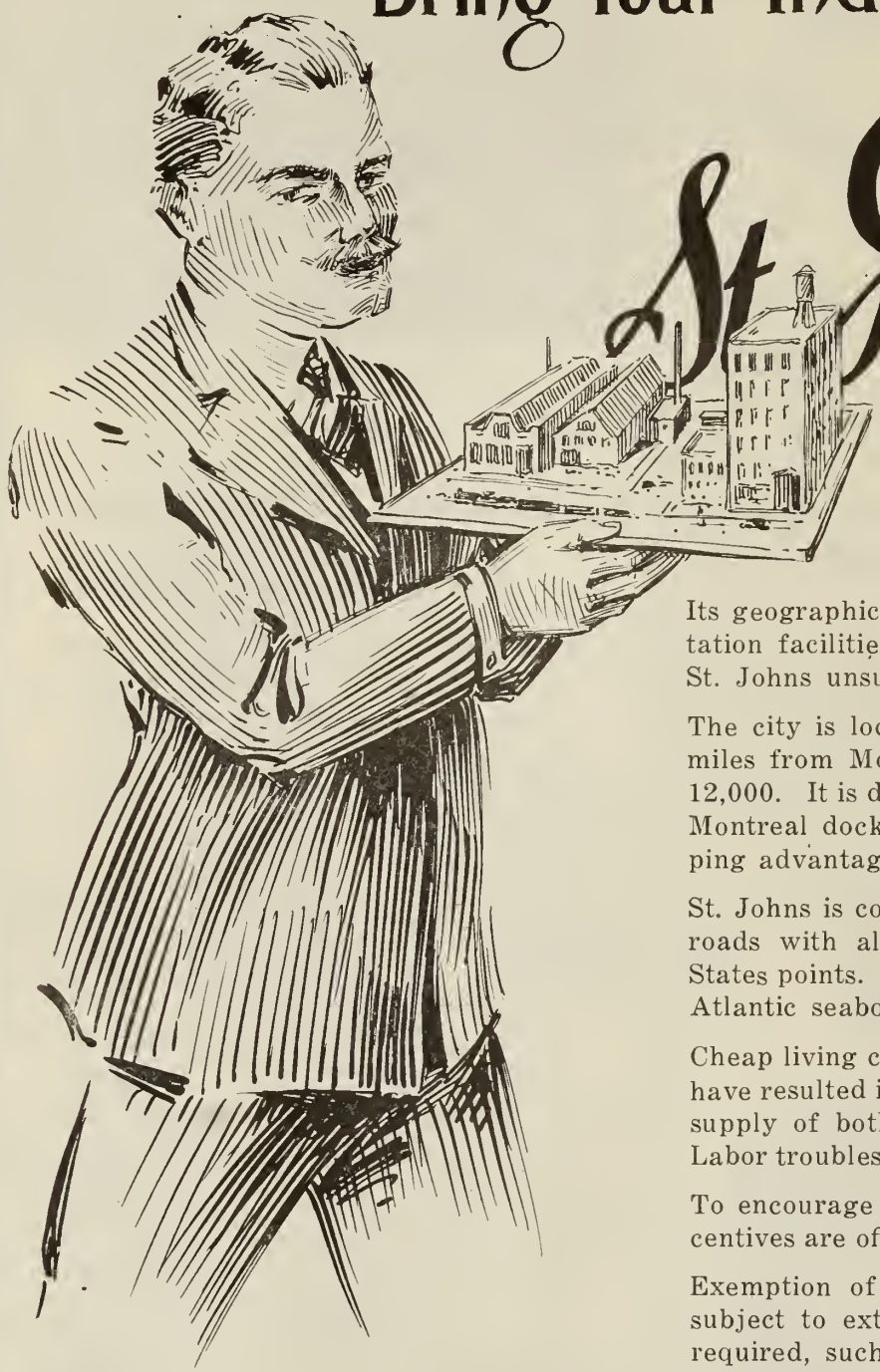

Its geographical location, unequalled transportation facilities and cheap labor market make St. Johns unsurpassed as an industrial centre.

The city is located on the Richelieu River, 27 miles from Montreal, and has a population of 12,000. It is directly connected by rail with the Montreal docks, providing unusual ocean shipping advantages.

St. Johns is connected by seven important railroads with all Canadian and Eastern United States points. It has canal connections with the Atlantic seaboard and the St. Lawrence river.

Cheap living conditions and low rents and taxes have resulted in cheap labor and there is a large supply of both skilled and unskilled workers. Labor troubles are unknown.

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Exemption of taxes for fifteen years' period, subject to extension; all public improvements required, such as street extensions, sidewalks, waterworks and sewage; five per cent. bonus on your payroll for five years. If you wish it, this bonus will be advanced to you to be applied to the construction of a suitable building.

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The Secretary of the City Council

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Withstands Rust and Corrosion

Rust and corrosion eat up the profits.

Thousands of crumbling factory roofs and broken down siding give mute testimony to this fact. Ordinary corrugated sheets fail to stand the strain. Weather, smoke, fumes and gas quickly eat them up. The short life of cheap building materials is a constant source of expense for replacement.

Not so with Robertson Process Metal—roofing and siding of this 3-times protected metal long ago proved the economy of *Robertson Process*. Three impervious coverings (a) Asphalt (b) Asbestos (c) Waterproofing so fully protect the metal that roofs, siding, ventilators and all building trim made of this material will *withstand rust and corrosion*.

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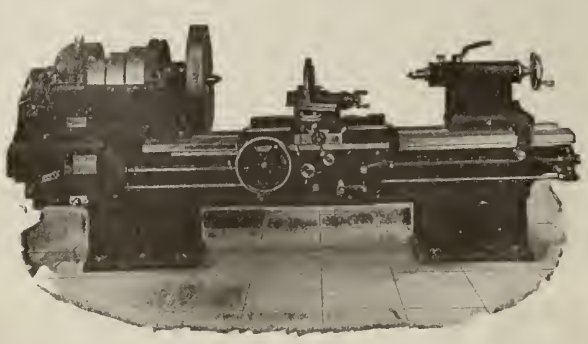
Sidney for Service

Sidney-for-Service Lathes are noted for their power and rigidity. Take deep cuts through toughest metal without pause or chatter.



Specifications include 3-step cone, double brake gear, semi-quick change gear lathe, built on 10 ft. bed. This lathe also furnished with quick-change gears. Bed lengths available: 10, 12, 14, 16, 18 and 20 ft.

The Sydney Line comprises 15-inch, 17-inch, 19-inch, 25-inch, 27-inch, 30-inch and 36-inch lathes, which are adaptable to the finest tool room work or the heaviest duty shipyard or factory rapid production work.

Heavy Duty Engine Lathes

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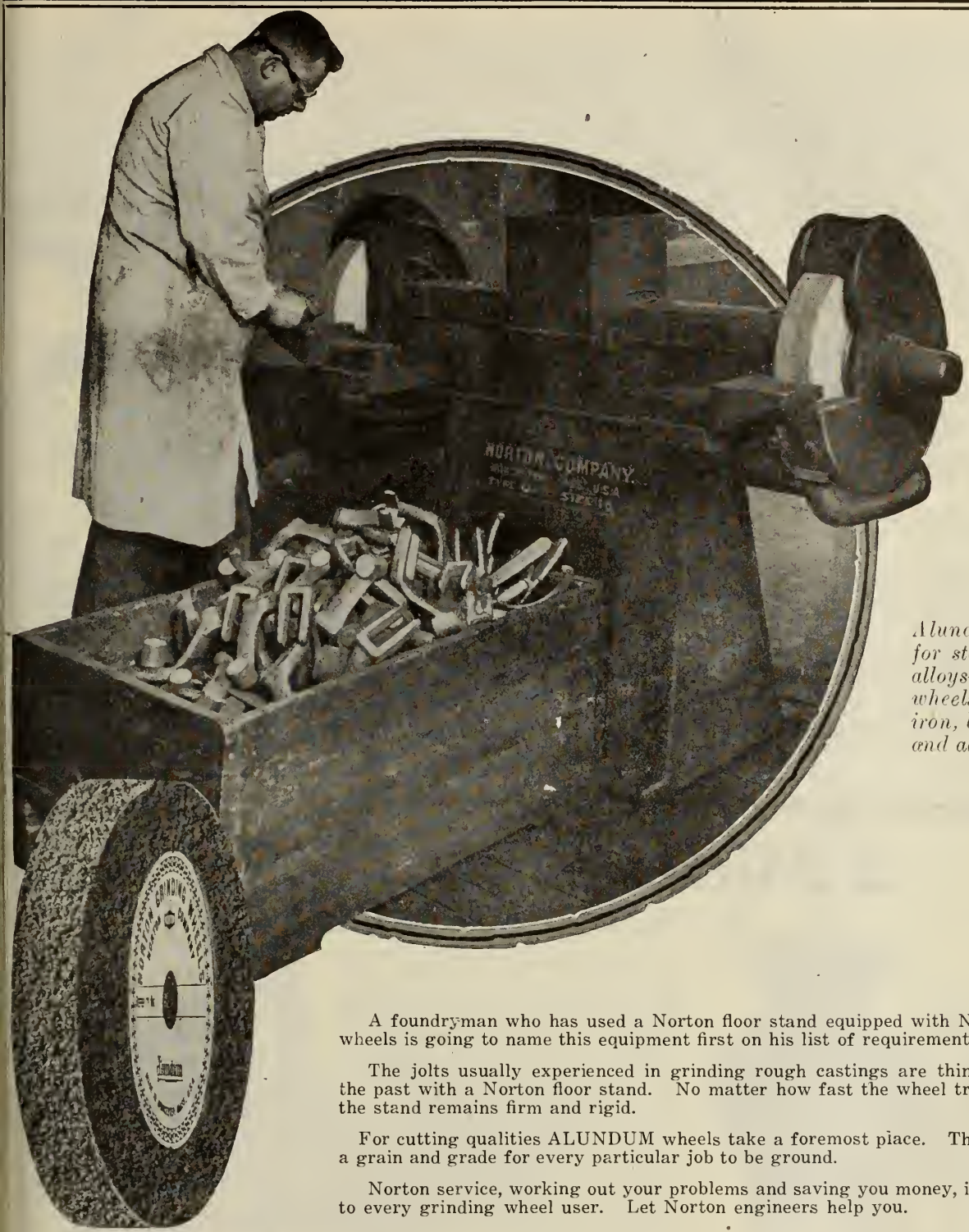

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The jolts usually experienced in grinding rough castings are things of the past with a Norton floor stand. No matter how fast the wheel travels, the stand remains firm and rigid.

For cutting qualities ALUNDUM wheels take a foremost place. There is a grain and grade for every particular job to be ground.

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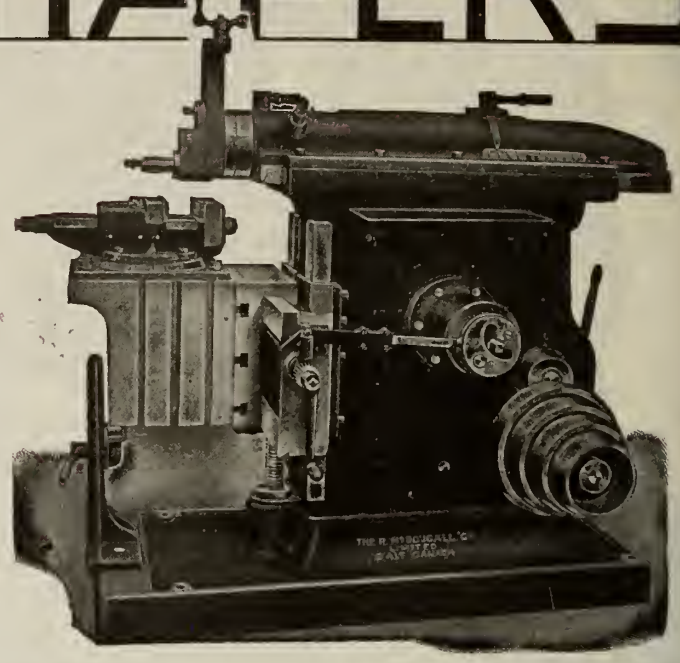

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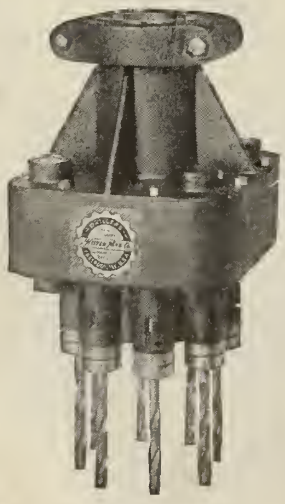
This Is The Vital Question



Do you drill ten holes in the time it takes for one? The Hoefer Auxiliary Head equips any driller so as to accomplish this big saving in time. It speeds up production in drilling tremendously. Not only do you save the drilling time, but also the time now lost in shifting the jigs and raising and lowering the spindle for the extra holes.

Hoefer Auxiliary Heads are made in any multiple, arranged in any manner, from 2 up. They are made by expert tool makers and unqualifiedly guaranteed to handle accurately the work for which they are designed.

Investigate now—every day you use a single drill where the multiple may be used you are paying for an auxiliary head through increased costs, but not securing its benefits.

Write for catalog. Send a blueprint of some of your work for estimate of time and cost.

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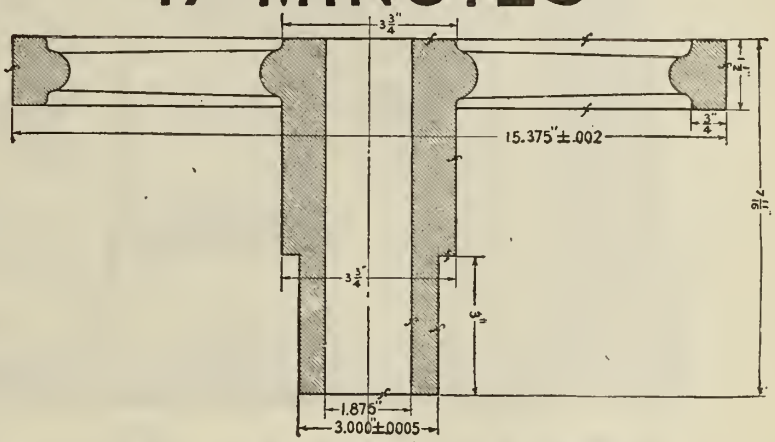
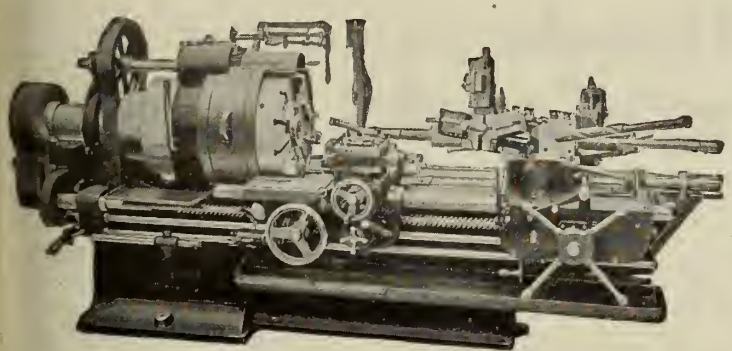
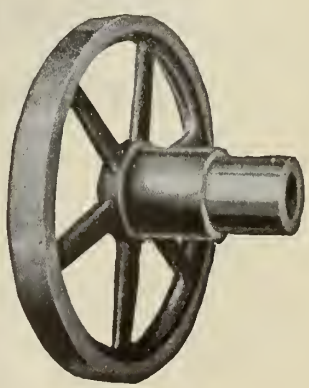
It was finished complete, as indicated by the drawing, in seventeen minutes with the use of Standard Tools only.

Why not gain the advantages of the Standard Tool Equipment on your own work? Think of the increased production.





Standard Gisholt Turret Lathe
Equipped with Standard Chucking Tools



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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

Vol. XIII, No. 15. April 8, 1920

Solutions to Everyday Machine Shop Problems

Read These Shop Hints Over and Perhaps One of Them Will Help You Out of a Dilemma. The Subjects Are Varied, for We Even Include the Story of a Pastor Preaching a Mechanical Sermon

By DONALD A. HAMPSON

SOME straddle mills had been recut by the softening and re-hardening method. Ordinarily, we took the precaution to scrape the holes a little oversize before hardening, so the contraction would not make them tight on the arbor, but this time it had not been done. They needed the cutters in a hurry, and one of the men was told to enlarge the holes in any quick way that he knew of.

He knew a good way. Chucking a bar of cast iron, he turned a three-inch length to nominally 1½ inch diameter, the size of the arbors. Then he carefully tapered this finished section to a little under size at the end, running to a little over near the chuck—0.003 inch in each case. This was coated with oil and dusted with emery. One at a time, the cutters were placed on this lap and, while the lathe was running, a stic pressed down on them, using it as a back and forth, with a very slight pressure toward the large end. Ten minutes of this enlarged each of the cutters to the desired size.

The shop that saves its old and broken drills has an advantage over the one that does not. Suppose a special counter-bore is required for one piece or a hundred. Pick out an end of a drill of right size, soften it, turn the proper size of heat, and re-harden. Or, if grinding facilities are available, do the whole job in the single grinding operation. In either case, you have the tool, shown by Fig. 1—rugged, cheap and free cutting. The angle of the twist insures this lat-

ter quality. And for abuse, a drill, or the remains of a drill, will stand more than any tool we may turn out of a bar of carbon steel and harden, at an expense of several hours' labor. Then, if a tool is wanted to square out the bottom of a drilled hole, one of these discarded drills may be ground off flat on the end, after which a clearance is ground back from each edge, and behold! The nicest kind of a square bottoming tool is ready. It does not take long to collect a full set of these for all diameters up to an inch by sixteenths.

In shops doing engine work, one of the frequent tasks is fitting up eccentric straps, planing off at the centre so the halves can come together. Usually made entirely of cast iron, the parts are scrapped after they have been worn and planed down considerably. It is possible to do as was done at Fig. 2. This consists of boring out the strap, babbitting it, and boring again to fit the eccentric. By undercutting, or dovetailing, as shown, the babbitt is well anchored. The divided construction of the strap makes it possible to hammer in the babbitt before boring, thus producing a high-class job and one that will prolong the lift of the strap indefinitely.

Where soft lathe centres are used, the cost of renewal amounts to considerable for a year's service. Hard centres do not need trueing so often, neither is the pastime of turning down the centre followed so frequently. Inserted points will cut the cost of renewal, as well as avoiding the job of turning and fitting tapers, which, somehow, no one seems to like. The centre in Fig. 3 is made with a piece of ⅜ inch drill rod set in the business end. This may be projected, when worn down, by putting a spacer behind it—up to the time when it is too short to be stable and must be thrown away. But it is so simple to put in a renewal that no one minds it or the loss of a stubby end of tool steel.

We attended a church service a while back, and, by luck, struck a good mechanical sermon. The pastor took for his topic "The Homely Virtues." These were: Orderliness, Common Sense, Thoughtfulness, Observation, Politeness and Push. We had expected to be bored, but instead we were cheered; yes, cheered to think that someone else (and outside of a machine shop) valued these qualities of person as we did; for if ever there is a business that demands these, it is ours. Give us a boy or a grown-up with these virtues and it is not necessary to ask about mechanical skill or ability—that follows quickly and as a matter of course. And the greatest of these is orderliness.

Smith & Smith were making a combined square and protractor for carpenters' use, a tool that included the functions or mitre square, rafter square, and protractor withal. A dial or rule was stamped along one edge, this dial being the familiar foot rule graduated in eighths of an inch. To do this work better and quicker than by the use of hand stamps, a machine was built. It followed the general lines of roll marking

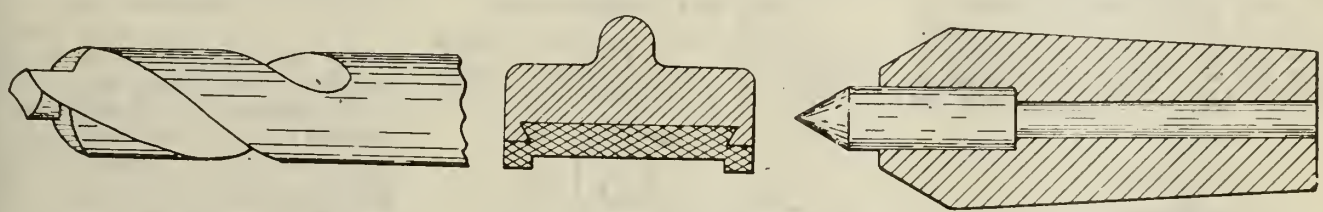


FIG. 1—USE FOR OLD DRILLS. FIG. 2—RENEWING WORN ECCENTRICS. FIG. 3—ECONOMICAL LATHE CENTRE.

machines. The task of getting an accurate roll stamp, or die, will be of interest.

This was made of a 1 in. thick disc of Champion non-changeable steel, oil hardening. The measurements are shown in part by Fig. 4. It was determined that the depth of the graduations in the finished pieces would be 1-64 in. and a "pitch diameter" was selected upon this basis. Instead of making the circumference of the pitch circle 12 in., graduations were cut to

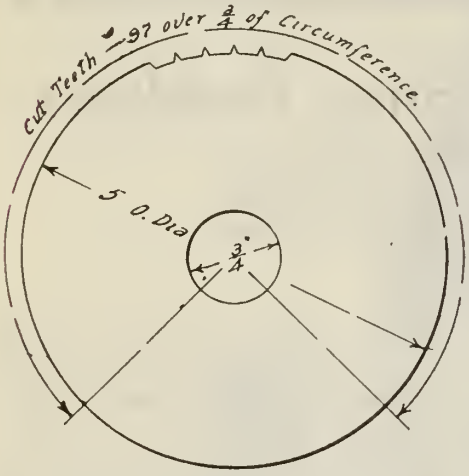


FIG. 4—DIE FOR A ONE-FOOT STEEL RULE.

roll the twelve inch dial only (beginning at the proper point), and a convenient blank space left over. The teeth were milled with the blank on centres, selecting an index circle that gave us 97 divisions in about three-quarters of a circumference. By actual measurement before and after, there was not 0.00025 change in size after hardening—and the dial as rolled matched perfectly with a B. & S. rule, tested under a glass.

Worn-out reamers may be restored to life by the following method: Anneal, by heating to a dull red and allowing to cool in the air. Then, with a swaging tool, which may be a chisel ground off flat on the edge, go over the front of each tooth of the reamer and hammer back on the cutting edge. Almost before one gets started, the diameter has been increased 0.005 in., because this driving back swells the metal on the edge and it can go in but one direction. After hardening and tempering, the tool is reground and is as good as ever. Or, if the worn tools have been replaced with new ones, this process may be resorted to to make a set of over-size reamers—handy in any shop. If a number of reamers are run through at once, the cost will be but a fraction of that for new tools.

Often the casting surrounding the drill press quill has been taken up to the limit of what the binder screws will draw. Still the quill is a loose fit, permitting sway to the spindle. If the casting be peened as shown by the arrows, Fig. 5, the divided part will be drawn together of its own accord and the screws may be further tightened.

One of the handiest fixtures to use in connection with face plate work is the V angle plate shown by Fig. 6. Not only for face plate work, but for many jobs that are done in the lathe chuck and with steady rest—for work of its class, it is better than the chuck for long pieces and better than the rest for short pieces. Boring, facing, drilling, and turning are among the principal uses found for the V plate. Rectangular-shaped parts are gripped as easily as round ones. Where there is no lathe in a shop having a hollow spindle, this attachment will do a large part of that class of work which has a small cross section and a length of several diameters and which requires machining at one end.

CAN YOU ADOPT THIS

In a certain plant there were several workmen who were habitually tardy, and one man in particular never seemed to be able to get to his job on time. When he came to work in the morning he usually showed up about fifteen minutes after the whistle blew and his tardiness was a source of vexation to the foreman.

One day the manager of this plant which had been experiencing considerable trouble in keeping labor decided to put in a bonus system, to see if conditions could not be bettered. His plan involved the payment of a bonus of 10% of the weekly wages every Saturday to each employe who had put in a full week.

At first he was somewhat skeptical about it working as he had a number of negroes on the payroll who had been in the habit of working about four days out of every week. Much to his surprise the first week the bonus system was placed in operation practically every negro on the job worked a full week.

The second morning the bonus system went into effect, the tardy workman came in and punched the time clock at half-past seven. He had been out the night before and had not recovered from the effects of his dissipation.

The foreman who happened to be standing near the clock remarked in a very curt manner:

"Jones, getting in thirty minutes late this morning will cost you exactly three dollars."

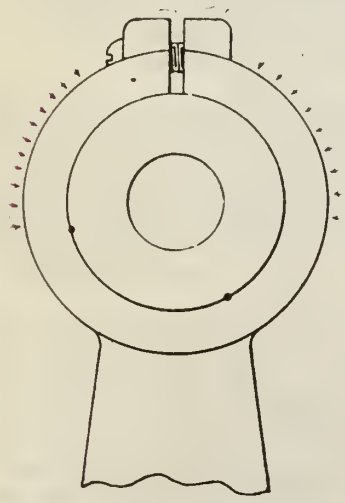
"What do you mean?" asked Jones looking at the foreman in surprise.

"If you had worked a full week you would have received a bonus of $3.00 on top of your wages," the foreman explained, "but getting in late this morning knocks you out this week. Maybe next week you can do better."

The lesson had the desired effect. From that time on the tardy workman was one of the first on the job when the whistle blew.—Dodge Idea.

The exclusive sales rights in Canada of the Rego welding and cutting outfit and supplies manufactured by the Blastian & Blessing Co., Chicago, have been acquired by the Carter Welding Co., Toronto. The latter company will operate sales and service stations in the cities of Hamilton, Montreal, St. John, N.B., Vancouver, Calgary and Winnipeg, with headquarters in Toronto. Before taking over the rights of the Rego welding outfit the Carter Welding Company were sales agents in Canada for the Davis-Bournonville line of welding and cutting apparatus.

At the "Ideal Home" Exhibition recently held in London, Eng., one of the exhibits consisted of a modern house equipped throughout with electricity, not only for lighting but for cooking, heating (including the heating of water for kitchen, bathroom, and all other purposes) and the electric driving of vacuum cleaners, machines for washing dishes and for washing clothes, serving machines, and plate and boot polishing machines.



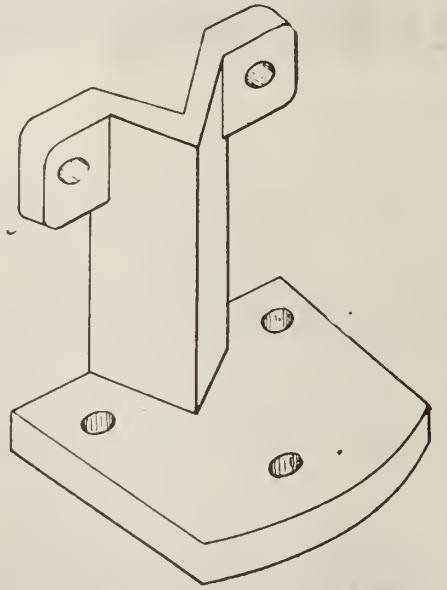


FIG. 5—CLOSING A QUILL BEARING. FIG. 6—THE VEE ANGLE PLATE FOR LATHES.

Interesting Data for Making Taper Reamer

Formulae for Calculating the Design of Spiral Taper Reamers is Herein Discussed. The Different Figures Given Are Derived From Practical Experience, So Should be of Special Value

By W. ERNEST

I HAVE looked up many handbooks for formulas for the calculations for making spiral taper reamers, without finding anything very definite, so I was driven to the necessity of fixing up some rules for myself, and I pass them along for your consideration. They may be useful to others, or perhaps someone else might suggest improvements on them. Let us suppose we are going to make a reamer to dimensions given in the sketch, Fig. 1.

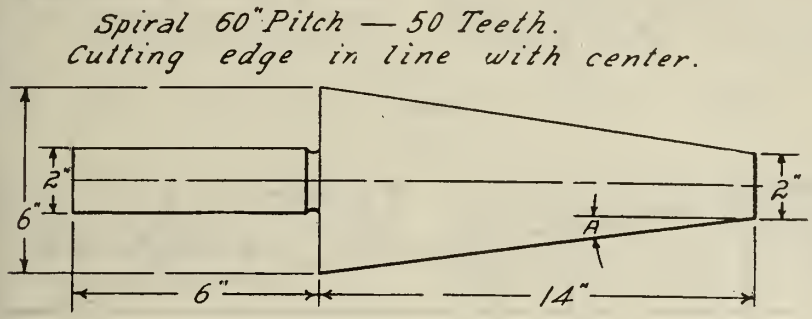


FIG. 1.

After cutting off and centering, the first operation would be to rough turn to within about quarter of the diameter given, then anneal before finish turning. This takes out the initial stress in the steel and gives you a better chance to harden the reamer without breaking the teeth, it being such a solid body and the teeth right up to a cutting edge there is a great danger of breaking the teeth in hardening.

Next finish turning, leaving about .015 in. on the shank and from .015 to .020 in. on the body for grinding or a little more according to your facilities for hardening, as the reamer never runs perfectly true after hardening. In turning the taper it is best to use the taper turning attachment if you have one. Some taper-turning attachments are graduated in taper per foot and some in degrees; if in taper per foot then the calculations would be:

Where D = Large dia.
d = Small dia.
L = Length of tapered part.

$$\frac{D-d}{L} \times 12 = \frac{6-2}{14} \times 12 = 3\frac{3}{7}\text{" per ft.}$$

FIG. 2

If in degrees the number of degrees would be:

$$\frac{D-d}{2} \div L = \frac{6-2}{2} \div 14 = .1428 = \tan. A.$$

FIG. 3.

$$x = \frac{D-d}{2} \times \frac{L}{l} = \frac{6-2}{2} \times \frac{20}{14} = 2\frac{6}{7}$$

FIG. 4.

Angle with Centre

Tan of .1428 = 8° 10′ as near as the lathe could be set.

If it is necessary to shift the tailstock centre we must remember that when the piece is revolved the same cut is made on all sides so that when we find the amount of taper the tailstock must be set over one-half. If D equals the large diameter and d the small diameter of the tapered portion, L the total length of the piece and l the length of the tapered portion, then the offset x of the tailstock is determined by the following formula, shown at Fig. 4.

In the actual turning there is one point worthy of mention, that is the tool must be set exactly the height of of the centre of the lathe, and if taken out to sharpen must be set back to the same place. If the tool is set either above or below the centre it will take more off the big end. The sketch will make this clear. The large arc represents the big end, the small arc the small end, and A the path of the tool on the centre line; now, if the tool be lowered to line B it will be seen it is nearer to the large surface than to the small one, hence it would take more off the big end than the small one, see Fig. 5.

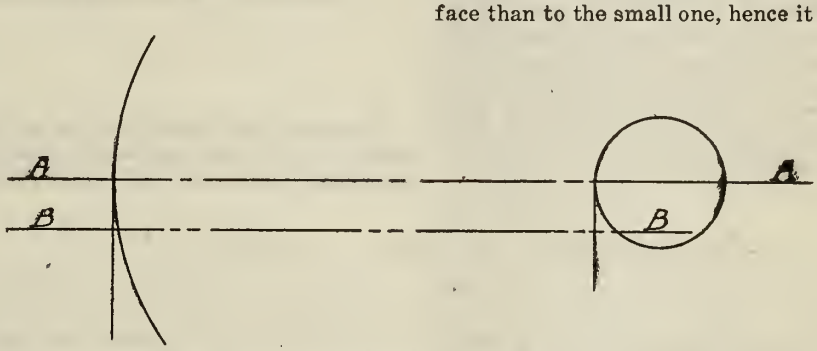


FIG. 5.

$$\frac{60 \times 4}{40} = \frac{6}{1} = 6:1$$

$$\frac{75 \times 60}{25 \times 30}$$

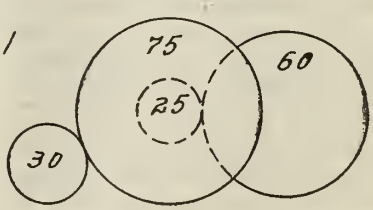


FIG. 6.

Now our lathe work is finished we will proceed to set up the miller. The pitch of the spiral is 60 inches. In setting up a miller for milling spirals there are two indispensable factors we must find out.

(1) The pitch of the feed screw.

(2) Number of revolutions of index crank to turn work around once. Suppose the feed screw is ¼ pitch and it makes 40 revolutions to turn the work round once, this table would advance

$40 \times \frac{1}{4}$ or $\frac{40}{4} = 10$ inches. This is called the lead of the machine. From this explanation the following universal rule is deduced: Multiply the lead in inches to be cut by the number of threads per inch of feed screw and divide by forty. See Fig. 6.

Or any set of wheels that have a ratio of 6 to 1 either single or compound.

Next let us calculate the divisions of our index plate for cutting fifty teeth.

How to Use Index Plate

Since forty revolutions of the worm shaft give one turn of the work, then one turn of the worm shaft would give $\frac{1}{40}$ turn of the work and would divide the work into 40 equal spaces. From this we deduce the following rule: Divide 40 or the number of turns required for one turn of the work by the number of divisions into which the work is to be divided and the resulting fraction will give the number of turns or part turns which the index crank must make to obtain the desired result. Thus:

$\frac{40}{50} = \frac{4}{5}$ of any chosen circle.

Next we must move the table round so that the line of the cut will be as nearly as possible in line with the milling cutter. This is found by dividing the circumference, taken at the centre in a taper reamer by the pitch of spiral; this will equal the tan of the angle, and by looking up a table of tangents we get the degree at which to set the table. The diameter in the centre is 4 in., the formula therefore would be, as shown at Fig. 7 :

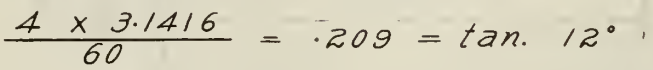


FIG. 7.

by reference to table equals 12 deg. nearly. Now it is evident that this being a taper job that one centre will be higher than the other, also it is imperative that the centres should be in line with each other, that is, pointing directly toward each other. If not, our teeth would not be equally spaced, and we should have wide landings on some teeth and no landings at all on others. Also our cut must be deeper at the big end than it is at the small end in order to leave our landings parallel; this being the case, we will work out the depth of cut and get the angle and height of the centre. The depth of cut can be found as follows: Dividing 360 by number of cuts gives us the angle with the centre. Multiply tan of angle by radius equals width of cut.

If we are using a 60 degree cutter the tan of the opposite angle 30 degrees, multiplied by width, will equal depth. The depth at the large end. This will be the tan of 7 degrees 12 multiplied by radius multiplied by tan of 30.

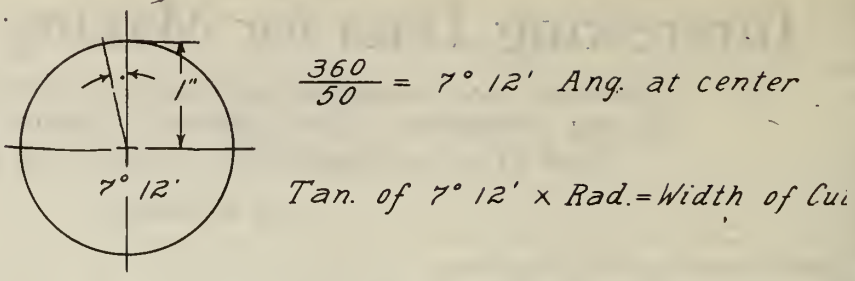


FIG. 8.

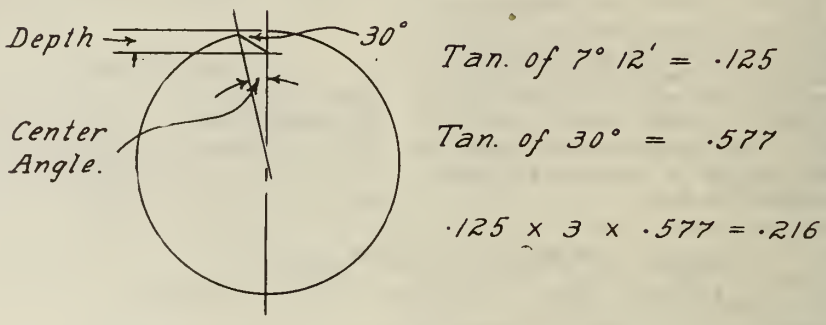


FIG. 9.

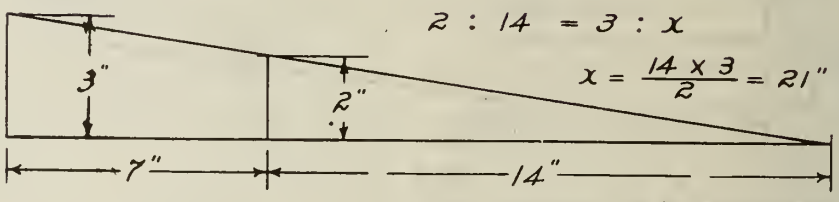


FIG. 10.

If we set the machine at the correct angle we need not consider the depth at the small end as it will automatically adjust itself. The depth of the cut at the large end will be .216; if this cut was continued until it ran out to nothing it would run out at the point where the surface of the cone and the centre line would meet. The length of this centre line can be found by simple proportion, thus: If the centre line is 14 in. long in a 2 taper. how long will it be in a 3 taper? See Fig. 10.

Or by using our previous calculation which we made for the lathe. The side opposite, that is 3 in. divided by the tangent of 8° 10', equals the length of the centre line.

$\frac{3}{1428} = 21"$

Now, by deducting the depth .216 from the radius 3 in. we can obtain our angle for the centres, see Fig. 11.

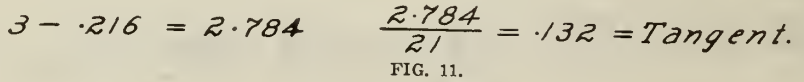


FIG. 11.

Angle of centres 7° 30" nearly. There is still a chance for a serious error: the tail of centre may not be at the right height. The difference in height from the table would be the tan of 7° 30' multiplied by the length of the work or the distance apart of the centres.

$132 \times 20 = 2.640$

This is neglecting the depth of the centre holes. If extreme accuracy is required the depth of the centre holes must be allowed for.

After adjusting machine to these requirements, set the sharp point of the cutter exactly over the point of the centre; we are using a 60 degree cutter with angles of 48 degrees on one side and 12 degrees on the other, as this is found by practice to give the best results. Now lower the table and place the work between the centres, start up the machine and raise the table until the cutter just touches the work at the large end. Now the work must be pushed over to one side until the edge of the cutter which forms the cutting angle makes a straight line with the centre when it is

at the required depth; this can be found as follows:

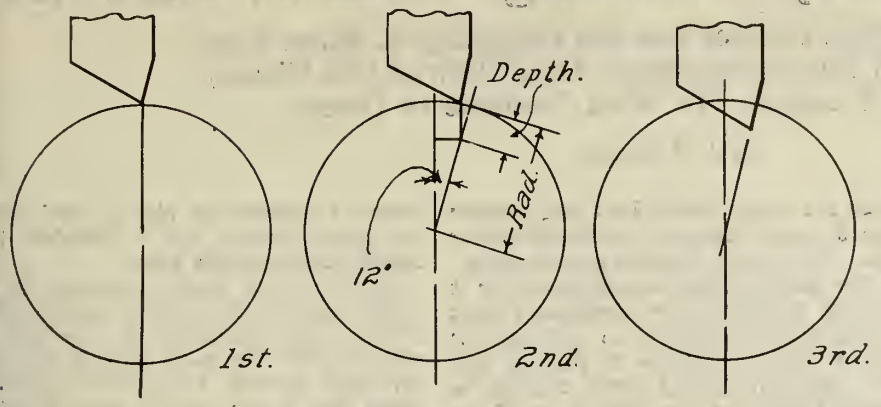


FIG. 12.

1st position has already been set by placing edge of cutter over centre; 2nd position, since the edge of the cutter makes an angle of 12 with the centre line. The side movement of the work will equal radius-depth times sine of 12:

$$3 - \cdot 216 = 2 \cdot 784 \qquad 2 \cdot 784 \times \cdot 2079 = \cdot 578$$

FIG. 13.

The depth of tool from centre line or amount to raise the table will equal radius-depth times cosine of 12 equals side adjacent. Radius-side adjacent equals depths from centre line.

$$3 - \cdot 216 = 2 \cdot 784 \qquad 2 \cdot 784 \times \cdot 9781 = 2 \cdot 723$$
$$3 - 2 \cdot 723 = \cdot 277'' \text{ Amt. to raise table.}$$

FIG. 14.

No other calculations are necessary and we can go ahead with a reasonable certainty of making a good job. This may not be the best method, but it is the way it looks to me. If any of my fellow readers have different methods let us have them, as an exchange of ideas is mutually profitable.

PONTOONS CARRY PORTABLE PNEUMATIC CAISSON

A portable pneumatic caisson mounted upon a pair of pontoons and designed for the recovery of diamonds from the deep pools of the river Naal, is described in the "South African Mining Journal."

A metal cylinder or bell having a dome roof, which is surmounted with a tubular shaft in sections to suit depth of water to be worked, is terminated by an air-lock chamber surrounded by a water ballast tank. The dome roof of the bell is provided with means of securing, and at will releasing, a quantity of solid ballast. The tubular shaft is furnished with external runners which engage in rollers or guides attached to the deck of a pontoon or raft which carries an engine, air compressor and centrifugal pump, and possibly plant for the treatment of the gravel or material recovered. The air-lock chamber is provided with the usual manhole door and equalizing valve, together with an air-lock chute for discharging gravel; a special door closing the entrance to the tubular shaft, which latter is furnished with ladder rungs and runners for skip way, operated by a hoist fixed in the air-lock. The base of the shaft where it enters the bell is fitted with an air-tight door which may be used when it is required to lengthen the shaft. The bell is provided with collapsible seats attached to the wall for the accommodation of workers during lifting operations, and with a centrifugal pump or hydro ejector having a flexible suction by means of which the loosened gravel is deposited in the kibble or skip hoisted to air-lock or elevated direct above water level to the deck of the pontoon.

Method of Operation

Sufficient solid ballast to partially submerge the bell is placed on the dome roof, water ballast is then pumped into the tank surrounding the air-lock in order to sink it and hold it securely on the river bed or sea bottom, and the gravel is elevated to the surface by pump or ejector direct, or hoisted to the air-lock and thence discharged through the air-lock chute projecting through the water ballast tank. The bell, or caisson proper, is fifteen feet in diameter, five feet high, and has a cone roof rising to eight feet six inches; the interior is fitted with electric light in a water-tight fitting, and has a telephone communicating to the air-lock and engine-room. A specially-designed hydro ejector with a flexible suction is installed for clean-up purposes. The apex of the cone roof is surmounted with an M. S. collar-piece to which the various lengths of the shaft are bolted. The shaft is two feet nine inches interior diameter and is made in lengths varying from five feet to twelve feet; each length is furnished with ladder rungs and steel runners for skip, also with an air-pipe and five core armored cables with G. M. couplings for electric light, telephone and signal bells. The air-lock is six feet six inches in diameter and six feet six inches high; is fitted with the usual manhole and shaft doors, equalizing and relief valves, and is placed inside the water ballast tank, which is ten feet ten inches in diameter. Through the wall of the air-lock chamber and ballast tank a gravel chute projects at an angle of 45 degrees; this is closed at either end by air-lock doors, the outer one being of special construction fitted with a positive interlocking device which prevents its being opened until the inner door is closed. An Ingersoll air-hoist, operating a ½-ton skip, raises the gravel from the caisson and tips into the chute, which has a capacity of 1½ tons. From this chute the gravel is discharged into a bin on the deck of the pontoon, and thence elevated to a trommel, whence it is delivered to gravitator. The pontoons are 37 ft. x 10 ft. x 2 ft. 6 in. and are connected by platform decks 37 ft. x 10 ft., thus forming a square, in the centre of which is a 17 ft. x 17 ft. opening to admit of the caisson being raised for transit in shallow water. A heavy gantry standing on columns is rigged for the purpose of raising and lowering the caisson. The deck plant consists of a vertical boiler, Laval steam turbines, air-compressor and receiver.

An important step toward the further development of British foreign trade is indicated in the plans announced by the University of London for establishing degrees in commerce. The National Foreign Trade Council learns from London that it is proposed to institute a 3-year course of study leading to the degree of bachelor of commerce. The addition of a minimum of two years' practical experience in the particular trade or industry selected would qualify the candidate for the degree of master of commerce.

The work of the first year would comprise the compulsory subjects of organization and industry, banking, trade and transport, elementary economic developments of the British Empire and chief foreign countries, commercial law and statistical methods. The second and third years would be devoted to specialization.

The scheme has the warm support of representative men in Britain's foreign trade, who are urging all business men to contribute liberally in support of this programme in order to secure for British commerce the advantages of a thorough and recognized commercial training

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Want Equipment.—The Lignite Utilization Board, 80 St. Francois Xavier Street, Montreal, is in the market for two belt conveyors, two bucket elevators, three screw conveyors and one wire mesh conveyor. Specifications may be had from the secretary, Leslie R. Thomson.

A Swedish scientist has produced a flame with a higher temperature than that of oxy-acetylene and has also devised a burner employing powdered aluminum and oxygen.

Canadian Machinery Drafting Course, Part XII

This Portion Goes Still Further Into the Designing of Miller Vise. It is Very Essential That Instructions Are Followed Out Closely, as It is the Principle We Wish Students to Grasp

By J. H. Moore

As a general rule, one would not start in to design a milling machine vise by drawing up the details, as we did in our last plate, but no doubt students can readily understand that our object in first drawing the details was in order to take up the more simple portions first.

When all is said and done, we are not designing this vise, but duplicating a type already in existence, so that our method of procedure is permissible.

Having already illustrated the details, we will now proceed with the base and its cap. Owing to the size of this portion, we suggest that the base be drawn half size; that is, to a scale of 6 inches equals 1 foot. The cap, of course, can be drawn full size.

We will make our plate size in this case 12 inches long by 8 inches wide to the border lines, with the usual ½ inch all round outside the border lines.

A good place to start in on the plate would be at the plan view of the base. Draw a centre line 5¼ inches down from the upper border line, and another line 6 inches from the left-hand border line. This gives students a good start.

The ensuing steps are optional, for it greatly depends on the draftsman what course would be taken, so perhaps our safest refuge would be to explain how we would do it, and leave readers to either follow out our method, or, if desired, their own inclinations. The result is what really counts, not the method of getting there, and it would be poor policy on our part to attempt to point out a hard and fast rule to follow. To proceed with how we would lay out this view.

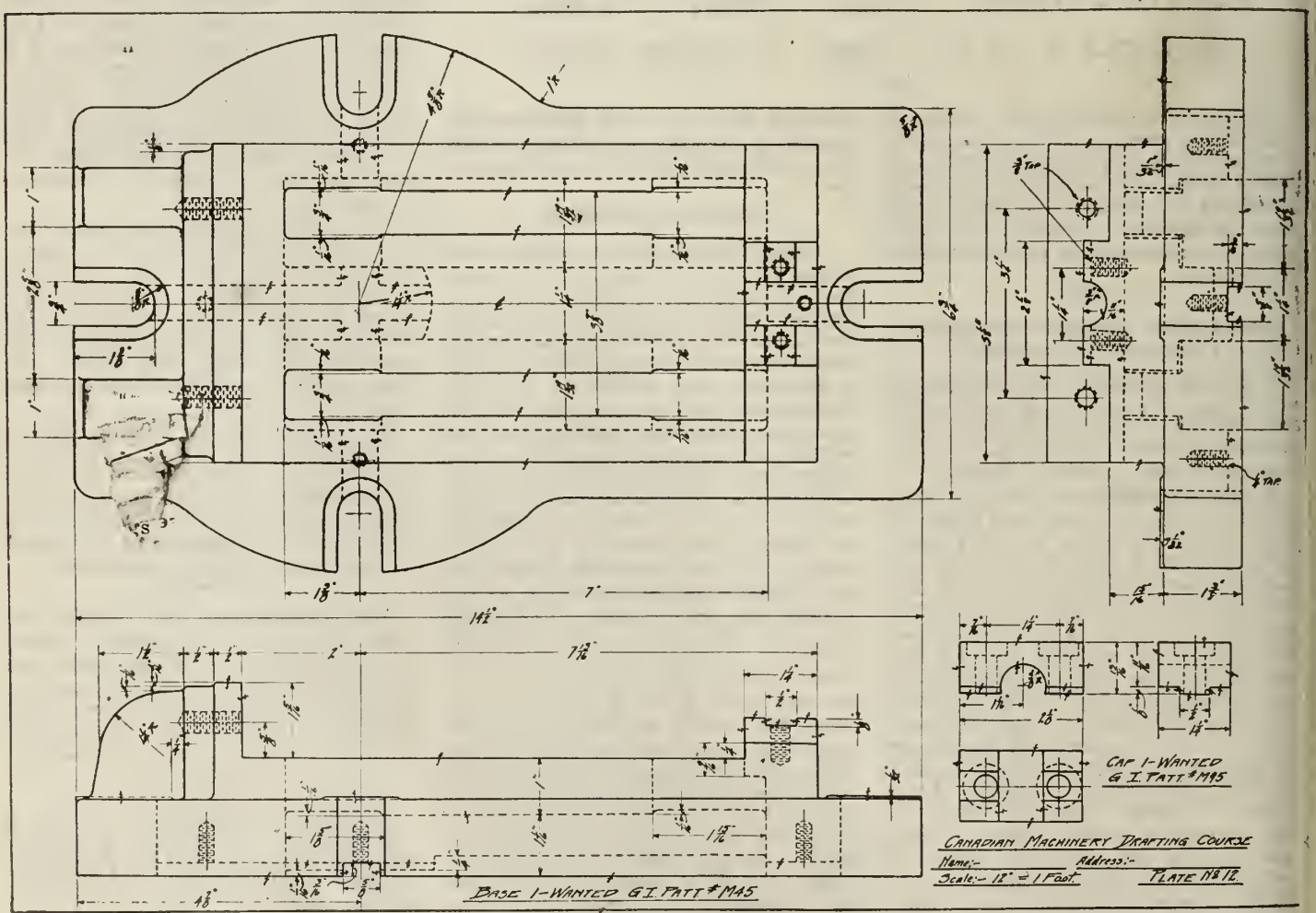
General Instructions

We would start from the intersection of centre lines drawn, and with a 4⅝ in. R describe two arcs to represent that particular portion of the base. Next draw two parallel lines 3⅜ in. on each side of the horizontal centre line. Now measure 4⅞ in. to the left, and draw a vertical line meeting these two parallel lines. Measure from this last line drawn a distance of 14½ in. and draw the other vertical line to complete the rough outline of the base.

Now set your small compasses to ⅜ radius and describe radii at each corner. Change your compasses to 1 in. radius, and describe the radii joining the 4⅝ in. radius portion. Of course it is understood that so far we have been drawing these lines lightly, for we take it for granted that students understand the advantage of doing so on any drawing before it is finally completed.

The next step would be to come in 1 in. from each end, on the centre line, and describe a ⅜ in. radius, and a ⅝ in. radius, continuing these lines to form the shape of slot, shown on the plate. The same procedure can be followed out for the two side slots.

Now lay out the top portion of the plan view by the same gradual steps. Draw lines 2 9/16 in. on each side of the centre line, and join to these lines, the various vertical lines at their proper positions as noted by the various dimensions. Having given students this much



AS SOON AS YOU RECEIVE THIS COPY, START ON THE PLATE. REMEMBER THE OLD SAYING ABOUT THE FELLOW WHO HESITATED.

of a start, we leave them to complete this view.

Either the side or end view can now be developed. In fact, some draftsmen prefer to develop views gradually, working from one to the other as they proceed with their designing. Had we been actually designing this portion of the vise, our method, no doubt, would have been to jump from one view to the other, until all were completed.

We will, for sake of example, start on the side view. Leave at least 1½ in. space between the plan and side view. Never crowd views too closely, but always leave room for dimensions. This may seem a small matter, but it is a most important one.

Draw all necesary parallel lines first, then join with the proper projected vertical lines, that is, the lines projected down from the plan view. Proceed as you did on the plan until you have finished this view. Lastly, develop the end view in similar manner, again leaving at least 1½ in. between views.

In this case, it would be wise to draw your main vertical lines first, after which project your horizontal lines across from the plan view.

Students will, no doubt, notice the difference between the end view and the plan and side view. By difference we mean the style of lines, etc. This has been done purposely, the end view being drawn by another party in order to illustrate the different methods of different draftsmen. Note the arrow heads. They are entirely different, being more splashy, and in some cases not touching the dimension lines. The figures also look different, as do the finish marks. In other words, each draftsman has his own particular style. Again, we repeat, "Always see that your arrows touch the lines; that your arrow heads are neat, neither too small or too large, and that every dimension is clear and distinct." Remember that a little extra time spent on the drawing will save considerable time afterwards in the machine shop.

Regarding the drawing of the cap. We leave this to the students' discretion, for when he has completed the base, he will be in good shape to tackle a simple part like the cap.

The Critic's Standpoint

They say that any old grouch can be a critic, but while we wish to be spared the name of grouch, let us go over the drawing, shown on the plate, and pick it to pieces. Starting on the plan view of the base, what do we find?

The first thing that the writer would say, is that some of his curves are not as neat as they might be. Make every curve meet into another curve, or into a straight line as neatly as possible. In some cases, where a great many curves occur, it is best to draw in the curves first, then joining the straight lines to these curves. The next point that could be criticized is the absence of certain dimension attention lines at the 1/16 in. dimensions. This is a small matter in this plate, yet an important one, in the case of a very complicated drawing.

We have also left off a finish mark at a rather important point, but, of course, it shows up in the side view, yet should be marked on the plan view, so get your eagle eye on the job, and remedy this point when you send your plate in.

The side view will, no doubt, pass, as it is not our intention to be over-critical. We have not the time to make a drawing of such minute perfectness to stand a close test for all small defects, besides the average drawing turned out in an office, could be easily picked to pieces, but yet is neat enough to serve its purpose. It is not necessary to spend a week on a drawing when a day is sufficient for the work. Learn to make a drawing neatly, but do not get the idea that neatness means to carry the effort to the extreme. Practice means perfection, and we feel sure that a good, serviceable, neat drawing will be made by our students in reasonable time before the completion of this course. While perhaps it may take you a little longer at present, do not get discouraged and rush matters, but rather take your time, turning out a drawing of which you can be justly proud.

Consisting the end view, we have various points on which we can safely comment. First, the dimension lines are too heavy, being practically of the same thickness as the rest of the drawing. Second, as before stated, the arrow heads are too splashy. Third, some of the dimensions are none too plain. Fourth, the various small curves do not meet in with the straight lines as neatly as they might. Fifth, the dotted lines are not as even as could be hoped for. Sixth, various small centre lines are left off the drawing, where, by a little extra attention, these could be added, making the view look more finished. This same condition is true of one part in our plan, which has been left so purposely.

Concluding this portion of the course, suppose we mention a few don'ts to students in general.

Don't be in a hurry.

Don't start any drawing before thinking out ahead, how you propose completing the plate.

Don't make your lines too heavy, but this does not mean make them too light, strike a happy medium.

Don't attempt drawing in curves freehand.

Don't make your dimension lines too heavy.

Don't make any of your lines rough and uneven.

Don't make your dotted lines of various lengths, long and short, and so on. Keep them as uniform as possible.

Don't write in the title; print everything.

Don't crowd your views, and above all don't lose patience if the drawing does not go as smoothly as you expected.

A good method to guard against all these above troubles is to see that your pencils are sharpened correctly, that your tools are clean and properly ground, and that you choose a suitable time to work on the different plates.

We want students to send in their work regularly, for otherwise we cannot tell what progress they are making. Next plate, we will take up another portion on this vise.

Cut out and send with drawing

Name .....

Address .....

Position .....

Firm's name.....

Segnite is the name given an explosive recently developed in South Africa by replacing the nitrate of barium in tonite by nitrate of soda. It is safe to handle and can be struck with a steel tool. It is equivalent in power to the same weight of gelignite.

Some elaborate tests, carried out by Mr. H. E. Doerr, chief mechanical engineer of the Scullin Steel Company, U.S.A., showed that in forging down an ingot of steel, at a temperature of about 2,250 deg. Fah. to 1¼ in. diameter, the density of the metal was increased, on the average, by 0.64 per cent.

In discussing the probability of oil being discovered by the borings now being sunk in Derbyshire, Mr. V. C. Illing, in "Nature," says: "The whole evidence of the geology, and the cumulative experience of the smallness and ephemeral nature of any oil occurrences which have been noted, agree in indicating that large commercial underground supplies of petroleum do not exist in this country. Small deposits have been found in the past, and will no doubt be found in the future, but the present search for large commercial supplies is not justified by the scientific evidence, though there is no doubt that the bores will yield useful scientific data."

A Large Wheel Job and How It Was Accomplished

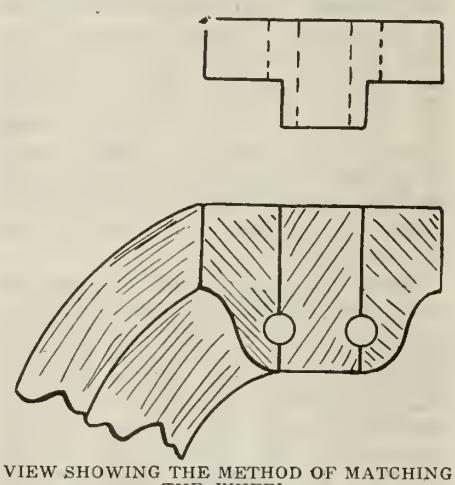
A Humorous and Interesting Story of a Happening in a Pioneer Machine Shop in the Far West. The Method Adopted to Machine This Wheel is Well Worthy of Note

By W. R. GREEN

SOME few years ago, roughly about 1904, the writer was working in a fair sized machine shop and foundry, when the firm received an order for a large bull-wheel from a silver mining company a few miles distant. This wheel was to be the upper sheave and brake wheel for a cableway to take ore down to the railway tracks, as the road haul was too expensive. The company already had a cableway in operation but the upper wheel was found to be too light in rim section and would heat up very quickly when the brake was applied, so it was decided to get a larger wheel, which was to be 12 feet diameter, with rim 18 inches face by 6 inches in thickness, hub to be cored half its length and bored for 12 inch shaft, the length to be 24 inches; the whole thing to weigh not more than 6 tons and not less than 5.5 tons. The wheel was to be in quarters with a plain key in three of them and a taper key in one section. The sections were held together at the rim lugs by two bolts at each joint and two smaller ones at each joint were put through the hub lugs. One month after the patterns were made was the time limit.

Well, the moulders certainly had some trouble, but turned out perfect iron, and then our troubles started as the shop did not have a machine to work on the joints with, and that work had to be done by hand, and a sweet job it turned out to be, as the rim joints were stepped together as the sketch shows. I devised a template for the joint I was working on from a piece of cast iron, and shaped the piece in the shaper until it was the right size for the male, and the foreman then told me to make one for the female, so that we did not have to kill ourselves fitting the sections together but were able to make the parts fit to within a 32nd of an inch without actual trial. We got the joints finished and the bolt holes drilled and reamed, taper reamed at that to fit standard 1.75 in. big-end bolts at the rim and 1.25 in. taper bolts at the hub lugs, and then the real troubles began.

We had to bore that hub on a 12-foot wheel with a 6-foot face-plate lathe as a boring machine. Incidentally at that time I was the junior machinist in the bunch of six general men, and naturally did what I was told to do by the older men as well as the foreman, although the men were really good to me at that. Well, that job descended to me after all the others had tried with the lathe jacked up in the air and bedded on block. I am afraid I got the job through laughing at the way the whole rigging threatened to collapse. Anyway I told the foreman that if I was to take the job of boring the hub I would do it my way or nothing doing. He told me to go ahead and suit myself, which I did by first taking the lathe down off its stilts and having it placed on its own foundation again, then the floor was cut away and rigidly braced underneath, and the wheel placed in the gap and also braced and trued square with the face-plate and centred, the other men working loyally to help. After I started the boring, the other men were getting the shaft (hollow) ready to fit the plain keys, or feathers as we called them into it. Why there were three parallel keys and one taper key I have never yet found out. Well, after a time the bore was finished and the wheel taken out, and after marking the joints with numbers it was taken apart and the key-ways cut in the sections; they were not cut in the centre or each section but were put where they had a lot of metal ahead of them in their work of turning the wheel. After this keys were fitted to the hub portions and the wheel was put together for what was



VIEW SHOWING THE METHOD OF MATCHING THE WHEEL.

to be the last time in the shop. The keys were put in place and the taper given to me to fit a little better. After taking a shaving off it in the shaper and draw-filing it smooth, I applied blue marking to it for the last trial and tapped it lightly in when the foreman came along, and, seeing what I was doing, pulled me out of the way and told me that this was how they did things in the West, at the same time driving up the key with an 8-pound flogging hammer. Well, that was all right, but after putting the shaft and wheel on the old lathe and driving it with the face-plate rigged as a temporary chuck and the other end of the shaft riding on skids and well-soaped V-blocks, facing the rim and taking everything down again preparatory to freighting the sections to the mine we found that we could neither get the taper key nor any of the others out, and to make matters worse, we could not take out the section bolts. After many trials and tribulations in the endeavors to take it apart, I found that I was to be the goat, and the queer thing about it was that none of us remembered about the foreman driving in the last key so hard; this key, by the way, had a head on it of twice its own section, or about 2.5 in. x 2.5 in., the key body being 2.5 in. x 1.5 in. at the head end. The lug being for the purpose of drawing the key, and the plain keys being expected to slide when the other was drawn out. After the whole gang, not counting myself, had tried every way they could devise, including the use of 40 per cent. giant powder and also drilling with a ratchet, with no success, I was told that as I had caused the damage I could also repair the damage. After thinking over the job for all one day and finding that we had plenty of 12 in. hollow shafting in stock, I got the rest of the machinists and helpers to rig the wheel the same way as for boring in the lathe, meanwhile two men were to make four more keys and spline the new shaft in readiness for the finished wheel. It did not take as long to set up as before owing to the shaft being in the wheel, and it was placed with the short end of the shaft facing the face-plate, and all braced rigidly as for the first boring. The blacksmith was told to make three flat drill bits of stated sizes, which he did, and after I had rigged up a sort of driving drill chuck from odds and ends around the shop, my real troubles commenced, which made all the others look small by comparison, for I found that the drills were not like the boring bar had been, that is, they could not be fed into the work, so they had to be thrown aside and a small self-feeding boring bar had to be made in a hurry to fit a hole 4.5 in. in diameter, the internal bore of the shaft. We only had two screw-cutting lathes in the shop, so one man had to make the lead-screw and another had to make the feed nut, still another made the tool box and one made the star-wheel (strike wheel some call it), and I had to make the slotted bar on the shaper after drilling both ends for the feed-screw bearings. Owing to the fact that the shaft was not absolutely true internally, a leader guide or bushing could not be used until the first cut was made, and as the total length from the shaft end to the rear end of hub was 4 ft., you can imagine the way the boring bar sprung during the first cut, but after truing up the first cut we used the bore as a mould by plugging the hole with clay and centering a piece of shafting of the same size as the cutter bar

One of us poured the mould full of hard babbitt, which, after cooling, was used as the guide bushing by pulling out the steel core and putting the head of the boring bar in it and jacking the whole thing back in the hole. The cutter having been turned back to the starting place by hand and the back end of bar placed in the chuck again, the lathe was started up again, and I found that on plain belt pull I was able to make a cut of about 3-32 feed by about a depth of 5-16 in. The boring took approximately one working day, the three men who were not doing the splining, etc., were so tickled with the job that they wanted to spell me off, and did so at dinner time so as to lose no time on the job. After the boring was done we fitted the new shaft and the keys, then took them out and disassembled the wheel; we found that every rim bolt looked as if it had only been rough-turned and yet the bolts nearest the binding key were in perfect shape. Well, after the whole thing was freighted out to the mine and put in its place the foreman told the main boss what caused the final trouble, he having remembered about drifting the key up tight. The boss came through with some extra cash for me and some for the men as a bunch. Then he told us that the profit did not matter on that one job as he expected he would get all that mine company's work in the future, which I think he did.

The old face-plate lathe had originally been shipped out from England for tire-turning in some railway shop and had been sold to our company as junk. It had a six-step cone and double back-gear, the shaft of the lathe was hollow with a taper hole through it being approximately 8 in. at the working face and 6 in. at the other. After the old shaft was cut away from the wheel I found that the taper key had buckled in the cored portion of the hub from drifting in the small end of it.

The Grinding of Rolls is An Art in Itself*

THE heavy chilled iron or steel rolls used in the manufacture of armour plate, sheet metal and paper require varying degrees of finish, but in every case they have to be made perfectly round. They vary in size from 6 in. to 60 in. diam. and 8 in. to 15 ft. wide, and previous to the inception of the roll grinding machine presented a very tedious machining operation.

In this country the production of new rolls and the re-truing of worn rolls is, in the majority of cases, still carried out by the old method of turning, filing and polishing. Occasionally we find that some very inadequate arrangement has been made to grind the rolls in position.

A smaller number of British manufacturers, however, now realize that the desired surface can be obtained much more economically by finishing in a roll grinding machine than by the methods mentioned above.

Chilled iron rolls are very difficult to turn in a lathe owing to the nature of the material. In addition it is necessary to take cuts deep enough for the tool to get right under the "skin" of the roll, so that a fairly large proportion of the chill is thus turned away needlessly.

In grinding a roll no more metal is removed than is necessary to obtain a clean, true surface, so that very little of the chill is lost at each grinding and the roll may be trued up a number of times before the chill has disappeared.

Rolls finished in a grinding machine are perfectly round, and may be either parallel or cambered according to the requirements for their particular use. Ground rolls give a more uniform product whatever the nature of the material being rolled; in the case of tin plate, the even deposit of tin due to the more perfect rolls causes an appreciable saving in the tin used. A ground surface is very hard to file or scrape, and surface abrasion much better than a surface finished by filing and polishing. This property gives the ground roll a much longer life between each re-truing.

Rolls that require a turning operation before grinding, as when the deposited tin is removed from tin plate rolls, should be rough turned in one traverse at about eight cuts to the inch; the general procedure is to remove this tin with a traverse as fine as 40 cuts to the inch, so that the surface obtained may be more easily filed up, but the coarse finish will be quite suitable for the grinding machine and will effect a considerable saving in the actual turning time.

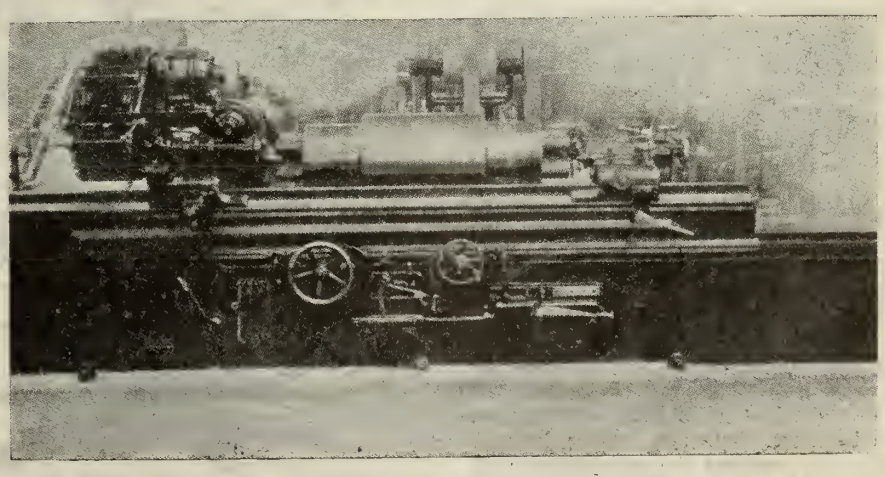
Recent times taken for re-truing tinning rolls average 21 mins. for grinding up a 4½ in. dia. roll 66 in. wide after the tin had been removed by one cut in a lathe taken at ⅛ in. traverse. The roll was in the lathe one-third of the usual time, and users of rolls will appreciate the 21 minutes' grinding time when they compare it with the time taken in their own shops to file up and polish a similar roll. These rolls were ground with a slight camber.

Large grinding machines will grind small as well as large rolls, but where the size of roll is limited a machine suitable for the maximum size should be obtained.

Fig. 1 shows a larger machine grinding a short heavy roll. If a camber is required on this class of roll, it may be obtained by grinding the roll taper from each end towards the centre, leaving a narrow parallel portion in the centre. If a curved camber must be produced the table ways of the machine will have to be specially scraped to give the required curvature, but the request for this must be made before the machine is completed. Rolls up to 6 in. in diameter and not less than 36 in. wide can be ground with a curved camber of .012 in. to .020 in. in the centre of the roll on a standard machine, the camber being obtained by means of the steady rests.

Fig. 2 shows a roll which was ground on a 16 in. by 50 in. Norton grinding machine in one hour. This was of chilled iron, and was ground on the necks or journals as well as on the roll face—the roll face taking 28 minutes of the time; .0625 in. was removed from the diameter, a good finish was obtained, the roll was quite parallel, and the wheel used was a 60K Crystolon.

Fig. 3 is the line drawing of a much more difficult roll—all dimensions were to a limit of .00025 in. including the width of the roll face—the fillets or radii joining the necks to the roll had to be ½ in. radius. The roll was made



4½ IN. ROLL 7 FT. LONG BEING GROUND ON NORTON MOTOR-DRIVEN PLAIN GRINDING MACHINE.

*From "Machine Tool Review."

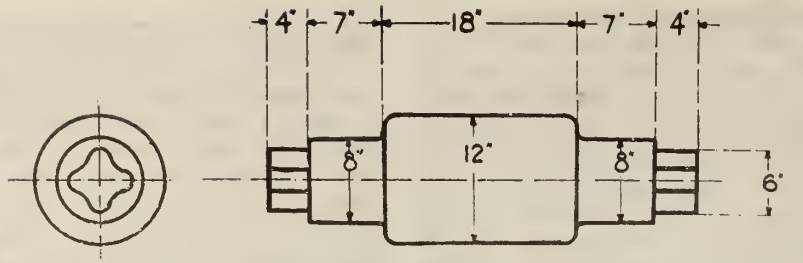


FIG. 2.

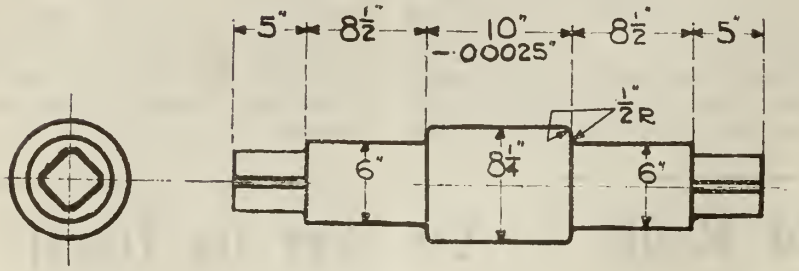


FIG. 3.

of tool steel, bone hardened, having .080 in. to be removed from the diameter. The roll was ground complete on a 16 in. by 50 in. Norton grinding machine in 2½ hours, using a 24 Combination K Alundum wheel.

The time saved by grinding these large rolls is over 50 per cent., and in some cases rolls are now ground up in hours that previously took the same number of days to produce in a lathe.

The following are grinding times on three rolls:—

34-in. dia. by 90-in. chilled iron roll, 3-32-in. removed from dia. in 2 hours 45 minutes.

21-in. dia. by 90-in. chilled iron roll, 1-16-in. removed from dia. in 2 hours.

27-in. dia. by 24-in. chilled iron roll, 1-16-in. removed from dia. in 1 hour 20 minutes.

The following are some comparisons of the times taken to grind a chilled iron roll from the black, and to turn a similar roll in a lathe. When comparing the times we must bear in mind that the roll when it comes from the grinding machine is quite finished and ready for use, whereas the turning times given are for turning only; the rolls must be filed and polished afterwards.

Size of Roll	in Lathe	in Grinding M-c
34-in. by 90-in.	12 hours	7 hours
30-in. " 86-in.	24 "	6 "
21-in. " 90-in.	8	5¼ "
27-in. " 36-in.	5 "	2 "
24-in. " 27-in.	3½ "	1¼ "

Note.—The second roll was especially hard and very difficult to turn.

The re-truing of rolls by grinding has a distinct advantage over turning when the journals of the roll have to be trued. The journal can first be trued up, removing a minimum amount of metal to secure a true surface. After this the roll can then be ground up on the face from its own journals, using journal rests. This ensures the concentricity of the roll with its journals.

Recent research has shown that a protective influence against the rusting of steel is exerted by a copper content that would be described by an analyst as a trace. By increasing the copper content from .01 per cent. to .03 per cent. the corrosion is decreased by 30 to 40 per cent. Steel, with a considerable excess of sulphur, can be protected by a copper percentage of .15.

The total production of radium in the United States up to the close of 1918 has been estimated at approximately 55 grammes, which is understood to be more than half of all the radium the world has produced. From recent survey work it is concluded that the carnotite of Colorado and Utah may yield at least 500 grammes.

It was stated by Professor J. C. McLennan, in an address to the Special Committee of the Canadian House of Commons on Scientific Research, that out of a possible 19 million horse-power obtainable from water power in Canada, 2,305,000 horse-power had already been developed, and it would not be long before a further one million horse-power would be available.

Shells of various calibre have proved by experiments to have considerable commercial possibilities. The steel of which they are made is in many cases capable of being rendered glass hard, and milling cutters have been produced which have stood the most exacting tests. After a little manipulation on a lathe an 18-pounder shell, minus nose and copper rotating band, makes an excellent shafting coupler. The 6 in. shell is readily convertible into a fine flexible coupling.

ANOTHER CASE FOR THE SAFETY FIRST EXPERT.

WELDING AND CUTTING

Welding, Its Relation to Repair Industry*

By L. CEMPBELL, JR.†

THE fusion of metal is usually termed welding. There are four general classifications which might be made of welding in general: the forge; the oxy-acetylene or other gas processes; the electric arc, and the Thermit method. All these methods are used extensively, and while at first glance they might seem to overlap, in reality, at the present time, each has its own field. To attempt a discussion of all welding methods would require considerable time, consequently we will limit ourselves to the oxy-acetylene process, unless there are questions bearing upon the other questions which may arise.

Acetylene gas, when burned with a proper portion of oxygen gas, produces an extremely hot flame, in fact the hottest flame known. Its temperature is over 6,000 degrees Fahrenheit. With this flame it is possible to bring any of the so-called commercial metals, namely: cast iron, steel, copper, and aluminum, to a molten state and cause a fusion of two pieces of like metals in such a manner that point of fusion will very closely approach the strength of the metal fused. If more metal of like nature is added, the union is made even stronger than the original. This method is called oxy-acetylene welding and differs from what the average layman considers welding in the blacksmith's forge, in so much that there is no blow struck to assist fusion in this process. And while the forge method is limited to wrought iron and steel which is detachable and of restricted size and shape, the oxy-acetylene process has, practically speaking, no such limitations.

As a manufacturing process a wide field opens up, but as we are limited in our discussion to the repair industry, we will merely hesitate to mention that on the Liberty motors, with which you are all undoubtedly familiar, there were 87 feet of welding, most of which was fusing cast iron to steel. As a repairing agent, the welding torch has no rival. Whether it is a casting iron, steel, brass, or aluminum that has broken; a boiler or tank that has worn away in spots, or an error on the part of engineer, foundryman or machinist, the part can generally be reclaimed and made stronger than originally. To-day practically no manufacturing concern that is dependent upon metallic machinery could think of being deprived of its oxy-acetylene apparatus, once having learned its worth. In the not far distant past, were a gear or some casting to break, it probably meant closing down the entire plant until a new part could be obtained, which, whether the source of supply was near or at a long distance, would mean costly delay. With oxy-acetylene equipment and an efficient operator on hand, almost every emergency is provided for.

If an automobile owner breaks a frame, he does not consider replacing it with a new one, as the labor alone for stripping his machine and setting it up again, not to mention the cost of the new frame and the time required for this operation, is prohibitive. Rather, he has his car taken to the nearest welder or his portable apparatus to the car and the job is completed within thirty or forty minutes, with the frame at the point of the break made stronger than ever. Locomotive frames are handled in much the same manner, only more time is required and perhaps extra operators, but the important point to be brought out is the fact that on many jobs no dismantling is required and the repair is permanently and quickly executed.

For service in the field on tractors, trucks and other automotive machinery a large percentage of the trouble is occasioned by the loosening of rivets which permits undue strains upon the transmission, the motor and other working parts. The welding torch permits a concentrated flame being played upon the loose rivets and a hot riveted joint being made. For brazing, pouring bearings, straightening bent members, welding water jackets of motors that have been frozen and many other parts too numerous to mention, the welding torch plays a very important part.

For salvaging, from the experimental laboratory right down through the entire factory, the welding arch eliminates costly delays. If a casting has been improperly designed and falls short of certain measurements additional metal may be added, lugs built up, and many other parts, which eliminates new patterns being made and the time lost while awaiting for new castings. In the factory, machinists' errors may be corrected, for if holes are drilled in the wrong place they may be filled up and drilled correctly. Broken taps and drills can be quickly removed, and many other applications found by the wide-awake engineer.

Why then, since every emergency is practically provided for, should replacement parts be kept on hand? Lack of efficient operators, is the answer. In turn, we ask why should good operators be lacking? This trouble is due, no doubt, because no means has been provided for the education of welders, and the inability to test a piece that has been welded.

It is surprising to learn how many good men have condemned the entire oxy-acetylene welding process, simply because some careless operators have turned out very poor pieces of work. Perhaps, righteously so, from their standpoint, but we do not think we are overstepping our bounds in estimating that 75 per cent. of those who claim to be welders are truly nothing more or less than "plasterers" who add metal without any thought of fusing.

How can welds be tested? Directly we are aware of no general rule for testing each particular weld, but this fact should not prevent our learning the skill of the operator. It is quite a simple matter to provide a welder with test bars of the metal generally worked, and have him fuse these bars from one side only. As soon as cold, they can be sawed through the weld and an etching acid applied, or a more simple method is to break the bar through the weld and on an anvil, and inspect the fracture. If a good clean break presents itself and the crystals are uniform, it is reasonable to suppose that this operator knows how to fuse that metal and can be trusted to make similar welds. It is appalling to learn how few are concerned enough with the skill of their operators to test their results. If more care were exercised along these lines, both the welders themselves and the overseers would benefit the industry as a whole.

The oxy-acetylene process of welding presents a very valuable means of making repairs and general salvaging, but in

*Read before Society of Automotive Engineers, Minneapolis.

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order to obtain the greatest efficiency it is absolutely essential that the operator be educated, first, to know his tools; second, to be able to distinguish one metal from the other; third, to be able to fuse thoroughly the metals he is called upon to weld, and, fourth, a general knowledge of contraction and expansion of metals where heat is applied.

Welding, Its Relation to Repair Industry

Welding apparatus in general consists of two regulators equipped with pressure gauges, two lengths of hose, and a welding torch. The regulators are attached to cylinders of acetylene and oxygen and are used to reduce and maintain a uniform pressure of these gases for use at the torch. The gases at reduced pressure are conveyed to the high-pressure gauge to indicate the contents of the cylinder, and also a line of working-pressure gauge to show the gas pressure on each hose. When the gases reach the torch they are there mixed and combustion takes place at the welding tip, which is fited to the torch. Such an apparatus is called portable, on account of its movability. There are other equipments wherein one or both of the gases are generated, but these will not be discussed here.

There are many small apertures in both the welding torch and the regulators which are required to be kept perfectly clean. The regulators, especially, have many sensitive parts which are constantly subject to much abuse. On the oxygen regulator, a pressure of 2,000 lbs. when suddenly opened against a small seat causes considerable trouble unless all passageways are kept clean. When the cylinders containing gas have been left out in the rain or storm, it is not an uncommon thing to find dust or rust accumulated in the cylinder valve. This should be all blown out before the regulator is attached to the cylinder, to prevent this foreign matter being carried into the regulator. But there are very few operators, indeed, who observe this practice. To thoroughly appreciate and treat the welding apparatus with respect, it is quite necessary that the welder become acquainted with the tools he works with, so he can make them function properly and real efficiency can be expected.

In the past "flash-backs" were not an uncommon thing, and they caused much loss of time, gas, and inferior welds, but they are now a thing of the past with modern apparatus. We have found that "flash-backs" are caused by an improper mixture of the gases, which increases the rate of flame propagation to such an extent that the flame will flash back to the mixing chamber. Acetylene in a pure state will burn very much slower than when mixed with equal parts of oxygen. When more oxygen is introduced the flame propagation is much greater, so that when an excess of oxygen is used, there is bound to be considerable trouble from backflashing. When sufficient acetylene is introduced to the mixing chamber, there is absolutely no chance for this lean mixture to occur. If the flame flashes back to the mixing chamber, both gases should be closed off immediately, at the torch, the oxygen first, and then the acetylene gas.

In some torches the heating of the mixing chamber will cause a flash-back and with these it is necessary to shut off the acetylene and leave the oxygen valve just cracked and immerse the torch head in water, dipping it slowly, so as not to cause too great a strain. The oxygen will bubble out and prevent the water backing up in the tip. If the flash-back deposits enough soot on the inside of the tip and the head to impair the working quality of the torch, the soot should be removed by using a soft wire, preferably of copper, or some other material which will not mar the tip.

In order to know how to weld, it is quite imperative that the operator first know the kind of metal he is to work on. It is surprising to find how few welders know their metals thoroughly.

The Difference in Metals

There are many operators who have trouble in distinguishing such metals as cast iron from malleable iron and cast steel and as each of these metals require a different "filler rod" it is quite necessary that their nature be determined before hand. An incident might be cited where some welders depend upon the sparks given off by the emery wheel in determining the kind of metal they are about to weld. They will approach the wheel; grind off their work, noting the sparks; return to their welding table; choose their filler-rods and do their welding without any delay whatsoever, much to the consternation of their fellow workers. There are four simple ways in common use to distinguish between cast iron malleable iron, cast iron and steel; they are: By casting the cross-section of a fresh break, by application of the welding torch, by the sparks given off when applied to the emery wheel and by the chisel test.

Externally cast iron usually has some sand on its surface and its cross-section shows the grain to be fine, even, and to have a dull grayish color. The surface of malleable iron contains no sand and its grain is very fine, such as cast iron, but slightly darker in color. A very fine steel veneer is on all surfaces of malleable iron, which is much lighter in color. When the welding torch is applied to malleable iron a bright spark is thrown off which breaks in falling, showing that the outside material is steel. Those sparks soon cease and the metal which is molten is covered by a heavy oxide or skin which recedes or draws away from the flame slightly, showing a very porous castiron interior. When brought in contact with the emery wheel steel sparks, which are very luminous and break in falling, are given off first in the case of malleable iron, but they soon change to the dull red spark of cast iron. When a chisel is applied to cast iron, the iron chips off; when applied to malleable irons the edge will curl up, then chip off when the cast iron is reached. The cross-section of cast steel shows a bright, coarse, silvery gray grain. When the torch is applied a distinctively steel spark, which is luminous and breaks in falling, is thrown off. When applied to the emery wheel steel sparks are thrown off; when the edge is chipped by a chisel it will curl up.

The metal in the filler-rod should be the same in practically all cases as the metal to be welded. There are few exceptions to this rule, but the principal one is that of malleable iron. The cast iron in the rods is of a very good grade and generally much better than the piece to be worked upon. To permit the ready flow of the rod and eliminate oxidation, as much as possible, three per cent. of silica is used on the casting of filler-rods for cast iron welding. Piston rings and other scrap iron should not be used for filler-rods, as they contain many impurities such as core-sand, dirt, grease, etc., which will ruin the weld. It is disheartening to see some operator attempt to economize on the filler-rod. It is not an uncommon sight to see several dollars' worth of gas and the same amount of the welder's time. together with a few cents' worth of filler rods all lost, and the operator's reputation ruined. This because an attempt is made to save the few cents involved in the filler-rods by substituting a rod of a very poor grade.

A flux is not used, as many suppose, to cement the filler-rod to the metal. It is used purely as a cleaning agent and may be likened to the acid used in soldering. It does not act on the metal until the latter has reached the melting-point, but then it starts to break up the oxides and clean the surface. This action permits the metal to flow together more readily. A cast iron flux is always used in welding cast iron, to break up the oxide, because the cast iron itself will melt before the oxide and no matter how hot the metal is it will not flow together as long as this oxide is present.

To obtain the best results, reliable fluxes should always be used. The flux is generally applied by means of the filler-rod. One end is heated and dipped in the flux; enough will adhere to break up part of the oxides, on the ordinary-sized job. The flux is carried to the work, which should be at the melting-point and introduced between the flame and the metal. Oxides will break up immediately and the metal will flow together, but it must be remembered that the flux has no action on cold or moderately heated metals. The flux, as has been explained, is used to clean the metal and break up the oxides. To the oft-repeated question, how often should the flux be applied, answer is made as follows: As often as it is necessary to clean up the metal and break up the oxides. All fluxes should be kept in air-tight containers when not in use, to keep their chemical contents in the very best

condition and it is best to use only a small quantity of flux on the welding table at one time.

As we stated before, oxy-acetylene welding is purely a fusing process and the most important points to remember in executing a weld are to eliminate the entire crack in the fracture and to add the filler-rod without changing the character of the metal. On thin pieces of metal it is possible to depend upon the force of the flame to entirely penetrate to the depth of the crack, but on work three-eighths of an inch thick or over, it is well to "V" out or remove some of the surface metal around the crack in order to get down to the bottom. By "V-ing" we mean to chip or grind off each edge at an angle of approximately 45 degrees, so that the opening will form an angle of 90 degrees where the two pieces come together, with the crack at the bottom portion of the "V." This should not be ground down to a knife edge, for it will readily burn up. It is preferable to leave about one-eighth inch along the line in order that the pieces will fit together and the proper alignment may be obtained. If two pieces of cast iron have been prepared in this manner the neutral flame of the welding torch is brought down in such a manner that the tip of the cone just licks the metal. The heat is not applied directly to the line of weld to start with, but rather to the surrounding part. This is done in order to get the entire locality in a condition which will not withdraw too much of the heat from the line of the weld, once the fusing is begun. If it is found that the tip will not produce enough heat to bring the metal to a red heat in a fairly short time, a larger tip should be used.

No Rule Possible

No set rule can be given as to the sized tip to be used on various kinds of metal. It will largely depend upon the welder's ability and judgment. When the metal is brought to red-heat, the neutral flame or cone is brought into contact with the lowest portion of the "V" and held there until it is seen that the metal is melted on both sides. The filler-rod, which has previously been heated at one end and dipped into the flux so that an amount adheres to the end of the rod, then carries this flux to that portion of the weld which is under way. Enough flux is blown off the rod into the weld to clean up the surface and permit the metal flowing together. The crack should be melted together all along before any additional metal is added, for the elimination of the crack is extremely important. It might be noted that as soon as the metal begins to flow freely the neutral flame should be raised a short distance from the work in order to better control the molten metal. In order to build up the metal to the original state along the line of weld or perhaps reinforce it, the sides and bottom of this "V-ed" out part are then brought to a molten state and held there while the filler-rod which brings up more flux is stirred into this metal and the end melted off. In this way the flame does not come in direct contact with the filler-rod and is used only to keep the metal in a molten condition. As much of the filler-rod can be melted off as is thought necessary to bring the weld to the normal condition of the metal or an additional reinforcement can be built up, if it is thought advisable. If care is taken in the above procedure, many of the blow holes and hard spots in the weld will be eliminated, for any impurities that might gather will be displaced by the melted metal and will float to the top. In cooling a weld of this kind, care should be taken not to permit any sudden chilling, for this will tend to harden the weld. It is best to cool it slowly by burying it in slack lime, ashes, or wrap it with asbestos paper to keep the air from it as much as possible.

There may be a great many causes for blow holes and hard spots in the weld, but probably they can all be traced directly to the lack of heat. It must be remembered that welding is a fusing process and heat is absolutely essential. Therefore, it should not be used sparingly. Welders who would not think of throwing a cast iron weld into cold water for fear of chilling the metal can be found lining up their work on large metal slabs or face plates and making the weld in this position. The large body of metal conducts the heat away from the weld and cools it very rapidly, causing it to be chilled, and there is no wonder why the weld is hard and brittle if this method is used.

The application of heat always caused expansion. There are no exceptions to this rule, likewise upon cooling the metal there will be a contraction. Outside of the actual welding, that is, the fusing of the metal into a homogeneous mass, perhaps the greatest problem that the welder has to confront is the expansion and contraction of his metals. Whenever the ends of two pieces of metal which are to be welded are free to move, or even one end, there will be no difficulty encountered with contraction and expansion, but if those ends are continued, it is an entirely different problem. In the latter instance, preheating is necessary to reduce the expansion to a minimum when the welding flame is applied. Whether the entire piece is to be preheated, or only one number, depends largely upon the nature of the work.

In the case of repairs the matter of costs plays a very important part. Many times the cost is a very small matter, but in other instances may exceed the cost of a replacement part. But if no part is available it may be worth while to weld it. In computing costs, conditions will naturally vary in different shops. In some cases where the parts are heavy they will be preheated and naturally will require less gas and time to weld them if they had not been so created. The time of the welder, the amount of gas and material used, added to the overhead, forms a basis for figuring costs. The amount of gas used on each job where individual cylinders are used can be determined from the gauge on the oxygen regulator, if a chart is obtained from the manufacturers of the apparatus showing the ratio of the oxygen consumption to that of the acetylene. This ratio varies for apparatus of different types.

In acetylene cylinders an absorbent called acetone is generally used, which gives up the gas as required. A full cylinder can be used for some time without any noticeable difference in the gauge reading, and then as it nears the empty point the gauge reading will drop very perceptibly. It is therefore impossible to depend upon a high-pressure acetylene gauge as an index to the contents of the cylinder. The only method known to correctly check the amount of acetylene gas on hand is to weigh the cylinder. There are 14½ cubic feet of acetylene gas to the pound, and when the net weight of the cylinder is given the contents can readily be figured. A tag bearing the net weight or figures which will permit this computation is generally found attached to each acetylene cylinder. In the case of oxygen cylinders, there being no absorbent used, the contents of the cylinder is indicated on the high-pressure gauge. On the latest type gauge the contents will be shown by cubic feet, by pounds pressure and by atmospheric pressure, to facilitate the computation of costs by the operator.

It may appear strange that so much emphasis has been made upon "fusion" in this talk on repairing, but really this is the keynote for successful welding, and without it, permanent repairs cannot be anticipated. The method of testing the operator's skill which we have referred to is quite a simple matter, yet one which is overlooked and has been the cause of much careless and ignorant applications in the oxy-acetylene industry. During the world's war we were called upon by the Ordnance Department of the army to establish schools and train welders for the various departments of the service. During this time, approximately 2,000 men were trained, averaging about 20 test welds per student.

In personally inspecting these 40,000 odd test welds a very good idea was obtained as to the ability of the operators who composed the classes, many of whom were men who had had considerable experience in civilian life. It is with this condition still in mind that we are trying so hard to emphasize the importance of through fusion. With proper training the results are most gratifying and it certainly behooves those dealing with, and depending upon, machinery and metal parts to-day, to give due time and consideration to the oxy-acetylene welding process and the operators who are called upon to do the work.

DEVELOPMENTS IN SHOP EQUIPMENT

THE MULTI-GRADUATED PRECISION GRINDER

The Precision & Thread Grinder Manufacturing Company, 1932 Arch Street, Philadelphia, Pa., are demonstrating improved grinding equipments, comprising several attachments, which can be used in conunction with any machine tool capable of use on a variety of work, and particularly adapted for thread grinding on lathes.

The grinder attachment, as shown in illustration, is a right-handed attachment for use in front of the lathe centre.

A noticeable improvement is the new style wheel truing arm, which is now attached to the base of the grinder in such wise that the thread angle is dressed on the wheel on a plane with the axis of the work centres, this producing a perfect formed thread. It also has positioning pins for quickly locating the angles for "V," U. S. and Whitworth threads.

This concern also makes a similar machine which is identical in all respects with the one exception that they face in opposite direction.

The grinding spindle is carried in five precision ball bearings, adjustable for radial wear and end thrust play, and are protected from abrasive dust by felt-lined steel bushings. The spindle housing carrying these also has an oil reservoir, and the bearings are always in perfect lubrication.

This style of spindle bearing precludes the possibility of the spindle being brought out of original alignment by taking up adjustments, as in the case of solid bearings. It is guaranteed that no heating and expansion of the spindle lengthwise will result.

The base and the spindle housing are proportionately massive and of solid construction to absorb vibration and eliminate chatter marks from the finished surface.

The spindle housing fulcrums in a vertical traverse plate and is indexed with graduations for setting to any angular inclination to conform to the helix angle of the thread.

Means are provided for raising and lowering the traverse plate to bring the wheel centre into alignment with the work centre. The spindle housing is provided with a longitudinal feed traverse, for bringing the wheel into lead with the thread, and also to shift the cut of the wheel during the grinding operation in cases of irregular distortion, in order to clean up the surfaces in all cases, without the need of leaving a lot of oversize stock on for grinding.

The wheel truing arm, which carries the truing device, is provided with vertical graduations corresponding to the angular graduations which facilitates the setting on of the wheel truing arm to always bring the diamond into correct centre into the wheel. The arm is instantly detachable after truing the wheel, by means of a breech lock screw. The truing device has a graduated base for obtaining any angular setting, in addition to the locating pins before mentioned.

The machine is equipped with individual motors of any specified voltage, and either direct or alternating current, sufficiently powerful for heavy duty work. This arrangement permits of always having the proper speed for the wheels. The motors are balanced to preclude vibration.

An outstanding new feature is the power transmission system, which is accomplished by an endless belt, which has a three-point contact with both the driving and driven pulleys and then travels over a compensating two-pulley arrangement, which automatically keeps it at the proper tension to prevent slippage and at the same time slack enough to prevent loss of power and heating.

The capacity of the machine is limited only by the size of the lathe it is attached.

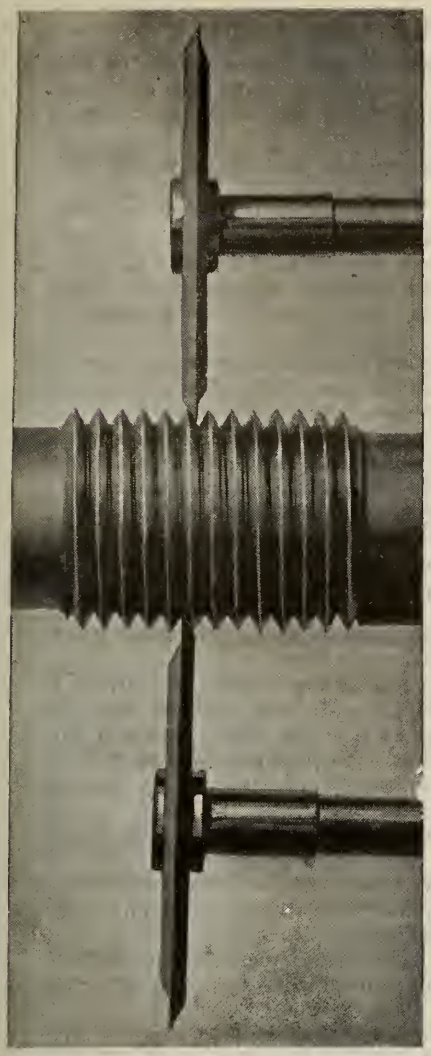
The regular equipment includes a full assortment of wheels, diamond, motor, chart showing angular setting of various pitches and diameters, and wheel adaptors.

Duplex Thread Grinder

This arrangement has been originated to meet the need of production grinding of screw thread surfaces on a commercial basis—such as taps, chasers, thread moulds, and rolling dies for threads, and a great saving results where duplicate sets of thread gauges are required.

By this arrangement a large lot of duplicate pieces may be rapidly ground, as after the setting of the wheels on the first piece of the lot, the setting of the wheels is not disturbed thereafter, but the following parts are brought into lead

GENERAL VIEW OF GRINDER



SHOWING WHEELS GRINDING THREAD.

with the wheels by means of an adjustable rotating lathe dog.

The wheels are beveled on one side only as shown in Fig. 2. Each wheel grinds only on one side of the thread angle and on the root of the thread. Also each wheel grinds on an opposite side of the angle to the other wheel. Both wheels grind on the root of the thread simultaneously. This is especially valuable in getting the sharp bottom in a "V" form of thread, there being no included angle point to wear away. The wheels do not require redressing, the effect being the same as flat grinding with a straight wheel.

A very important advantage is that very heavy cuts may be taken, without resultant heat of friction, as is the case in grinding included angles. The fact of one side of the wheel being free and without bearing surface against the part allows the wheel on very heavy cuts across irregular or distorted surfaces to maintain the correct angle on its beveled and working side, for in case there is too much distortion to remove in the first cut, the wheel is made with sufficient elasticity to slightly spring toward the free side. There being less cause for this spring on each subsequent cut across the thread, the high, distorted and untrue surfaces are soon brought down, without the wheel losing its correct angle on the bevelled side.

This arrangement requires the use of both type machines in combination.

TOOTH ADJUSTMENT FOR INSERTED TOOTH SAW BLADES

A new arrangement for adjusting the teeth of their inserted tooth saw blades to the proper distance from the centre of the blade has been developed by the Hunter Saw & Machine Company, Pittsburgh, Penna.

The high speed steel teeth are supported by hex head heat treated steel screws (see illustration) and half round removable steel nuts embedded in the body of the saw blade. A milled tongue in the semi-circular nut pocket fitting into a groove in the nut holds the nut firmly in place and prevents any side movement. A clearance hole drilled into the body of the saw blade at the bottom of the nut pocket just large enough for the screw, serves as a receptacle for that portion of the screw projecting through the nut when the tooth is set in its lowest position.

The arrangement permits the adjustment of one or more teeth independently of the others. As all teeth will not wear alike, it may become necessary at times to remove one or more teeth for regrinding, or a particle may break from the cutting point of the tooth, making regrinding or replacement necessary. In either case, the tooth must be readjusted to its proper relative position with the other teeth.

The screws and nuts are easily removed or replaced if either should become damaged or worn through service.

After setting to the proper height, the tooth is securely clamped in position by a grooved hardened steel wedge or key.

The exclusive sales rights in Canada of the Rego welding and cutting outfit and supplies manufactured by the Blastian & Blessing Co., Chicago, have been acquired by the Carter Welding Co., Toronto. The latter company will operate sales and service stations in the cities of Hamilton, Montreal, St. John, N.B., Vancouver, Calgary and Winnipeg, with headquarters in Toronto. Before taking over the rights of the Rego welding outfit the Carter Welding Compnay were sales agents in Canada for the Davis Bournonville line of welding and cuting apparatus.

FIRE NOT SERIOUS

The Latrobe Electric Steel Co. had a slight fire at their plant that has been greatly exaggerated in the Pittsburgh papers. The fire was confined to the heat treating department, which was damaged to the extent of about $8,000. This department was not essential to the regular production, and will not interfere with the regular schedule of filling orders. None of the employees will be thrown out of employment.

THE SAW, AND A DETAILED VIEW OF THE TOOTH ADJUSTMENT.

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Being Fair To Them All

THE MOULDERS' UNION of Brantford, in a recent meeting, passed a resolution protesting against the policy of the Brantford *Expositor* in refusing to insert advertising matter in its columns telling of vacancies in other places. The moulders claimed that wages were higher in other places than were being paid in Brantford, and that by refusing to publish these advertisements the paper was discriminating against the Brantford workers.

There is nothing particularly new in this case. The real motive behind the action of a paper in such a case is that it does not want to place the local manufacturers at a disadvantage. It believes, and rightly so, that its own city is as good as any on the map, and that if wages are a little higher elsewhere, living expenses will keep pace. In this latter assumption the paper is also correct.

When the labor market is scanned just now it would appear that taking men from one city to another is simply taking worries and troubles from one shop to another. A number of firms that never turn out apprentices are always very willing to grab off all the finished men any other factory may turn out.

Although there is much to be said on both sides of the question, any paper is within its rights in refusing to accept advertising that it considers will harm the best interests of the community. We doubt very much if any mechanic can better his position very much just now under present conditions by moving from one place to another unless he has a promotion in sight.

At other times such a policy on the part of a paper would be wrong. There might be work in one place and not in another. In such conditions, the paper would be doing the men an injustice by keeping this information out of print.

Doctoring Our Lignite

CANADA has had enough coal experience in the past two or three years to make the nation stop and think. The trouble with these stopping and thinking seasons is that they are brief and evaporative.

When we are up against the real thing we stop and think and promise.

When the real thing has been removed, we at once forget about the stop-think-and-promise session.

That is what happens to the average Canadian in regard to the coal supply of this country. As soon as he gets a supply, or as soon as his fire is out for the summer, he proceeds to forget it.

The industrial section of Canada is more apt to remember the problem, and for this reason should appreciate the work that is being undertaken by the Lignite Utilization Board of Canada. Industrial sections are interested in domestic fuel as well as in power and heating provision. If the employees can get only a little coal, and pay a very high price, they are going to be dissatisfied and the firm employing them suffers.

The Lignite Board for the present is chiefly concerned with the deposits of lignite in Saskatchewan and Alberta, although Saskatchewan would be the more strategic point from which to work, either east or west. The order creating the board says in part:

"That by carbonizing this lignite, a coke or charcoal is obtained which briquettes readily and, without consideration of the by-products such as oil, pitch, ammonia sulphate, gas, etc., the result is to turn two tons of inferior fuel into one ton of briquettes approximating, in heating value, anthracite coal with practically the same heating value in the domestic furnace as the two tons from which it was made."

A study of machinery, processes, etc., for briquetting this coal is being made, and the matter of using any other by-products will be considered.

Western Canada has heretofore imported about 500,000 tons of anthracite from Pennsylvania at a cost of about $5,000,000 per annum.

Canada's coal resources are greater than those of any country in the world, with the exception of the United States. Much of Canada's coal, however, requires treatment before being available for satisfactory domestic use.

It is expected that a successful outcome of the development undertaken by the board will result in the establishment of an industry of national importance.

Where is the Weakness?

IT IS a widely known fact that some manufactured products cannot be obtained outside of a particular locality, of the same degree of excellence as in that favored spot.

Various reasons are given for this variation of quality, ranging from the difference of climate to the lack of skill of the operators. It is notable that even with the same appliances and the same men, certain woollens cannot be manufactured on this continent as they are in England or Scotland. The same is true of certain brands of mineral waters, and very true of that much discussed fluid, beer.

However, one would think that such a thing as cast iron would not be affected by little delicacies of manipulation or environment. Chemists can tell us just what properties a certain proportion of the various pig irons will possess when melted together and poured in a casting. Take marine engine cylinders, for instance. The quality required is hard, close-grained iron. The experience of generations of cylinder makers is available. Stationary cylinders have been produced in Canada for years. When the necessity arose to make marine cylinders considerable trouble was encountered, and it is a fairly well known fact that the cylinders which were made and delivered have suffered from certain weaknesses, which have involved costly repairs and replacements. Just across the line they seem to avoid these difficulties. Where is the secret? Can any of our founders explain this question?

HE FOUND THE GARAGE BUSINESS ALL RIGHT

Thinks the Public Have Confidence in Bringing Business to the Machine Shop for Attention

WHY SHOULD the machine shop, especially in the smaller cities and towns, get a larger share of the automobile repair business? It requires only a little thinking to see that this is a good line, and one that is growing. A new lot of people are buying cars every year. They know little or nothing about the mechanical details of the car. They know how to start the engine, stop it and steer the car. When anything goes wrong they may figure away at the instruction book, but as a general thing it will be found that many of them want to buy some real mechanical service.

The garage men have picked off most of this business, but why should not the machine shops, equipped for the purpose, keep things coming their way? The standard of the work done in the average garage, from the mechanical standpoint, is poor.

CANADIAN MACHINERY discussed the matter with the proprietor of a machine shop in a town of about 6,000 in Ontario, and found that this man had found a good line of business in the automobile. Here is part of his experience:

"When cars started to become quite common in our town the business of repairing them was attended to by the local garage, and afterward by the garages, as they increased. Where there was any work required of a fine nature, or where good mechanical sense had to be used, they brought it over to me, and I charged my usual rates for the work. A little inquiry showed that the price charged to the car owner was about double what I was charging the garage men. I talked the matter over with a couple of men in the shop, both of whom were good mechanics, and we decided that it would be good business to go ahead and make a bid for this work direct.

"Well, we took a part of the shop that opened right out on the street, but which had been used for storage and junk in general. This was cleared out, and a big double door put in. The thing was planned so that the car being repaired would be right next the machine shop. We got this ready and obtained a list of all the automobile owners in the town and country. Our announcements were sent to all these people, and a couple of weeks later we followed this with another letter, at the same time doing some advertising in the town paper. We made it a point to state that an automobile engine, the transmission, ignition, etc., was a fine and well-adjusted piece of mechanism, and should, when in need of repair, be entrusted to men who had made a life study of the mechanical field.

"It wasn't over three weeks before we were approached with the idea of taking the agency for a car that had not been introduced very well in that district. Of course this did not seem to fit in with the work of running a machine shop and foundry, but we went ahead. I put one of my own men in charge of the agency, and stocked a lot of supplies. I am not going to give you any figures as to what we are doing between machine shop, foundry, garage and agency, but I sometimes wonder which of these friends is the best to me. They are all busy, and they all make money for us. You can pass this along to others who may be in similar positions. They will find what we found, that the general public has confidence in the machine shop to undertake the making of repairs on their cars. There is a feeling that the machine shop ought to know, and the machine shop ought to know enough to capitalize on this. The garage business is good now, and it lines up with what a mechanic knows. "Look into it" is my advice."

The Smallest Screw Made

DURING wartime we heard much of working to fine dimensions. People who used to romp around the shop with a foot rule and measure eighth-inches only in a pinch began to think and measure in terms of thousandths.

A writer in a current magazine speaks of the smallest screw used in the smallest watch made in this country.

Now put down your monkey wrench, screwdriver, hammer and can opener, step over and hear what is said about this screw:

It might be possible, under some conditions, to hear the proverbial pin drop, but no ear could catch the sound of the dropping of one of these screws.

The screw can be definitely seen only with the imagination or a watchmaker's glass. This tiny screw is of brass, of the following dimensions:

Total length, 28 thousandths of an inch.
Diameter of head, 26 thousandths of an inch.
Diameter of the thread, 12 thousandths of an inch.
Number of threads per inch, 360.
Weight, 12 thousandths of a grain.
It takes 583,333 of the screws to make a pound.

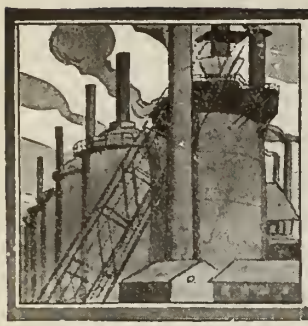
The machines for producing these screws are different in design from any other screw machine that is known of. They are of a positive cam action type and have proved very satisfactory to their users.

There is but one chuck to a machine of this type and a single piece of stock is used. These machines are so accurately made and the parts so closely fitted together that it is necessary for them to be warmed up in order that the oil may work in all of the bearings before they start to produce. Otherwise they would not operate.

The machine is belt-driven. Compressed air is used on these machines for the purpose of forcing oil to the different parts of the machine and also to blow out the finished work after it has been cut off. These machines are electrically controlled and are so arranged that they stop whenever the stock is used up or the finished screw not blown out of the machine.

MEN will continue to demand more wages as long as prices continue to increase. Tacking on more to the prices of things men must buy to support their families is one sure and certain way of trumpeting to them to formulate new wage demands.

The Vacant Chair



MARKET DEVELOPMENTS

Big Volume of Business in Many Lines Now

Some of the Makers Are Facing Peculiar Situations Trying to Keep Up With Supplies at Prices They Have Named to Their Distributors. Prices Continue at Very High Level

KEEPING up with the prices is providing a merry time for a good many lines of business in either steel, iron or machinery. There is a much larger volume of trade moving now than a year ago in many of these lines, and this is bringing new problems never encountered before. Here is a case in point: A large Toronto distributor has been in the habit of sending about $4,000 a month in business to a certain maker of pulleys. This year there has been an enormous demand for this line of equipment, and business has been going forward at the rate of something nearer $20,000 per month. The maker of the pulleys had based his 1920 business on the 1919 and allowed for a very slight increase. His contracts for material were placed accordingly. Now that he has to go into the markets again over and above his contracted amounts he comes into contact with new peak prices, and on these he cannot produce to sell at a price named by the distributors who have sent him the business. There are several cases of this. It is the result of firms trying to be careful in their purchases of material in a season when it is very hard to be careful and busy at the same time.

Supplies are moving out very rapidly, with prices firm. Nothing better can be said for the supply of steel and iron coming to this country. Much of the steel is from the premium mills and brokers, and of course the price is fairly high.

Several dealers from this district have been in the United States machine tool districts during the past few days. From reports there they can see nothing much better in sight in the way of deliveries or lowered prices. There are several lines that are now selling at from 18 to 20 per cent. above the high prices that were asked during the war, and yet the state of trade is good enough to make it a fact that delivery and not price is still the deciding factor in the business.

The scrap metal market continues uninteresting. There is very little business moving.

OPENING OF SHIPPING IS EXPECTED TO MAKE DIFFERENCE

Special to CANADIAN MACHINERY.

MONTREAL, Que., April 8.—With the gradual clearing away of winter conditions that have generally interfered with the transportation problems of the railroads, the prospects for betterment of trade are more encouraging.

Dealers here are more hopeful regarding the early improvement in delivery of materials. Circumstances are shaping toward the point when operations throughout the industrial world will take on a more normal note and where trading will be carried on with less uncertainty than has been experienced during the past six months. It is anticipated that the opening of navigation, which is generally looked for in a couple of weeks, will provide some relief to shipping, so that railroads will be in a better position to adjust the car conditions, the chief factor that prevents a speedy return to normal operations. Reports coming from the States indicate that production in the steel district is steadily increasing and that freer shipments of fuel and raw materials will enable the mills to operate to better advantage from now on. While there appears to be no marked shortage in any one particular line in this district, the difficulty experienced by many consumers in getting material prevents them from carrying out some undertakings that would be attended to if more supplies were forthcoming. Shippers here have been studying the new wharfage rates effective this season, and several meetings have been held with the Harbor Board in an effort to have a revision made in the charges on different commodities. Plate and sheet users are still experiencing some difficulty in getting supplies but are generally able to secure sufficient to maintain normal operations.

Copper Demand Improves

A general rally has apparently developed in the metal market and a relatively strong situation has arisen out of the comparatively dull condition of a week ago. Local demand has shown a slight increase and inquiry indicates a good market during the present month. Copper is moving freely and has regained the strength of a few weeks ago, the past week or so being marked with a dullness that tended to lower prices. Tin has been weak but advances in English markets have prevented a decline in prices here. Other metals are not active, the demand being normal and the prices firm.

Steady Improvement Shown

Business in machine tools has become more settled as a result of the improved exchange conditions, but dealers and users are still experiencing difficulty in getting desired delivery of equipment, particularly where such is wanted promptly. Manufacturers are promising improvement in this regard, as they state that the near future will see relief in many ways. With the winter difficulties passing away and the return of inland water transportation only a question of a few weeks, the pressure on the railroads will be partially removed, and movement of materials proportionately increased. The demand for small lots of machine tools is steady in character and while new tools are largely wanted, the sales of second-hands show little decline over the past few weeks, which were quite extensive. A feature of the present supply market is the increasing quantity of English made goods that many dealers and agents are offering.

It is believed that many British houses are recognizing the advantage of stocking their lines here as consumers are reluctant to depend on delivery dates, even though dealers promise better conditions than exist on some lines from the States.

Scarcity in Steel Scrap

There is still a heavy demand for steel scraps and machine cast iron, and there is little of either to be had. Mills are endeavoring to obtain supplies but dealers are unable to fill the full requirements of many consumers. The non-ferrous market is more normal and the movement is quite regular, but prices are very firm and less subject to change than that of steel or iron scraps, where the irregular supply makes it difficult to quote definite prices.

New Incorporations.—The following companies have been incorporated in Ottawa during the past week: J. Coughlan & Sons, Ltd., shipbuilders, Vancouver, $3,000,000; Max Beauvais, Ltd., tailors and haberdashers, Montreal, $500,000; Wilson, Paterson and Clifford, Ltd., merchants, Montreal, $1,000,000; Dauphin-Earle Co., Toronto, $250,000; United Farmers' Guide, Ltd., Winnipeg, $250,000; Black Star Line of Canada, Ltd., Montreal, $1,000,000; Rite-Bake System Bakeries, Ltd., Toronto, $50,000; Inter-Provincial Clay Products, Ltd., (not stated) $500,000; Trans-Canada Sales and Storage, Ltd. (not stated), $50,000; Franco- Belgic Canadian Syndicate, Ltd. (not stated), $40,000; Regal Kitchens, Ltd., Montreal $50,000; Regal Paper Box Company, Ltd. (not stated), $50,000; Herman Silberman Co., Ltd. (not stated), $49,000; Co-operative Rainproof Garment Co., Granby, Que., $49,000; W. A. Marshall & Co. of Canada, Ltd., Montreal, $25,000.

DOES NOT LOOK LIKE ANY DROP IN PRICES

Market is Still Poorly Supplied—Some Peculiar Turns by the Price Inflation

TORONTO.—There is a certain amount of monotony attached to a week-after-week summary of any market, but it has been especially noticeable in the Toronto markets for some weeks and months now. It seems to make little or no difference whether reference is made to the steel, iron, or machinery market, the same conditions prevail—plenty of orders but a lack of material from which to fill them. It is not a pleasant nor a profitable experience for dealers to have to watch business coming to their desks day after day, only to be turned down or filled in small percentage of the total requirements.

Several dealers from this district have been in the American machine tool centres for the past week or so. They bring back little in the way of encouragement for better deliveries, and certainly nothing at all in the way of lower prices.

POINTS IN WEEK'S MARKETING NOTES

New York reports that there are lines now that sell at from 18 to 20 per cent. above the peak prices that were touched during the war.

—

The inquiry for machine tools which slumped in United States for a month or so is now coming back strong.

—

Canada uses annually about 250,000 tons of galvanized sheets, and of this about 3 per cent. is produced in the country. Shipments from United States are very satisfactory.

—

Small lots of boiler tubes arrived, but they were not a patch on the volume of unfilled orders booked here.

—

Large demand is reported for all lines of small tools and supplies, and the inquiries and orders are coming from a well-distributed list of industries, no one line doing the bulk of the buying.

—

Montreal expects the opening of navigation to do great things in the way of improving the transportation service.

—

The scrap metal market is inactive and dull this week. Little material is coming in, with prices firm and upward for such lines as stove plate, cast iron and heavy melting.

—

Machine tool dealers from this district who have returned to the city from U.S. plants tell of new wage scales being signed giving an increase to thousands of workers. In the light of this, and the present price of raw material, they fail to see any improvement in the selling prices of machine tools.

"While I was in Chicago," stated one of them to CANADIAN MACHINERY, "a new agreement was signed with the mechanics which gave tool makers $1.11 per hour. Others were in proportion, while the rate for helpers was 60 cents per hour. In the face of that I can't see where the talk of cheaper machine tools is going to have anything to stand on."

Several well-known British firms are opening up for the Canadian trade with offices in Toronto. It is understood that they have been assured by the head offices that shipments will be made very shortly for the Canadian trade.

Still a Starved Market

This week's advice from Pittsburgh tells of greater production in the steel mills, but, as stated in these columns before, the dealers here have failed to see any improvement in the deliveries. Galvanized sheets are the worst. Many of the warehouses have none of these in stock, and most of the shipments that are arriving are from the premium operators. The quotations are from 10½ cents per pound, but there are sales made at figures higher than this. Many of the jobbers feel that they would not be justified in quoting definite prices, which might commit other dealers who have to get their supplies as best they can from brokers or premium mills. The Canadian consumption of galvanized sheets, in normal times, is about a quarter of a million tons per year, while there is produced in this country some three per cent. of this amount. The duty has been very light, about 5 per cent. under normal conditions, and it has not appealed to Canadian manufacturers as a good field in which to venture. The result is that we are largely dependent on what we can get from the plants in United States. Some manufacturers are releasing stock that they will not require for some time, and in this way they are helping out the situation to some extent.

Some of the warehouse interests are inclined to hold that the tardy deliveries of the past month have been a blessing in disguise. They claim that the rate of exchange is much more favorable now than it was a few weeks ago, and payments will be made for material received at a much more favorable price.

One Toronto representative left on Wednesday for New York and Pittsburgh to see what could be done in the way of getting tubes over in greater quantities. A car came in last week, of assorted sizes, but that amount was hardly noticed against the orders stacked up for this line, many of them being very insistent and much needed for urgent repair work.

Black sheets from the premium mills are coming in more freely than for some time. They are offered for resale around 9c per pound. There is no trouble disposing of them at this price.

Small Tools and Supplies

Taking the first three months of this year against the corresponding time in 1919 several firms have informed CANADIAN MACHINERY that their business is away ahead this year. They point out that last year at this time there was still a lot of war material in the market, and this was taking something from the regular channels of trade.

Some of the jobbers find themselves in a peculiar position at present. They are trying to keep their stocks fairly low, as they are afraid of taking on large amounts at the present high prices. The demand keeps up so well that they are practically sold out all the time. This

works out in some unforeseen ways. For instance one Toronto firm has sent an average of $4,000 per month to a maker of pulleys but for the first two months this year the amount went to $20,000 per month. Business from other sources also came in on a similar scale and the firm is swamped. They have to buy great quantities of raw material outside and above their contracts, and they are paying a stiff premium in many cases. Against this all the product has been sold at the prices stipulated in their own orders. They could make money up to the estimated business for the year, but anything above that will mean a loss.

Scrap Markets Dull

There is little business being done in the scrap market. Much keener competition is being experienced for any offerings that may come up for disposal, as several large melting interests are out for suitable scrap. The brass and copper section continues weak and uninteresting, while nothing has come up to relieve the shortage in stove plate, heavy melting and cast iron scrap.

NEW YORK TOOL MARKET IN SOME CASES 18 PER CENT. OVER THE WAR PEAK

Special to CANADIAN MACHINERY.

NEW YORK, April 8.—The Eastern machine-tool trade had a good month in March and orders are coming in this month at a fairly good rate. While business slumped somewhat during the first half of March, it picked up during the latter half, and with some sellers was one of the best months they have had since the end of the war.

Prices continue upward and the end is not yet in sight. One Central Western manufacture of turret lathes and screw machines has advanced about 5 per cent., its present prices now being about 18 per cent. higher than the peak reached during the war. Some of the drill manufacturers are selling all drills for forward delivery subject to a possible increase of 10 per cent.

Some of the machine-tool dealers are apprehensive lest high prices tend to injure the machine-tool business seriously. At present buyers are more concerned about deliveries than price. The second-hand tool market is very active, because of the long deliveries on most lines of new tools. Large profits have been made on used tools.

The General Electric Co. continues to be the most prominent machine-tool buyer in the East. This company is buying more or less for all of its plants, but more particularly for the newly acquired Bridgeport, Conn., plant, and the Edison Lamp Works Division at Newark, N.J. It also has inquiries out for the Pittsfield, Mass., plant. Some buying has been done for Lynn, Mass.; Erie, Pa.; and Schenectady, N.Y.

Aside from the General Electric Co., the Van Sicklen Speedometer Co., of Toledo, Ohio, and Newark, N.J., is one of the most active buyers in this market. Inquiries have been issued covering 75 to 100 tools, mostly for the new plant at Newark, but some of the equipment will go to the Toledo plant. Several men formerly associated with the Splitdorf Electrical Co., Newark, N.J., recently became interested in the Van Sicklen Speedometer Co.

Other buyers of the past week include the Nathan Mfg. Co., New York; the Otis Elevator Co., Yonkers, N.Y., and the Federal Shipbuilding Co., Kearney, N.J.

The Norton Co., Worcester, Mass., which has been represented in New York and other Eastern territory for many years by Henry Prentiss & Co., machine tool dealers, New York, will soon sell its grinding machines from its own office.

PREMIUMS ARE STILL HOLDING FOR PROMPT DELIVERIES IN STEEL

Special to CANADIAN MACHINERY.

PITTSBURGH, April 8. — Generally speaking, the iron and steel market has been quiet the past week, even quieter than in the preceding week. Production has continued to increase and is now at a rate not far from what was recently considered the full capacity, but with transportation difficulties and a few minor restrictions to production out of the way still heavier production is in prospect.

Soaring Coke Prices

An exception to the general condition of there being little in iron and steel by way of new developments is the activity in the Connellsville coke market. Government price control had been announced to terminate at the end of March, and this gave the trade an opportunity to arrange transactions for shipment and invoicing April 1 or later. The termination of Government price control ended a number of arrangements that existed between producers and consumers, whereby during the period coke would be shipped and invoiced at the Government price. Also, there were a few regular contracts for coke which had been made for the first quarter of the year only, and these came to an end at the same time as the price control. Thus a considerable tonnage of Connellsville coke was released for sale in the open market, while at the same time a considerable tonnage of consumption became uncovered through the expiration of these contracts or arrangements. The course of the market in the past few days indicates that the consumption needing to be covered was greater than the production needing to be sold, for the initial market transactions were at 50 per cent. over the Government price and then there were sharp advances from this basis.

The Government price limits on Connellsville coke had been $6 for furnace coke and $7 for foundry coke, per net ton at ovens. The initial sales of furnace coke when the open market began were at $9, there being a few odd lots of prompt, a fair sized tonnage for the month of April and a small monthly tonnage for the remaining nine months of the year. There is a report that a scale was made for the second quarter also at $9, but this has not been fully confirmed. The market stood at $9 only for a day or so and then it began to advance sharply. As furnaces were indisposed to pay such high prices for any length of time the trading settled down to April deliveries only, and successively higher prices developed, the market at present being $11 to $12 for furnace and $13 to $14 for foundry, prompt or April delivery. The $12 figure for furnace coke is not an asking price, but has actually been done on no inconsiderable tonnage of coke of good grade.

It is said that certain consumers are not unwilling to pay coke operators what is obviously a very fancy price for coke, as an offset to the coke these consumers received from them during the control period, since coke was regarded as worth more money than the Government limit, this being proved by the contracts that had been made prior to the resumption of control. For the general future, however, it does not seem at all probable that $12 is going to obtain on coke, or even $9. The blast furnaces are able to pay the price, so far as that goes, since they have a large margin on pig iron they have sold at $40 and higher, but there is likely to be a good bit of competition in coke when the by-product ovens are again well supplied with coal. Part of the demand for Connellsville coke in the past few months has been due to the restricted output of the by-product ovens.

Pig Iron

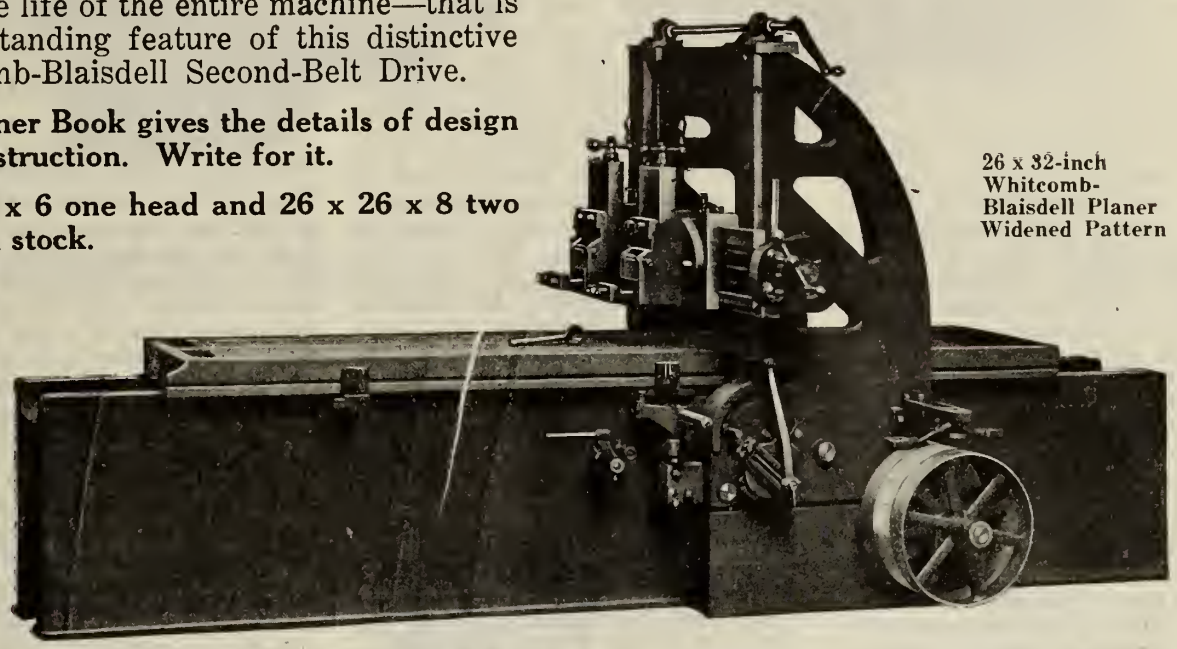
The jump in the coke market stiffened the backbone of the merchant furnacemen, who have been firmer in the matter of pig iron prices in the past few days. Generally speaking, however, there does not seem to be much basis for expecting higher prices for big iron, while there may easily be lower prices in the near future. Present prices are too high for the steel industry, $40 pig iron being quite out of line with prices the steel mills that buy their pig iron are likely to secure for second half, and it must be remembered that a considerable proportion of the pig iron made by the merchant furnaces is sold to steel works. Various odd lots of pig iron are being offered in the market by holders who are not producers and who are not ordinarily engaged in buying and selling pig iron.

The Planer With the Second-Belt Drive

A smooth, easy reverse—which permits higher cutting and return speeds yet prolongs the life of the entire machine—that is the outstanding feature of this distinctive Whitcomb-Blaisdell Second-Belt Drive.

Our Planer Book gives the details of design and construction. Write for it.

24 x 24 x 6 one head and 26 x 26 x 8 two heads in stock.



26 x 32-inch Whitcomb-Blaisdell Planer Widened Pattern

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Acid Electric STEEL CASTINGS

Acid Electric Steel Castings show superior ability to resist wear and crystallization. They are smooth in texture, free from Blow Holes, and machine perfectly. We specialize in

Railroad and Other High Grade Castings

up to 15 tons, any specification. Electric Steel Castings COST NO MORE than ordinary Steel Castings.

Prices on Application—Prompt Deliveries

The Thos. Davidson Mfg. Co., Limited

Steel Foundry Division, Lachine Canal

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Phone Victoria 1492

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The market remains quotable as follows: Bessemer, $42; basic, $41.50; foundry, $42, f.o.b. valley furnaces, freight to Pittsburgh being $1.40.

W. P. Snyder & Company compute each month the average prices of Bessemer and basic iron, by taking all the sales of valley iron reported in lots of 1,000 tons or over, and striking an average of the whole tonnage. Their averages as computed for March are $42 for Bessemer and $41.50 for basic, at valley furnaces, or precisely the figures at which the market has been generally quoted. There had been a contention that sales had been made at $43, but this average, which is semi-official, does not confirm such claims.

It is only three or four months ago that the iron and steel trade was full of talk that the furnaces and mills would not be able to function well for a long time, as if the normal condition of the plants making new output records from time to time, when they had the orders to work on, had been permanently lost, to be succeeded by a condition in which something or other would always be wrong. Production of late has not been justifying such forebodings, but on the contrary has been at such high levels as to make it appear probable that the iron and steel industry will in the near future not merely produce at what was considered its capacity, but at greater rates still, necessitating a revision upwards in the estimates of capacity. While pig iron capacity has hitherto be taken to be 43,000,000 or 40,000,000 tons a year, it may be that output will prove 5 to 10 per cent. above that if demand continues heavy. Steel ingot capacity has been taken at 49,000,000 or 50,000,000 tons a year, but may eventually prove to be about 10 per cent. above that.

Breaking of output records has indeed begun already, not a few plants or departments having done better last month than ever before. The most notable case is that of the National Tube Company (Steel Corporation) whose output in March was the best on record, and not by a small but rather by a large margin. As this company produces about 4 per cent. of all the finished steel of the country, the case is an important one. Thus far, however, breaking of records has been very far from general. April and May are likely to show much more in that direction.

Transactions in steel products have been light all along the line. There is a small but insistent demand in a few quarters for prompt lots, and with offerings so limited the premiums for prompt shipment do not decline very rapidly. The larger mills, that have a policy now of selling quarter by quarter, have not formally opened their books for third quarter, and seem to have found that their customers are not anxious for them to do so, seeing that prices would probably be $10 or $15 a ton above the schedule at which the Steel Corporation continues to sell to regular customers, and for the later deliveries it has to offer.

SHORTAGE OF MATERIAL MAKES IT HARD FOR THE RAILROADS

LONDON, Ont. — A rather striking illustration of the manner in which the acute shortage of materials needed for construction work accentuates the general condition in the whole district is shown at the Grand Trunk car shops here. Under normal conditions between $500,000 and $600,000 worth of timber, nails, steel and iron, paints and similar materials are kept in stock and from $200,000 to $300,000 worth is used up every month. Sometimes two carloads of nails are used in a week in rebuilding cars.

For some time past the supplies have been coming in in such small quantities that it has been impossible to do anything like the usual quota of work. This means that cars which are badly needed for transporting coal and all sorts of merchandise have to lie idle because it is impossible to get the materials with which to rebuild them. Orders for some kinds of nails are as far behind as October. It is impossible to get some lines of steel and iron goods at all.

It is expected, however, that there will be a gradual improvement in shipments of steel and those in charge of the big shops are looking for a steadily growing output of steel cars and a corresponding decrease in the number of wooden cars. The extremely high prices which have to be paid for the high grades of wood required for car construction and the great difficulty in obtaining timber will mean, they say, that it is only a question of time before only small quantities of lumber will be used in buildling cars.

Work will be commenced shortly on reclamation yards here for the Grand Trunk. These will cost approximately $500,000 and it is hoped that by sending in all the wreckage from the entire district that several hundred thousands of dollars will be saved every year. At the present time, if a car is smashed much of the timber in it is burned to get rid of it. The steel and iron work goes to junk dealers, many of whom have been making big profits. Under the new plan, all timber that can be used again will be saved. Iron or steel which cannot again be used for the original purpose will be made into bolts or bars or some other parts instead of buying new ones. Those not in touch with the situation have no appreciation of the number of cars which are either partially or badly wrecked each month or of the large sums required to put this rolling stock again in commission.

CANADIAN STEEL CAN SELL IN JAPAN

Demand Exists and There is Difficulty in Supplying Material at Present

Trade and Commerce Department Bulletin, in a recent issue, says:

Canadian mills should be able to do considerable business with Japanese importers during the present year. Last year the market here was overstocked in a great many lines, owing to the fact that heavy orders had been placed before the armistice, the goods not coming to hand until after the various Allied Governments had lifted all export embargoes. Then, again, Japanese buyers held off buying on account of the high prices, thinking they would decline. As a result stocks are now very low. The building trade was very dull during the past year, contractors thinking the price of steel shapes would drop. Men in the trade now say that there will be a big demand this year for steel shapes, and in fact steel of all kinds. Cargo from the United States has been delayed by three months owing to the recent strikes in that country, so that it is expected supplies will be slow in coming forward. On account of the great demand of their own markets, Japan cannot count on receiving supplies from Europe. There would therefore seem to be a good market here for Canadian steel during the coming year. Several inquiries have recently been received at this office for 12-pound rails, but business cabled to Canadian mills showed that it was impossible to obtain deliveries in the near future.

DEVELOPMENTS IN NEW BRUNSWICK

Preparations are being made by the Canadian Pacific Railway to construct another traffic bridge across the falls at St. John. It will be ready for traffic in 1921.

A new factory for the manufacture of automobile springs is about to be started by J. E. Arrowsmith.

The Corona Candy Company has lately enlarged its chocolate manufacturing premises on Union Street, by the addition of another storey to its plant.

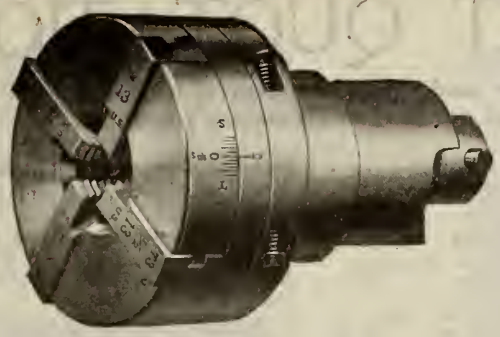
Plans for a new Baptist Church at Moncton to cost $100,000 are being prepared by C. L. Archibald, of St. John.

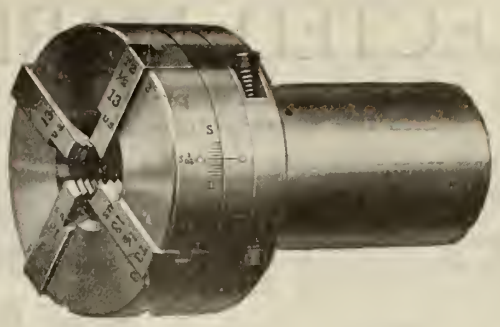
The work on the erection of the two Fraser lumber mills just above Campbellton has been completed.

A potato flour mill to cost $60,000 is to be erected at Woodstock.

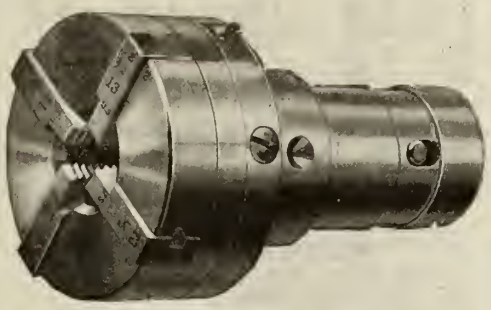
A sawmill for the manufacture of long lumber is to be erected at Kennedy Island, Upper St. John River.

D. W. Clark, manager of the Canadian B. K. Morton Co. of Montreal, will leave for England on the 23rd of the month, in connection with new developments of the company. He will be away about six weeks.





Geometric Solid Adjustable Die Heads



When one uses the word "ONLY," he needs to be sure of what he is talking about. With confidence we use the word in saying that a Geometric Solid Adjustable Die Head, fitted with a set of milled dies, is the only solid die head that will back off without stripping the thread.

Geometric Solid Adjustable Die Heads may be fitted with either a releasing shank, plain shank, or with special shank for the Gridley Automatics. The releasing shank permits the head to disengage from the shank upon completion of the thread. The plain shank fits the head for use on the turret of a lathe or on a live spindle, such as a drill press.

Apart from the fact that it is not equipped with the self-opening feature or the roughing and finishing attachment, the Geometric Solid Adjustable Die Head is the same in principle and construction and will do equally as accurate work as the other styles of Geometric Die Heads.

Whatever the requirements, there is a type of Geometric Die Head best adapted to the work.

THE GEOMETRIC TOOL COMPANY
NEW HAVEN **CONNECTICUT**

Canadian Agents :

Williams & Wilson, Ltd., Montreal.

The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg, St. John, N.B.

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SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$42 40
Lake Superior, charcoal, Chicago	57 00
Standard low phos., Philadelphia	50 00
Bessemer, Pittsburgh	43 00
Basic, Valley furnace	42 90
Toronto price:—	
Silicon, 2.25% to 2.75%	52 00
No. 2 Foundry, 1.75 to 2.25%	50 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 50
Steel bars, base, Toronto	5 50
Iron bars, base, Montreal	5 50
Steel bars, base, Montreal	5 50
Reinforcing bars, base	5 00
Steel hoops	7 00
Norway iron	**11 00**
Tire steel	5 75
Spring steel	10 00
Band steel, No. 10 gauge and 3-16 in. base	6 00
Chequered floor plate, 3-16 in.	9 40
Chequered floor plate, ¼ in.	9 00
Staybolt iron	9 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	4 00
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	**3 62**
Structural shapes	**3 72**
Plates	**3 90**
Small shapes under 3"	**3 62**

FREIGHT RATES

	Per 100 Pounds. C.L.	L.C.L.
Pittsburgh to Following Points		
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

	Gross. Montreal	Toronto
Lake copper	$25 00	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	77 00	75 00
Spelter	12 50	12 25
Lead	12 00	12 00
Antimony	14 50	14 00
Aluminum	34 00	35 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$ 7 25	$ 7 25
Plates, ¼ up	6 50	6 50

Price List No. 38

WROUGHT PIPES

Standard Buttweld

Per 100 feet

	Steel Blk.	Steel Gal.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Gal.
⅛	$ 6 00	$ 8 00	$.....	$.....
¼	4 83	6 96	5 31	7 44
⅜	4 83	6 96	5 31	7 44
½	6 42	7 99	7 10	8 67
¾	8 11	10 24	9 03	11 16
1	11 99	15 13	13 35	16 49
1¼	16 22	20 47	18 06	22 31
1½	19 39	24 48	21 59	26 68
2	26 09	32 93	29 05	35 89
2½	41 24	52 07	.....	.....
3	53 93	68 09	.....	.....
3½	68 54	85 56	.....	.....
4	81 21	101 37	.....	.....

Standard Lapweld

Per 100 feet

	Steel Blk.	Steel Gal.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Gal.
2	$29 79	$36 63	$33 49	$39 96
2½	43 58	54 41	49 43	60 26
3	56 99	71 15	64 64	78 80
3½	70 38	87 40	79 58	96 60
4	83 39	103 55	94 29	114 45
4½	95	1 19	1 20	1 45
5	1 10	1 39	1 40	1 69
6	1 43	1 80	1 81	2 19
7	1 87	2 36	2 34	2 83
8L	1 96	2 48	2 46	2 98
8	2 26	2 85	2 84	3 43
9	2 71	3 42	3 40	4 11
10L	2 51	3 17	3 15	3 81
10	3 23	4 08	4 06	4 90

Terms 2% 30 days, approved credit

Freight equalized on Chatham, Guelph, Hamilton, London, Montreal, Toronto, Welland.

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.
4½" and larger 50%.
4" and under, running thread, 30%.
Standard couplings, 4-in. and under, 30%
Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds. Montreal	Toronto
Copper, light	$15 00	$14 00
Copper, crucible	18 00	18 00
Copper, heavy	18 00	18 00
Copper wire	18 00	18 00
No. 1 machine composition	16 00	17 00
New brass cuttings	11 00	11 75
Red brass cuttings	14 00	15 75
Yellow brass turnings	8 50	9 50
Light brass	6 50	7 00
Medium brass	8 00	7 75
Scrap zinc	6 50	6 00
Heavy lead	7 00	7 75
Tea lead	4 50	5 00
Aluminum	19 00	20 00
	Per Ton	Gross
Heavy melting steel	18 00	18 00
Boiler plate	15 50	15 00
Axles (wrought iron)	22 00	20 00
Rails (scrap)	18 00	18 00
Malleable scrap	25 00	25 00
No. 1 machine cast iron	32 00	33 00
Pipe, wrought	12 00	12 00
Car wheels	22 00	26 00
Steel axles	22 00	20 00
Mach. shop turnings	11 00	11 00
Stove plate	25 00	25 00
Cast boring	12 00	12 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜-in. and less	10
Carriage bolts, 7-16 and up	Net
Coach and lag screws	25
Stove bolts	55
Wrought washers	45
Elevator bolts	Net
Machine bolts, 7/16 and over	Net
Machine bolts, ⅜-in. and less	15
Blank bolts	Net
Bolt ends	Net
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square, blank	add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 50
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	25 and 5
Sq. and hex. hd. cap screws	22½
Rd. and fil. hd. cap screws	plus 17½
Flat but. hd. cap screws	plus 30
Fin. and semi-fin. nuts up to 1-in.	20
Fin. and Semi-fin. nuts, over 1 in., up to 1½-in.	10
Fin. and Semi-fin. nuts over 1½ in., up to 2-in.	Net
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$60 00
Open-hearth billets	60 00
O.H. sheet bars	76 00
Forging billets	56 00-75 00
Wire rods	52 00-70 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 70
Cut nails	5 85
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

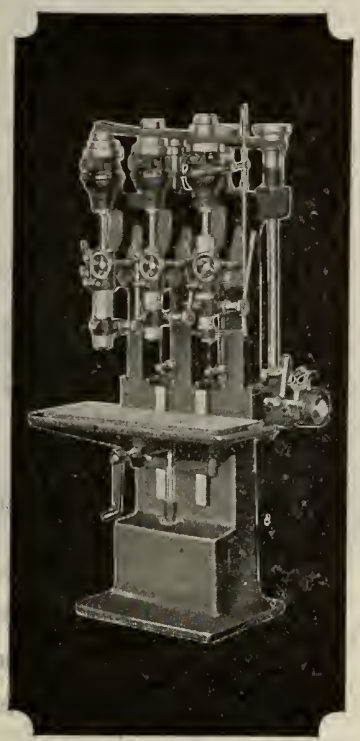
ROPE AND PACKINGS

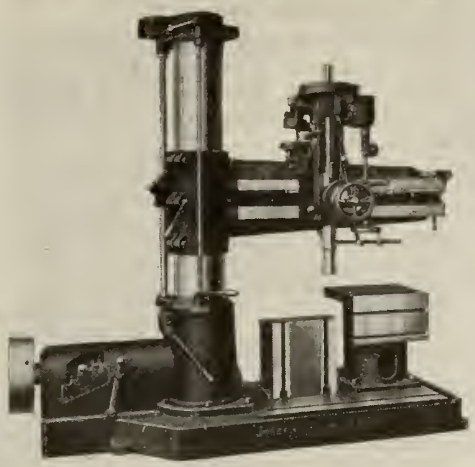
Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 35½
British Manila rope	0 28
New Zealand hemp	0 28
Transmission rope, Manila	0 47
Cotton rope, ¼-in. and up	0 88

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net

DRILLS
DRILLS
DRILLS



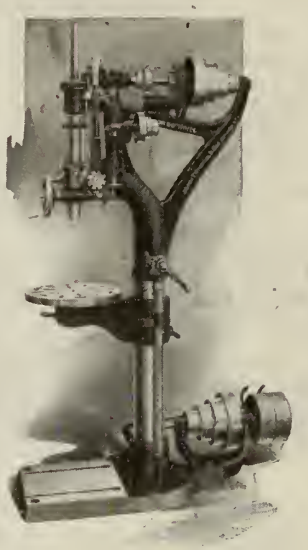


Radial Sliding Head Power Drills

High Speed Single and Multiple Spindle Drills

Bench and Sensitive Drills

DRILLS
DRILLS
DRILLS



WE HAVE IN STOCK FOR IMMEDIATE SHIPMENT

Ryerson 4′ Radial
Carlton 2½′ Speedy Sensitive
Colburn 36″ D8 Heavy Duty
Baker 24″ No. 314 Heavy Duty
Barnes 20″ P. W. & L. Back Geared
Woodward 4 Spindle Pedestal Type
Edlund High Speed Single Spindle Sensitive
Barker 10″ Bench Sensitive
And a large number of used drills, from heavy duty machines to the smaller sensitive types.

May we have your enquiries?

Garlock-Walker Machinery Limited

567 Banning Street
Winnipeg

32 Front Street West
TORONTO

334 St. James St.
Montreal

"Everything in Woodworking and Metalworking Machinery"

If interested tear out this page and place with letters to be answered

MISCELLANEOUS

Solder, strictly	$ 0 40
Solder, guaranteed	0 43
Babbitt metals	18 to 70
Soldering coppers, lb.	0 62
Lead wool, per lb.	0 16
Putty, 100-lb. drums	8 30
White lead, pure, cwt.	20 00
Red dry lead, 100-lb. kegs, per cwt.	16 50
Glue, English	0 40
Tarred slater's paper, roll	1 30
Gasoline, per gal., bulk	0 35
Benzine, per gal., bulk	0 35
Pure turp., single bbls., gal.	3 60
Linseed oil, raw, single bbls.	3 00
Linseed oil, boiled, single bbls.	3 03
Sandpaper, B. & A.	List plus 43
Emery cloth	List plus 37½
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin, "D," per lb.	0 14
Borax crystal and granular	0 14
Wood alcohol, per gal.	2 70
Whiting, plain, per 100 lbs.	2 75

CARBON DRILLS AND REAMERS

S.S. drills, wire sizes	32½
Can. carbon cutters, plus	20
Standard drills, all sizes	32½
3-fluted drills, plus	10
Jobbers' and letter sizes	32½
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	net
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	20 to 40
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At warehouse]

Rounds and squares	$7 base
Hexagons and flats	$7.75 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	60	75
Class B	27	37
Class C	18	27

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 8 50	$ 9 50
Sheets, black, No. 10	8 50	9 00
Canada plates, dull, 52 sheets	8 50	10 00
Can. plates, all bright	8 60	9 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	11 00	....
Fleur-de-Lis, 28 B.W.G.	10 50	....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28.	....	....
Premier, No. 28, U.S.	11 50	10 50
Premier, 10¾-oz.	11 50	10 90
Zinc sheets	16 50	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	29 50
1¾ in.	31 50	30 00
2 in.	30 00	30 00
2¼ in.	35 00	29 00
2½ in.	42 00	37 00
3 in.	50 00	48 00
3¼ in.	.. ..	48 50
3½ in.	63 00	51 50
4 in.	85 00	65 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	24½
Palacine	27½
Machine oil, per gal.	43½
Black oil, per gal.	18½
Cylinder oil, Capital	82
Cylinder oil, Acme	70
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	$2 60
Union thread cutting oil, antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil, bbls., net	13½

BELTING—No 1 OAK TANNED

Extra heavy, single and double	10%
Standard	10%
Cut leather lacing, No. 1	2 75
Leather in side	2 40

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 60
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	09
Pumice, ground	06
Emery glue	30
Tripoli composition	09
Crocus composition	12
Emery composition	10
Rouge, silver	60
Rouge, powder, nickel	45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 43

WASTE

XXX Extra	24	Atlas	20
Peerless	22½	X Empire	19½
Grand	22½	Ideal	19
Superior	22½	X Press	17½
X L C R	21		

Colored

Lion	17	Popular	13
Standard	15	Keen	11
No. 1	15		

Wool Packing

Arrow	35	Anvil	22
Axle	28	Anchor	17

Washed Wipers

Select White	20	Dark colored	09
Mixed colored	10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades ... 15%

ANODES

Nickel	.58 to .65
Copper	.38 to .45
Tin	.70 to .70
Zinc	.18 to .18

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10.		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6 x 4 base	45 00	44 00

LEAD SHEETS

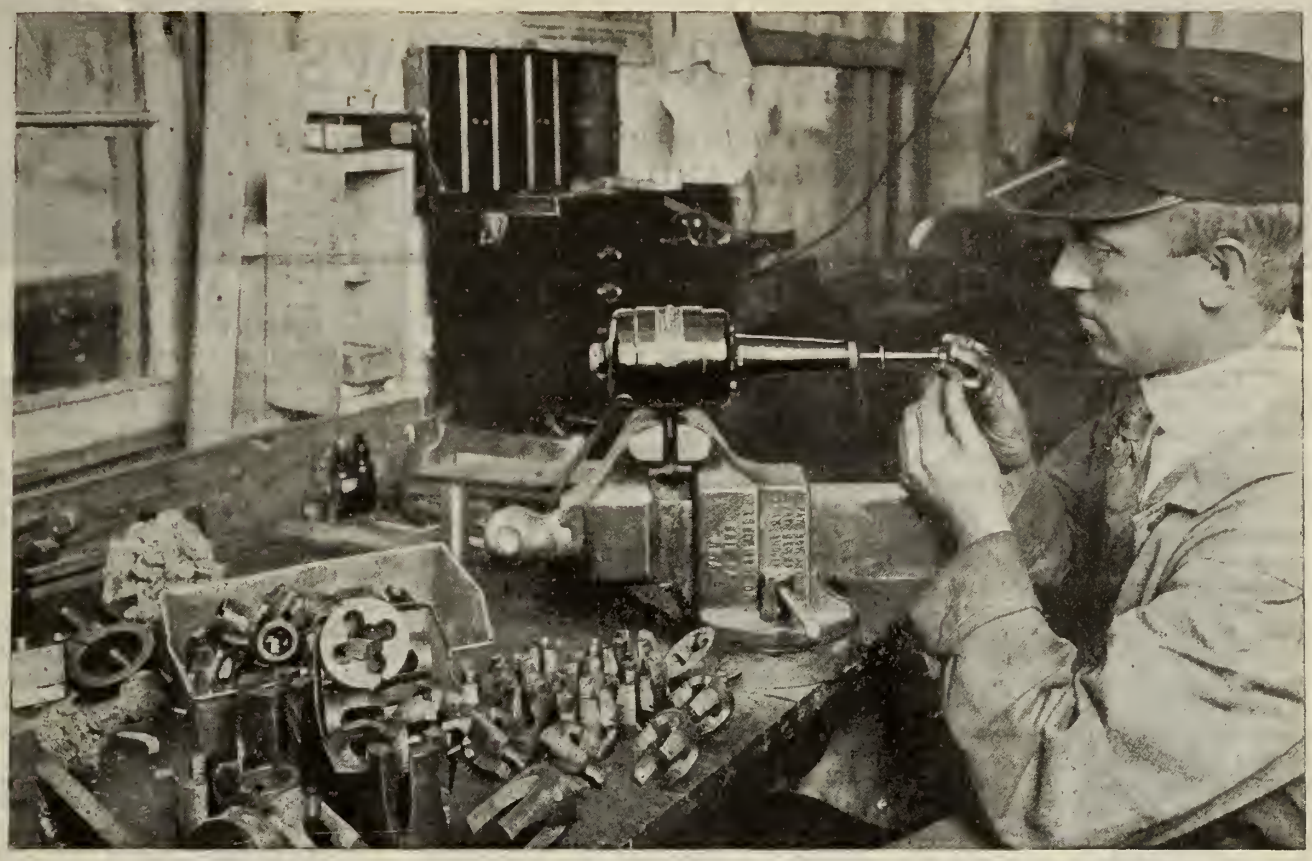
	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 75	$14 50
Sheets, 3½ lbs. sq. ft.	10 50	14 00
Sheets, 4 to 6 lbs. sq. ft.	10 25	13 50

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .23
Acid, hydrochloric	.03¼
Acid, nitric	.10
Acid, sulphuric	.03¼
Ammonia, aqua	.15
Ammonium, carbonate	.20
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.14
Copper, carbonate, anhy.	.41
Copper, sulphate	.16
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.08
Nickel carbonate	.32
Nickel sulphate	.19
Potassium sulphide (substitute)	.42
Silver chloride (per oz.)	1.25
Silver nitrate (per oz.)	1.20
Sodium bisulphate	.11
Sodium carbonate crystals	.06
Sodium cyanide, 127-130%	.38
Sodium hyposulphite per 100 lbs	8.00
Sodium phosphate	.18
Tin chloride	1.00
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated



These Dies Produce Set Screws by the Million

HERE is an interesting photograph of one of the Dumore Grinders in operation in the Hartford, Conn., plant of the Allen Manufacturing Co., where safety set screws are produced by the million. To maintain this enormous production many dies are necessary, and a large number must always be held in reserve. Day in, day out, all year 'round an operator is busy sharpening dies. Because of the importance of this work, and its difficult character, it is natural that the Dumore Grinder has been chosen for the job.

Chatter-marks, taper and bell-mouth are eliminated through the use of a Dumore.

And the two reasons for this lie in the high spindle speed and dynamic balance of the armature. Even small wheels are thus given the correct cutting speed without a possibility of vibration. The Dumore Grinder is light and portable—easily carried from one part of a shop to the other and quickly set up on a lathe, shaper or milling machine.

Most jobbers carry Dumore Grinders. They will be glad to demonstrate what these handy tools can do for you. Look into the matter today.

WISCONSIN ELECTRIC COMPANY
2922 Sixteenth Street **RACINE, WISCONSIN**

DUMORE HIGH SPEED GRINDERS

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INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS PERSONAL AND TRADE NOTES

TRADE GOSSIP

Brass Foundry Will be Built.—Mr. Richard Hart of Brantford has been granted a permit to erect a brick building for a brass foundry 20 feet by 36 feet by eight feet high at 22 Leonard Street in that city.

Timber Held Up.—There is lying along the tracks of the Transcontinental Railway 60,000 cords of pulp wood and 30,000,000 feet of lumber that cannot be shipped. It is estimated that 6,500 cars are required to move this lumber, and during the month of February only fifty were available.

Russia Wants Railway Equipment.—According to advices from Stockholm, Russia is willing to pay in gold and cereals for manufactured products of which she is in need. Box cars and locomotives are said to be the most urgently required, and secondly farming equipment of all classes

St. John, N.B., Custom Receipts.—Custom receipts for the port of St. John, N.B., were $5,309,514 for the year ending March 31, as against $3,278,492 in the year previous. The receipts for the month of March were $525,495, as compared with $375,465 in the corresponding month last year.

Employees Reject Offer.—Mechanics employed by the Dominion Shipbuilding Co., Toronto, at a recent meeting rejected an offer of an increase in wages of 10 per cent. Negotiations are, however, still being carried on and it is hoped a satisfactory agreement will be reached without any industrial disturbance.

Sarnia Bridge Reorganized.—A reorganization of the Sarnia Bridge Co. has taken place, and the new concern has secured a Dominion charter under the name of the Sarnia Bridge Company, Ltd., with a capital of $500,000. The president is R. N. Norton; vice-president, H. B. Fenton, and the secretary-treasurer, H. F. Holland.

To Get Information.— A committee representing the industrial commission of British Columbia is at present in Seattle, Wash., investigating the steel mills there and in other parts of the States. The information obtained will be used in connection with the proposed establishment of a steel mill in Vancouver, to be built by the Provincial Government.

Welland Canal Construction.—In the estimates brought down in the House of Commons was included one of $5,500,000 to proceed with the work on the Welland Canal. This vote was increased from $3,500,000. Operations will probably be resumed with the coming of favorable weather. Other Ontario votes include $1,700,000 for Toronto Harbor improvements, $200,000 for Toronto Island breakwater.

Japanese Machinery Developing.—The machinery trade in Japan has developed in a remarkable fashion in the last five years. From importing machinery to a value of $12,000,000 in 1914 the importations rose to $29,000,000 in 1918. Her exports of machinery were in 1914 $634,000, while in 1918 she exported $7,890,000 worth, which included textile and printing machines, electrical machines, and machine tools.

Montreal Wharfage Rates.—A conference of the first of a series was held at which a subcommittee representing the Board of Trade, Chamber of Commerce, Shipping Federation, and representatives of the railroad and steamship interests, met the Montreal Harbor Commissioners in regard to the proposed increase in wharfage rates to be charged on import and export traffic. The trading interests claim that the increases would average 50% and in some cases nearly 100%.

It is understood that the Board of Railway Commissioners will not interfere with the railways in their action ordering their agents not to accept prepayment of freight charge on shipments destined to the United States. They take the view that the railways should not have to shoulder the adverse rate of exchange burden. The Commissioners intimated that this was the only view they could take of the matter, to a deputation of shippers complaining of the order.

Wages in the Metal Trades.—At a meeting in Montreal of delegates representing the American Federation of Labor, wages were discussed and the following decisions were arrived at: Demands would be made on the firms comprising the metal industries on May 1 for an eight-hour day, a forty-four hour week, Saturday a half holiday. Wages to be 90 cents an hour for mechanics, 65 cents an hour for helpers, and 60 cents an hour for laborers. The Federation has 400,000 members employed between Halifax and Port Arthur.

The Car Shortage.—As an instance of the difficulties caused by the retention of Canadian cars in the United States, the closing of the Midland Shipbuilding Company's yard is notable. This company, which has two vessels on hand for construction, has been compelled to close down, and almost 100 men have been thrown out of employment, owing to the firm being unable to get delivery of material necessary to go on with the work. This material is all ready for shipment from the manufacturers in the United States, but there are no cars available to bring it up in.

Western Industrial Convention.—In connection with the industrial convention to be held in June in the cities of Lethbridge, Calgary, Vancouver, and Edmonton, Lieut.-Col. G. L. McDonnell is in Ottawa interviewing various members of the Government. He is leaving for England shortly with the object of interesting British manufacturers in the exhibitions, which will be held under the auspices of the British Columbia and Alberta Industrial Development Associations. The conventions will be timed in each city to agree with the tour of the Canadian Manufacturers' Association.

Barn Business Good.—With deliveries on galvanized sheets about six months late, manufacturers have a right to view with dismay a persistent demand from the farming community for metal building and roofing material. "The farmers have been holding off," said one manufacturer to CANADIAN MACHINERY, "but they now realize that a drop in prices is out of the question. An advance of from $7.50 to $11.50 per 100 square feet in the last two years does not now seem much of a detriment to the demand. The barn business is coming back strong, but deliveries on material from the United States are very discouraging. Shipments promised for February have been shoved forward to April without much guarantee. In the meantime the best of the season is slipping by."

MARINE

Goderich.—Goderich harbor is now clear of ice, and there is no ice to be seen within the range of vision on the lake. The winter fleet of grain carriers has been fitted out, and the vessels will all be in trim to sail when the insurance comes in force on April 15.

Chicago.—According to the United States Weather Bureau, navigation on the Great Lakes should be open about April 10. The icefield at Duluth which

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Strong where strength is needed—Proper thickness of web — Scientifically built—*Forged*—Sturdiness —Pounded into the form of the Drill.—Note the shape of the wide chip space—the web is *braced.* (A "Morrow" feature) The Steel—Hammered Bars, not less than 18% Tungsten content.

NOTE — Every High Speed Drill is given the File test in addition to the usual tests in process.

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INGERSOLL, CANADA

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extended for twenty miles has decreased to four miles in places and seven at the widest part, while the ice at the Soo and other points is rapidly weakening.

Toronto.—The Canada Steamship Lines' steamer "Macassa" again opened navigation between Hamilton and Toronto 24 days later than last year's date. During the last ten years this vessel has had the honor six times. The captain was presented with a high hat in honor of the event, an annual custom.

Sault Ste. Marie.—Ice conditions are such that it is expected navigation will be open by April 10, the recent warm rains having helped a great deal in softening the ice. Whitefish Bay is already partly clear. The steamer Charles Heiden has made the trip up through Lake St. Clair, being the first steamer of the season to make this voyage.

Big Dock for Kingston.—The Collingwood Shipbuilding Company is preparing to make big additions to their plant at Kingston. A 750-foot dry dock is projected, and representatives of the company waited on the Mayor of Kingston and the Utilities Commission in connection with the plan. It will be necessary if the scheme is carried out to remove the city pumping station to another site.

St. John's, Nfd. — The British Admiralty has presented the Government of Newfoundland with four steamers for the public service of that country. They will be operated by the Shipping Department of the Government. The largest of the vessels is of 1,400 tons and will be operated in the general trade of the country, while the others will be employed as lighthouse tender in the mail steamer service and as rescue vessel on the south coast.

Toronto.—It is quite probable that the new steamer for the Canada Steamship Lines will be built in Toronto. She will be for the Toronto-Niagara route and will be 120 feet longer than the "Cayuga" and will have a capacity of 4,000 passengers. The proposed vessel will be the second largest passenger steamer on the Great Lakes, and if constructed in Canada will be the largest passenger steamer ever built in a Canadian yard.

Quebec.—It is reported that the local agency of the Department of Marine and Fisheries and the Quebec Harbor Commission will amalgamate. This would enable the stores of the Marine Department and their plant at King's Wharf to be moved to a place within the radius of the Harbor Commissioners' property. Besides the extra convenience and economy of such a plan, much more room would be available for the Transcontinental terminals on the water front.

Port Stanley—A delegation from London, St. Thomas, and Middlesex and Elgin Counties will shortly have an interview with Hon. J. D. Reid in an endeavor to secure the needed improvements to Port Stanley harbor. The interview has been arranged by H. B. Cronyn, M.P. for London. The improvements, which were interrupted by the war, should be resumed, in the opinion of the residents of the district, and a vigorous protest will be made against the plans of the Government, which are held to be inadequate.

Sarnia.—It was stated by the Mayor of Sarnia that the White Star Line of steamers would shortly settle their differences with the city over the tax assessment and resume their calls at this port. The Mayor again affirmed that the matter was one between the Northern Navigation Company or the Grand Trunk and the city, and the company has the right of appeal to the Court of Revision. The assessment is placed on the Northern Navigation Company's wharf, and they in turn collect part of the cost from the White Star Line.

Sydney, C.B.—It has been definitely decided that this port will be the regular port of call for the steamers of the Canadian Government Merchant Marine on the Liverpool and Canada route during the summer. In the winter Louisburg will be the venue. The Dominion Iron and Steel Corporation have concluded arrangements with the management of the Government steamers to ensure quick handling of the products that they export to the United Kingdom. The "Canadian Ranger" has already taken a cargo, and the "Candian Miller" follows shortly.

Vancouver.—The Canadian Merchant Service Guild have sent a strong telegram to Hon. C. C. Ballantyne regarding the competency certificates for masters and mates of ships up to 750 tons, a bill affecting which is now before the house. The Guild strongly protests against any lowering of the standard of certificates, and further urges that the standard ought to be raised to that of the British Board of Trade. The statement in the bill that there is a shortage of masters and mates is denied by the Guild, which states that the reverse is the case.

Port Arthur.—The Masters', Mates' and Pilots' Association of the Upper Lakes have instructed Captain Wright to visit labor organizations in the East and enlist their support for the seamen of the Great Lakes in their fight for a deep load line for lake vessels. The association claims that there is much loss of life due to the absence of regulations to prevent overloading, and quote the case of the John Owen, lost off the Caribou Island last fall. This vessel, built thirty years ago for a draft of 14 feet, was loaded to 20 feet at the time she foundered. The association will also demand life-saving apparatus and wireless equipment for all lake vessels.

PLANNING TO MAKE BIG ADDITIONS

Carborundum Co. Have Extensions on at Falls and Shawinigan

The Carborundum Company of Niagara Falls, N.Y., is to spend approximately a half a million dollars in extending and improving its mammoth plant at Niagara Falls and its two big furnace plants, one at Niagara Falls, Ont., and the other at Shawinigan Falls, Quebec.

The big building plan includes a three-storey addition to the Paper and Cloth Plant at Niagara Falls in which are manufactured carborundum paper and cloth, carborundum brand garnet paper and cloth, and aloxite cloth. This addition, which has just been recently finished, is 432 feet long and 81 feet wide, and will provide greater facilities for the storing and curing of all carborundum, garnet and aloxite paper and cloth products, and for the extension of the rubber bonded wheel department.

Another addition, just completed, will extend one of the wheel-making and kiln departments, the new building being two stories high, 96 feet long and 64 feet wide. Both of these new structures are of concrete and are of the most modern type.

Other big extensions and improvements have been planned and work will be started immediately. These plans call for additions to the crushing departments and other improvements at the furnace plant at Niagara Falls, Ont., where the abrasive aloxite is made, and at Shawinigan Falls, Que., where is located an extensive carborundum furnace plant. Besides these building operations the programme calls for the extension of at least fourteen different departments at the big Niagara Falls (N. Y.) plant of the Carborundum Company.

With the expenditure of a half a million dollars in improving its manufacturing facilities the Carborundum Company will be in a better position than ever before to meet the ever-growing demand for its abrasive products.

TENDERS

The City of Niagara Falls, Ontario, is asking for prices and particulars of sewer cleaning machines. Address Alderman Wm. Cole, Chairman of Committee on Sewers, on or before April 10.

The St. Thomas, Ont., Board of Water Commissioners offer for sale one Allis-Chalmers horizontal compound steam pump, two Worthington duplex pumps, one centrifugal pump direct-connected to engine, and one 7 h.p. vertical engine. Particulars can be obtained from the City Engineer, St. Thomas.

The City of Moosomin, Sask., will receive tenders up till May 5 for the supply, delivery and erection of internal combustion engines, generator, exciter, switchboard, street lighting apparatus, pole, wire and line material, power station and cooling chamber. Plans and specifications can be obtained from the Consulting Engineers, Saskatoon; Town Clerk's Office, Moosomin, Sask. The consulting engineers are Murphy & Underwood, Saskatoon, Sask

PERSONAL

Mr. S. W. Crabbe has been appointed superintendent, Smiths Falls division of the C. P. R., in place of Mr. T. A. Wilson, transferred.

J. H. Malone has purchased the business of the Precision and Thread Grinder Manufacturing Company, manufacturers of the Multi-Graduated Precision grinder. Mr. F. Rodger Imhoff will continue as field engineer, with headquarters in Detroit, and under his direction a force of salesmen and demonstrators will cover the United States and Canada.

MONTREAL NOTES

Forrest, Jackson and Forrest, manufacturers' agents, 230 Craig St. West, have secured the sole Canadian agency for the Sheffield Twist Drill and Steel Company of Sheffield, England.

The Dominion Welding Manufacturing Company, 584 St. Timothee St., Montreal, have acquired the plant of the Belanger Foundry Company at 340 Amherst St. and will occupy these premises immediately. They will commence manufacturing the "Presto" instantaneous water heater, and will also continue in the general welding repair work.

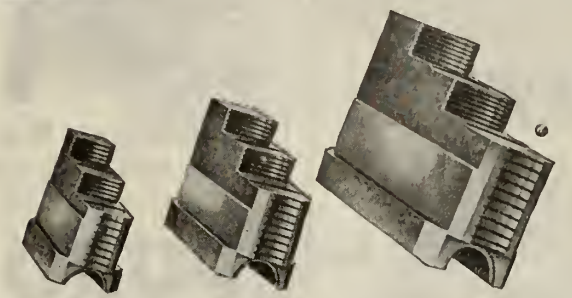
As a result of the meetings that have been held between the Montreal Harbor Board and the different shipping and trade bodies, there is a possibility that some modification may be made in the schedule of the wharfage rates that were proposed for this season. Pending further adjustment of the matter the new rates, effective April 1st, will remain in force.

The recently incorporated company, Bearing Metals, Ltd., with head offices in Room 316 Dominion Express Building, Montreal, have acquired the old plant of the Lion Metal Company, Cote St. Paul, and will manufacture babbitts, solders, etc. E. L. W. Saunderson, formerly manager of the Magnolia Metal Co., will be in charge of the company's business.

The Canadian Steamship Lines are considering a plan whereby their tourist steamers, which are only in service during the months of July and August, may be at the disposal of such organizations that propose holding conventions in Montreal this summer, where it would be difficult to obtain adequate accommodation at the hotels of the city, owing to the large number of delegates expected at some of these gatherings.

DOMINION CHUCKS

STEEL OR CAST-IRON BODY
BUILT FOR HEAVY DUTY



The Jaws Are Extra Strong

THEY are drop forgings, made of best quality steel, heat-treated and hardened. The threaded portion of jaws form a half nut for the setting-up screws. Have stood the test of heavy duty work in our own shops where accuracy was the only accepted standard.

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Engineers • Manufacturers
BRANTFORD, CANADA

3

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SPECIAL DRAW CUT R.R. SHAPERS
FINISHED MACHINE KEYS
STATIONARY & PORTABLE KEY WAY CUTTERS
SPECIAL LOCOMOTIVE CYLINDER PLANERS
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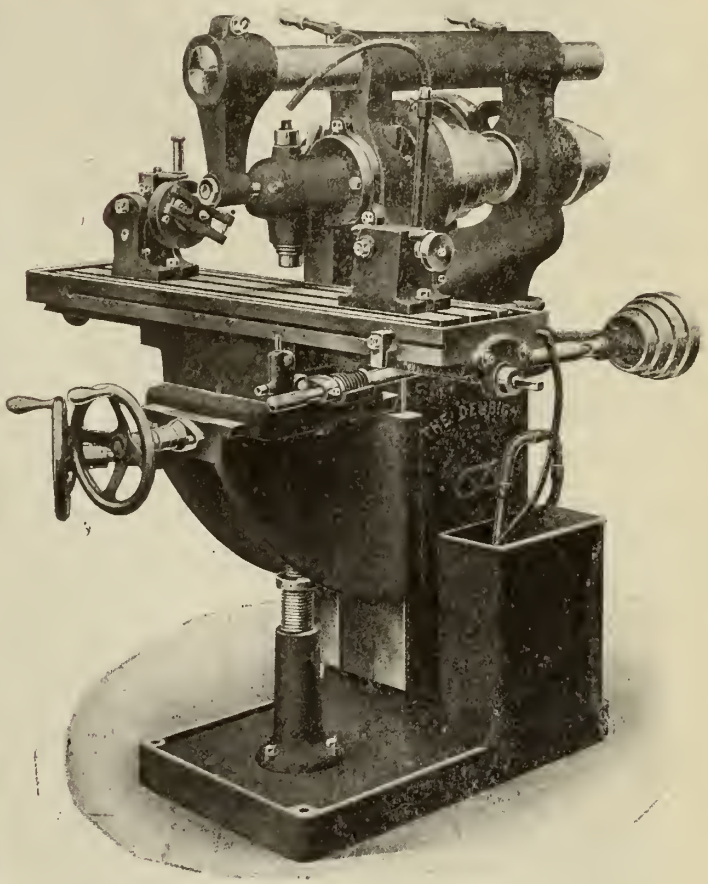

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A second-hand straight-line 8-inch Mill, in good condition; five stands of rolls, buckeye engine, with gears and pinions complete, all in good operating condition.

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Each tender must be made upon the proposal form provided, and must be accompanied by all the information required.

Copies of specifications and form of proposal may be obtained from the Secretary of the Lignite Utilization Board upon application, on or after April 6th, 1920.

The Lignite Utilization Board of Canada does not bind itself to accept the lowest or any tender.

R. A. ROSS,
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Montreal, P.Q.,
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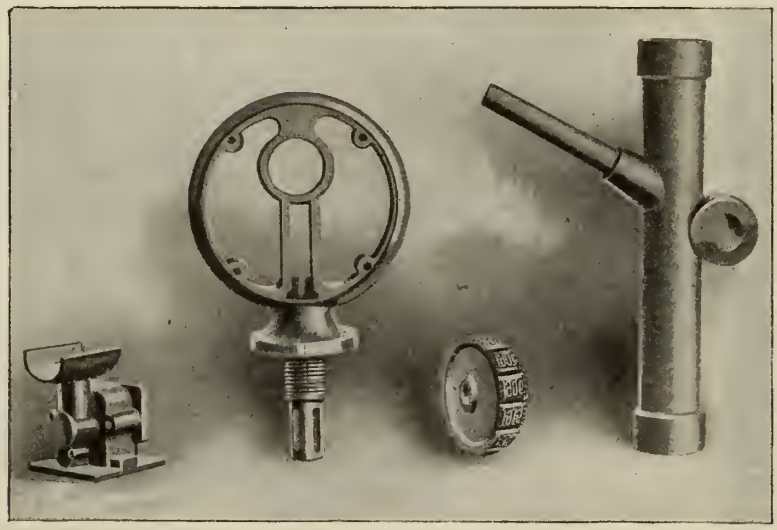

Die-Casting Chat No. 2 Last issue we mentioned a Die-Casting as an accurate molded casting in a specially constructed die. We will now tell how die-castings are manufactured. A special machine is so arranged that when the die is closed a stream of molten metal is forced up into the die at an enormous pressure, guaranteeing that every corner of the die is filled without blow-holes in the metal. A good die-casting is always perfect.

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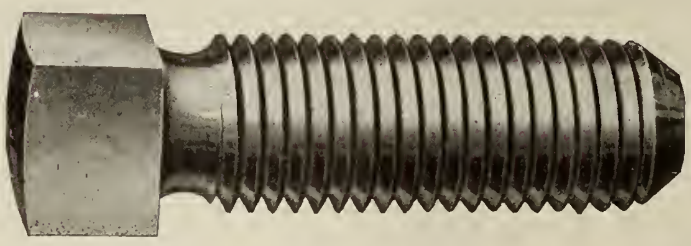

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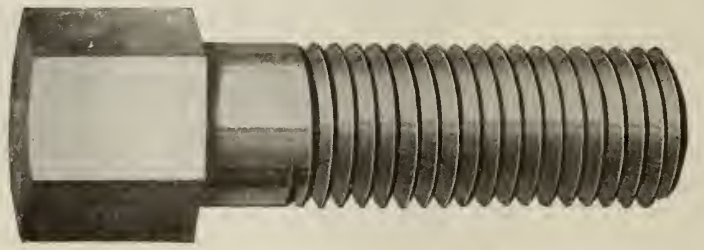

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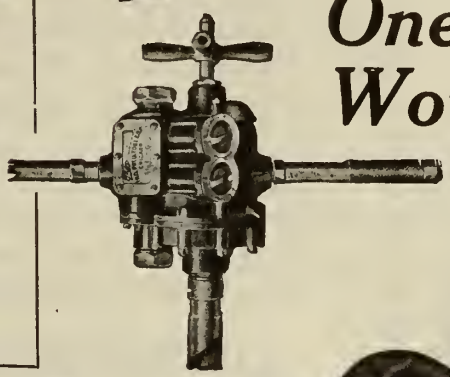

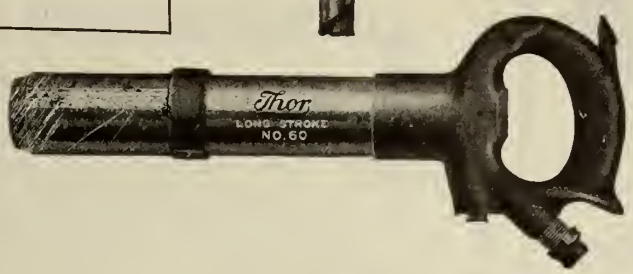

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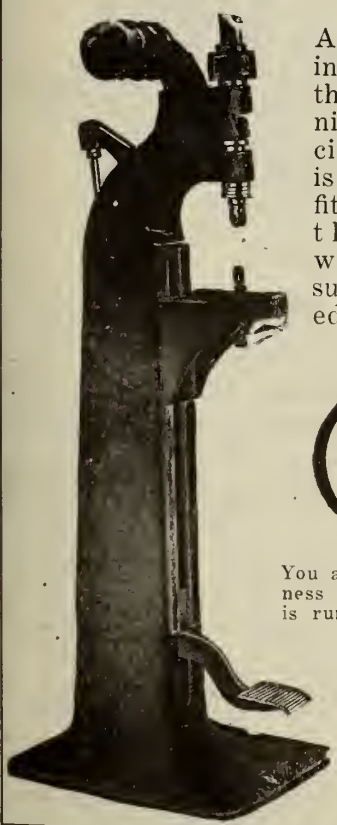

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You are assured of perfect quietness wherever the **Grant** Rotary is running. And it spins a perfect polished rivet head every second without breaking or marring the casting. Rivets tight or loose. Write for details.

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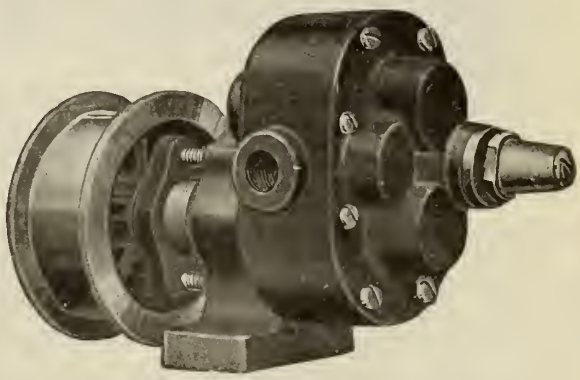

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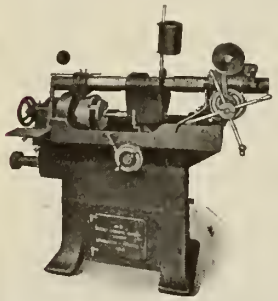

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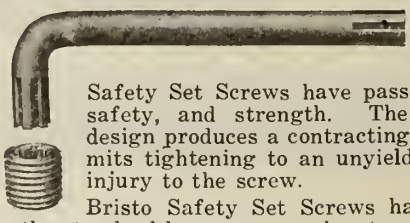

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Safety Set Screws have passed every test for safety, and strength. The patented fluted design produces a contracting effect which permits tightening to an unyielding grip without injury to the screw.

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Catalog No. 6.

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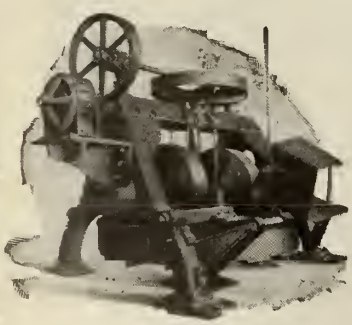

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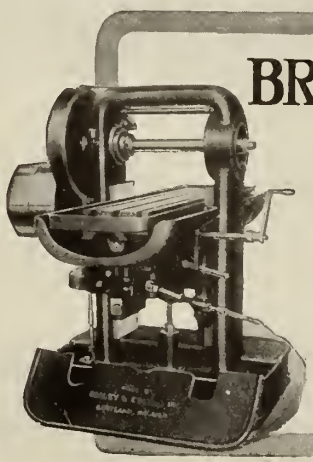

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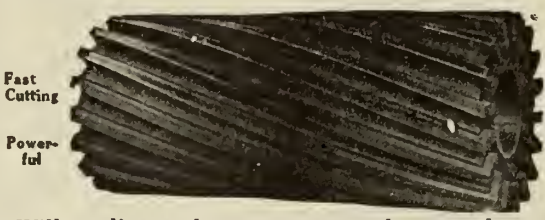

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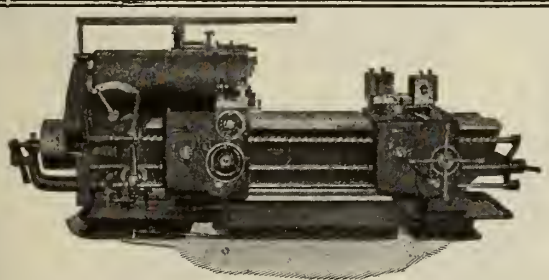

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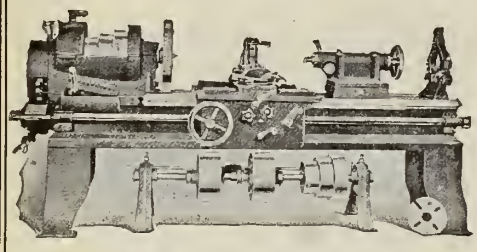

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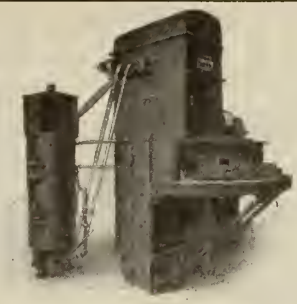

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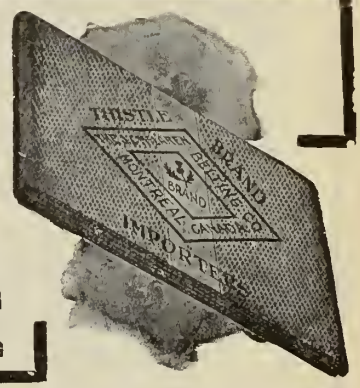

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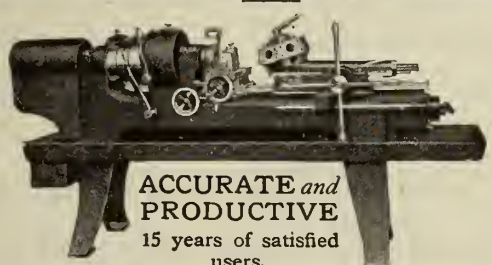

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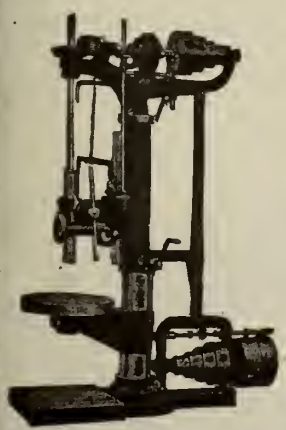

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ence Welding Co, Ltd., Montreal

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St Lawrence Welding Co, Ltd., Montreal

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Jones & Lamson, Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.
Marshall, Son & Bunney, Toronto.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Rickert-Shafer Co., Erie, Pa.
Stoll Co., Inc., D. H., Buffalo, N.Y.
U. S. Ordnance, Toronto, Ont.
Wells Brothers of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DIES, HAMMERED
Kimber & Hillier Mfg., Co., St. Catharines, Ont.

DIES, DROP FORGE,
Kimber & Hillier Mfg., Co., St. Catharines, Ont.

DIES, METAL STAMPING
Crescent Mche. Co., Ltd., Montreal, P.Q.
Elliott & Whitehall, Galt, Ont.

DIES, PIPE THREADING
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Crescent Mche. Co., Ltd., Montreal, P.Q.
Landis Machine Co., Waynesboro, Pa.

DIES, THREADING
Butterfield & Co., Inc., Rock Island, Que.
Crescent Machine Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

DIE SINKERS
Becker Milling Machine Co., Boston
Garvin Machine Co., New York.
Jackson Machine Tool Co, Jackson, Mich.
Kimber & Hillier Mfg., Co., St. Catharines, Ont.
Pratt & Whitney Co., Dundas, Ont.
Walcott Lathe Co., Jackson, Mich

DIES FOR MACHINES
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Rock Island, Que.
Firth & Sons, Thos., Montreal, Que.
Landis Machine Co., Waynesboro, Pa.
Wells Brothers Co. of Canada, Galt.

DIE HEADS
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Canada, Galt, Ont.

DIES, SELF-OPENING
Geometric Tool Co., New Haven.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Wells Brothers Co. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.

DIE FILING MACHINES
Oliver Mach. Co., Grand Rapids, Mich.

DIE STEEL, HOT AND COLD WORK
Armstrong-Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.
Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.

DIES FOR SCREW PLATES
Butterfield & Co., Inc., Rock Island, Que.
Wells Bros. Co. of Can., Galt, Ont.

DIES, SHEET METAL WORKING
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada
Globe Engineering Co., Hamilton, Ont.
Stoll Co., D. H., Buffalo, N.Y.

DIES, SCREW AND THREAD
Butterfield & Co., Rock Island, Que.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
National-Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros., Co., of Can., Galt, Ont

DISCS, LEATHER, STEEL
Graton & Knight Mfg. Co., Worcester, Mass.
Swedish Steel & Importing Co., Montreal

DIRECT CONNECTED UNITS
MacGovern & Co., Montreal, Que.

DRAFT, MECHANICAL
Butterfield & Co., Rock Island, Que.
Can. Blower & Forge Co., Kitchener.
A. B. Jardine & Co., Hespeler, Ont.
Pratt & Whitney Co., Dundas, Ont.
Sturtevant Co., B. F., Galt, Ont.

DRAINAGE FITTINGS
Crane Ltd., Montreal, Que.

DRAWING INSTRUMENTS
Hughes, Owens Co., Ltd., Montreal, Que.

DRAWING OFFICE SUPPLIES
Hughes, Owens Co., Ltd., Montreal, Que.

DRESSERS, GRINDING AND EMERY WHEEL
Atkins & Co., E. C., Hamilton, Ont.
Can. Desmond-Stephan Mfg. Co., Hamilton
Dominion Abrasive Co., Ltd., Mimico, Ont.
Petrie, Ltd., H. W., Toronto.
Wheel Trueing Tool Co., Windsor, Ont

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Aurora Tool Works, Aurora, Ind.
Barber Mchy. Co., Ltd., Toronto, Ont.
W. F. & John Barnes Co., Rockford.
Can. Blower & Forge Co., Kitchener.
Canada Machinery Corp., Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal
Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
U. S. Mach. Tool Co., Cincinnati, Ohio.
A. R. Williams Machinery Co., Toronto

DRILL RODS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Kayser-Ellison & Co., Ltd., Montreal
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
Marshall, Son & Bunney, Toronto.
Swedish Steel & Importing Co., Ltd., Montreal.

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Barnes, W. F. & John, Co., Rockford, Ill.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bilton Mach. Tool Co., Bridgeport, Conn
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Silver Mfg. Co., Salem, Ohio.

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Barber Mchy. Co., Ltd., Toronto, Ont.
John Bertram & Sons Co., Dundas.
Bilton Mach. Tool Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal
Garlock-Walker Mach. Co., Toronto.
Garvin Machine Co., New York.
Hoefer Mfg., Co., Freeport, Ill.
Henry & Wright Mfg. Co., Hartford, Conn
A. B. Jardine & Co., Hespeler, Ont.
Landis Tool Co., Waynesboro, Pa.
Nat. Automatic Tool Co., Richmond, Ind.
Niles-Bement-Pond Co., New York.
Rockford Drilling Mach Co., Rockford, Ill

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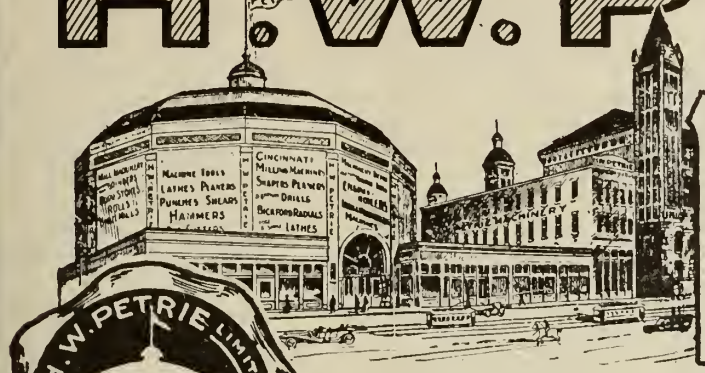

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Garlock-Walker Machinery Co., Toronto.
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Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Williams Mchy Co., A. R., Toronto, Ont.

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Barber Mchy. Co., Ltd., Toronto, Ont.
Bilton Mach. Tool Co., Bridgeport, Conn.
W. F. & John Barnes Co., Rockford, Ill.
Canadian Fairbanks-Morse Co., Montreal.
Canadian Machinery Corp., Galt, Ont.
Geo. F. Foss Mch. & S'ply Co., Montreal
Garlock-Walker Mach. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
United States Mach. Tool Co., Cincinnati
Williams Mchy Co., A. R., Toronto, Ont.

DRILLING MACHINES, UPRIGHT AND HORIZONTAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Aurora Tool Works, Aurora, Ind.
John Bertram & Sons Co., Dundas.
Garlock-Walker Mach. Co., Toronto, Ont
Can. Blower & Forge Co., Kitchener.
Canada Mach. Corp., Galt, Ont.
Garvin Machine Co., New York.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mach. Co., Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
A. B. Jardine & Co., Hespeler, Ont.
Knight Metal Products, Toronto.
Landis Tool Co., Waynesboro, Pa.
R. McDougall Co., Galt.
Nat. Automatic Tool Co., Richmond, Ind
Rockford Drilling Mach. Co., Rockford, Ill
Niles-Bement-Pond Co., New York.
Silver Mfg. Co., Salem, Ohio.
U. S. Ordnance, Toronto, Ont.
A. R. Williams Machinery Co., Toronto

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Silver Mfg. Co., Salem, Ohio.

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W. F. & John Barnes Co., Rockford, Ill
Can. Blower & Forge Co., Kitchener.
Can. Fairbanks-Morse Co., Montreal.
Geo. F. Foss Mch. & S'ply Co., Montreal
Garlock-Walker Machinery Co., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

DRILLS, CENTRE
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto.
Rice Lewis & Son, Toronto, Ont.
Wilt Twist Drill Co., of Can., Walkerville

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Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Can. Blower & Forge Co., Kitchener.
Cleveland Twist Drill Co., Cleveland.
Geo. F. Foss Mch. & S'ply Co., Montreal
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.
Whitman & Barnes Mfg. Co., Akron, O.
Wilkinson & Kompass, Hamilton, Ont.
Wilt Twist Drill Co. of Can., Walkerville

DRILLS, CARBON
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Marshall, Son & Bunney, Toronto.
John Morrow Screw & Nut Co., Ingersoll

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Can. Blower & Forge Co., Kitchener.
Cincinnati Electrical Tool Co., Cincinnati
Geo. F. Foss Mch. & S'ply Co., Montreal
Haskins Co., R. C., Chicago, Ill.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Pilot Steel & Tool Co., Montreal, Que.
Prest-O-Lite Co., Inc., Toronto, Ont.
U. S. Electrical Tool Co., Cincinnati, O
A. R. Williams Mach. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLS, HAMMER
Samuel Osborne, Ltd., Montreal, P.Q.

DRILLS, EMERY
Garlock-Walker Mach. Co., Toronto, Ont.

DRILLS, HIGH SPEED TWIST
Aikenhead Hardware Co., Toronto, Ont.
Armstrong-Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Canadian Fairbanks-Morse Co., Montreal
H. A. Drury Co., Montreal.
Geo. F. Foss Mch. & S'ply Co. Montreal
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
W. F. & John Barnes Co., Rockford, Ill
Osborne, Samuel, Montreal, P.Q.
Plewes, Ltd., Winnipeg, Man.
Pratt & Whitney Co., Dundas, Ont.
Petrie, H. W. Toronto.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Taylor J. A. M., Stair Bldg., Toronto.
Wilt Twist Drill Co. of Can., Walkerville
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLS, OIL TUBE
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

DRILLS, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Williams Mchy Co, Ltd., A. R., Montreal
Greenfield Tap & Die Corp., Greenfield, Mass.

DRILLS, PNEUMATIC CORNER
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.

DRILLS, RATCHET AND HAND
Aikenhead Hardware Co., Toronto, Ont.
Armstrong Bros. Tool Co., Chicago, Ill.
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cincinnati Electrical Tool Co., Cincinnati.
Cleveland Twist Drill Co., Cleveland.
Garlock-Walker Mchy. Co., Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilt Twist Drill Co. of Can., Walkerville.

DRILLS, ROCK
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
The Foss Mchy. & Supply Co., Montreal.
Samuel Osborne Ltd., Montreal, P.Q.
A. R. Williams Machy. Co., Toronto.

DRILLS, SQUARE & HEXAGON
Globe Engineering Co.

DRILLS, TRACK
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
The Foss Mchy. & Supply Co., Montreal.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Wilt Twist Drill Co. of Can., Walkerville.

DRINKING FOUNTAINS, SANITARY
Crane, Ltd., Montreal, Que.
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

DRIVES, CHAIN
See Belting, Chain.

DRIVING TOOLS
The Thos. Pink Co., Ltd., Pembroke, Ont.

DRY CLEANING SYSTEM
Bowser Co., Ltd., S. F., Toronto, Ont.

DRYERS, SAND
Lyman Tube & Supply Co., Montreal, Que.
Pangborn Corporation, Hagerstown, Md.

DRYING APPLIANCES
Baird Machine Co., Bridgeport, Conn.
Sturtevant Co., B. F., Galt, Ont.
W. S. Rockwell Co., New York, N.Y.

DRUM CONTROLS
Volta Manufacturing Co., Welland, Ont.

DUMP CARS
Canadian Fairbanks-Morse Co., Montreal.
MacKinnon Steel Co., Sherbrooke, Que.
Lawrence Welding Co, Ltd., Montreal

DUST EXHAUSTER. ARRESTER SYSTEM
Pangborn Corporation, Hagerstown, Md.

DUST HANDLING EQUIPMENT
Pangborn Corporation, Hagerstown, Md.
Sturtevant Co., B. F., Galt, Ont.

DUST SEPARATORS
Can. Blower & Forge Co., Kitchener, Ont.
Sturtevant Co., B. F., Galt, Ont.

DYNAMOS AND ELECTRICAL SUPPLIES
Canadian Fairbanks-Morse Co., Montreal.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
MacGovern & Co., Montreal, Que.
A. R. Williams Machy. Co., Toronto.

ELECTRICAL SUPPLIES
Can. General Electric Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Northern Electric Co., Ltd., Montreal Que

ELECTRIC FURNACES
Electric Furnace Construction Co., Philadelpria, Pa.
Hamilton & Hansell, Inc., New York City
Volta Manufacturing Co., Welland, Ont.

EECTRIC FURNACE REGULATORS, WINCHES, ROOF COOLERS AND ELECTRODE HOLDERS
Volta Manufacturing Co., Welland, Ont.

ELECTRICAL RESISTANCE MATERIALS, NICHROME, KROMORE, CHROMAX, CLIMAX, NICKEL, SILVER, ADVANCE.
Can. Driver-Harris Co., Walkerville, Ont.

ELECTRIC HOISTS, STATIONARY AND MONO RAIL
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Volta Manufacturing Co., Welland, Ont.

ELECTRIC MOTORS
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
Sturtevant Co., B. F., Galt, Ont.
Volta Manufacturing Co., Welland, Ont.

ELECTRIC TRUCKS
Cowan Truck Co., Holyoke, Mass.
Goad Engineering Co., Toronto, Ont.

ELEVATOR, ENCLOSURES
Volta Mfg. Co., Welland, Ont.
Canada Wire & Iron Goods Co., Hamilton

ELEVATOR WEIGHTS
Katie Foundry, Galt, Ont.

ELEVATORS AND BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Machy. Co., St. Louis.

ELEVATING AND CONVEYING MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Petrie, Ltd., H. W., Toronto.

EMBOSSING PRESSES
Dom. Steel Products Co., Ltd., Brantford.
Oliver Machinery Co., Grand Rapids, Mich

EMERY GRINDERS (PNEUMATIC)
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.

EMERY CLOTH
Atkins & Co., E. C., Hamilton, Ont.
Atkins & Co., E. C., Hamilton, Ont.
H. H. Barton & Son Co, Philadelphia, Pa
Wausite Abrasives Co., Chicago, Ill.

EMERY PAPER
Atkins & Co., E. C., Hamilton, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Wausan Abrasives Co., Chicago, Ill.

EMERY AND EMERY WHEELS
Atkins & Co., E. C., Hamilton, Ont.
Brantford Emery Wheel Co., Brantford, Canada.
The Foss Mchy. & Supply Co., Montreal.
Garvin Machine Co., New York.
Canadian Fairbanks-Morse Co., Montreal.
Canada Emery Wheels Co., Hamilton.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Wilkinson & Kompass, Hamilton, Ont.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.

ENAMELWARE
Crane, Ltd., Montreal, Que.

EMERY WHEEL DRESSINGS
Dominion Abrasive Co., Ltd., Mimico, Ont.
Wheel Trueing Tool Co., Windsor Ont.

END MILLS
John Morrow Screw & Nut Co., Ingersoll

ENGINEERS—INDUSTRIAL CLEANING (Free Consultation)
Oakley Chemical Co., New York, N.Y.

ENGINEERS
Samuel Osborne (Canada) Ltd., Montreal.

ENGINES—HOISTING, PILE DRIVING, BRIDGE ERECTING, MINING
Canadian Mead-Morrison Co., Limited, Montreal, Que.

ENGINES, STEAM, GAS, GASOLINE
Furniss, Clarke & Co., Montreal, Que
Canadian Fairbanks-Morse Co., Montreal.
Johnson Mach. Co., Carlyle, Manchester, Conn.
MacGovern & Co., Montreal, Que.
Sturtevant Co., B. F., Galt, Ont.

ENGINES, HORIZONTAL AND VERTICAL
Johnson Mach. Co., Carlyle, Manchester, Conn.
A. R. Williams Machy. Co., Toronto.
Petrie, Ltd., H. W., Toronto.

ENGINES, OIL
Ker & Goodwin Machine Co., Ltd., Brantford, Ont.

ENGINES, HEAVY OIL, DIESEL TYPE
Dom. Steel Products Co., Ltd., Brantford

ENGINES, MARINE
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Sturtevant Co., B. F., Galt, Ont.

ESCUTCHEON PINS
Parmenter & Bulloch, Gananoque, Ont.

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Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Sturtevant Co., B. F., Galt, Ont.

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Pangborn Corporation, Hagerstown, Md.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
St Lawrence Welding Co, Ltd., Montreal

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Strong, Kennard & Nutt Co., Cleveland.
Willson & Co., Inc., T. A., Reading, Pa.

FACTORY GATES
Page Steel & Wire Co., Adrian, Mich.

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FACTORY SITES
City of St. Johns, Quebec.

FANS
Baird Machine Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont.
Sturtevant Co., B. F., Galt, Ont.
Sheldons, Ltd., Galt, Ont.

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Page Steel & Wire Co., New York, N.Y.

FENCE, IRON AND FACTORY
Can. Wire & Iron Goods, Hamilton, Ont.
Page Steel & Wire Co., Adrian, Mich.

FERRO-TUNGSTEN
Vanadium-Alloys Steel Co., Pittsburgh, Pa

FILES
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., Wm., Sheffield, Eng.
Ingersoll File Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Marshall, Son & Bunney, Toronto, Ont.
Nicholson File Co., Port Hope, Ont.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
Whitman & Barnes Mfg. Co., Akron, O.
Wilkinson & Kompass, Hamilton, Ont.

FILES, COMMUTATOR SLOTTING
Lyman Tube & Supply Co., Montreal, Que.

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Barry Mfg. Co., Chicago, Ill.

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Bowser Co., Ltd., S. F., Toronto, Ont.
Can. Wire & Iron Goods, Hamilton, Ont.

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Elk Fire Brick Co., Hamilton, Ont.
General Combustion Co., Ltd., Montreal, Que.

FIRE CLAY
Elk Fire Brick Co., Can., Ltd., Hamil-
General Combustion Co., Ltd., Montreal, Que.

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Brown & Sharpe Mfg. Co., Providence, R.I.

FIRST AID CABINETS
Strong, Kennard & Nutt Co., Cleveland.

FIRE EXTINGUISHERS
Strong, Kennard & Nutt Co., Cleveland, O.

FITTINGS, CAST IRON, SCREWED, FLANGED
Crane, Ltd., Montreal, Que.

FIXTURES
Brown Engineering Corp. Toronto, Ont.
Crescent Mchy. Co., Ltd., Montreal, Que.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Toronto Tool Co., Toronto, Ont.

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FLEXIBLE SHAFT EQUIPMENT
R. C. Haskins Co., Chicago, Ill.

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Can. Electric Co., Ltd., Montreal Que

FLOTATION MACHINERY
Elec. Steel & Metals, Welland, Ont.

FLUMES
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
William Hamilton Co., Peterboro, Ont.

FORGES, HAND PORTABLE
Hardware Co., Toronto, Ont
r & Forge Co., Kitchener.
A. B. Jardine & Co., Ltd., Hespeler, Ont
Rice Lewis & Son, Toronto, Ont.
Sturtevant Co., B. F., Galt, Ont.
U. S. Ordnance, Toronto, Ont.

FORGE TOOLS
Kimber & Hillier Mfg., Co., St. Catharines, Ont.

FORGES, OIL
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.

FORGINGS
Mesta Machine Co., Pittsburgh, Pa.
Can. Found. & Forgings, Ltd., Welland
Nova Scotia Steel & Coal Co., New Glasgow, N.S.

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Dominion Bridge Co., Montreal, Que.
Dom. Forge & Stamp'g Co., Walkerville
Steel Co. of Canada, Ltd., St. Catharines
Victoria Foundry Co., Ottawa.
Williams & Co., J. H., Brooklyn, N.Y

FORGING MACHINERY
John Bertram & Sons Co., Dundas, Ont
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Ont
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Wm. Kennedy & Sons, Ltd., Owen Sound, Ont.
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Grant Gear Works, Boston, Mass.
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Greenfield Tap & Die Corp., Greenfield, Mass.
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Wells Bros. of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

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Foss Mchy. & S'ply Co., G. F., Montreal.
Greenfield Machine Co., Greenfield, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Norton Co., Worcester, Mass.
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Ford-Smith Mach. Co., Hamilton, Ont.
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Grant Mfg. & Mach. Co., Bridgeport, Conn.
Garlock-Walker Machinery Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Independent Pneumatic Tool Co., Chicago
Petrie, Ltd., H. W., Toronto.
United States Elec. Tool Co., Cincinnati.
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Cleveland Pneumatic Tool Co., Toronto.
Garlock-Walker Machinery Co., Toronto.
Heald Machine Co., Worcester, Mass.
Independent Pneumatic Tool Co., Chicago
MacGovern & Co., Montreal, Que.

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Cleveland Milling Machine Co., Cleveland.

GRINDERS, ROTARY SURFACE
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GRINDERS, TOOL AND HOLDER
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W. F. & John Barnes Co., Rockford, Ill.
Blount & Co., J. G., Everet, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield.
National-Acme Co., Cleveland, Ohio.
Tabor Mfg. Co., Philadelphia, Pa.
Wells Bros. of Canada, Galt, Ont.

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Manhattan Machine & Tool Co., Grand Rapids, Mich.
Modern Tool Co., Erie, Pa.
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Garvin Machine Co., New York.
Garlock-Walker Machy. Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Haskins & Co., R. C., Chicago, Ill.
Hall & Sons, John H., Brantford, Ont.
Niles-Bement-Pond Co., New York, N.Y.
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Ford-Smith Machine Co., Hamilton, Ont.
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Victor Saw Works, Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
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Atkins & Co., E. C., Hamilton, Ont.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Wks., Buffalo.
Foss Mchy. & S'ply Co., G. F., Montreal.
Ford-Smith Machine Co., Hamilton.
Perfect Machine Co., Galt, Ont.
Starrett Co., L. S., Athol, Mass.
Victor Saw Works, Hamilton, Ont.
Williams Machy. Co., A. R., Toronto.
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Nazel Eng. & Mach. Wks., Philadelphia.

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GARVIN MACHINE TOOLS

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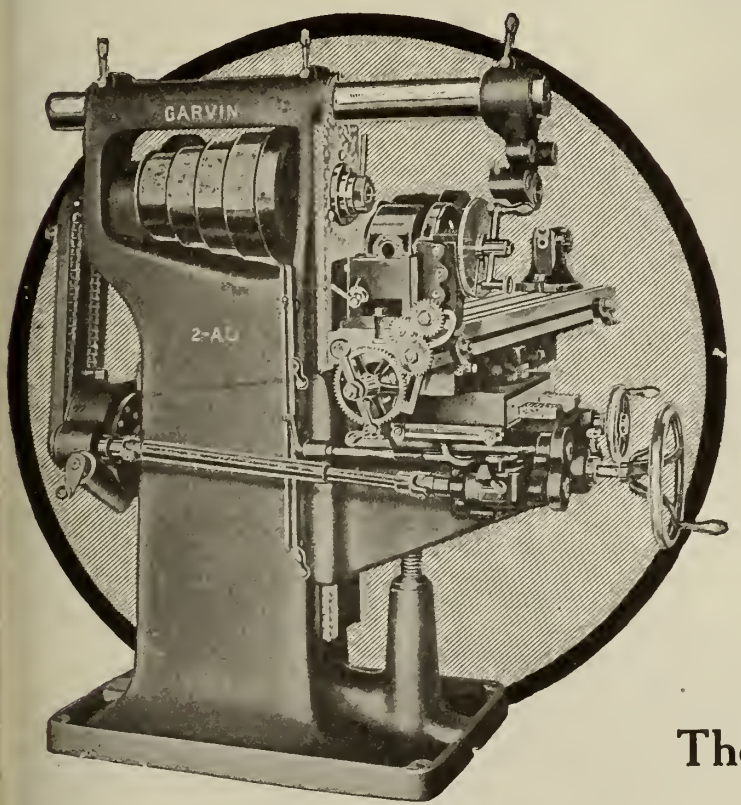

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Petrie, Ltd., H. W., Toronto.
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Williams Mchy Co, Ltd., A. R., Montreal

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Nazel Eng. & Mach. Wks., Philadelphia.

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Nazel Eng. & Mach. Wks., Philadelphia.

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Niles-Bement-Pond Co., New York.

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Chapman Double Ball Bearing Co., Toronto.
Gray Ball Bearing Co., Ltd., Toronto.
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Can. S K F Co., Toronto, Ont.
Gardner & Son, Robt., Montreal.
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Williams Mchy Co, Ltd., A. R., Montreal

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Shore Instrument & Mfg. Co., New York

HELMETS, SANDBLAST, AMMONIA
Strong, Kennard & Nutt Co., Cleveland

HIGH SPEED STEEL
See Steel.

HINGE MACHINERY
Baird Machine Co., Bridgeport, Conn.

HINGES
Butterfield & Co., Inc., Rock Island, Que.
London Bolt & Hinge Wks., London, Ont.

HOBS
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Pratt & Whitney Co., Dundas, Ont.
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Wells Bros. of Canada, Galt, Ont.

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Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

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Garlock-Walker Machinery Co., Toronto.
Ford Chain Block & Mfg., Philadelphia.
Independent Pneumatic Tool Co., Chicago
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.
Petrie, Ltd., H. W., Toronto.
U. S. Ordinance, Toronto, Ont.
Williams Mchy Co, Ltd., A. R., Montreal

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A. Leatty & Sons, Ltd., Welland, Can.
Oliver Engineering Co., Montreal.
Volta Mfg. Co., Welland, Ont.

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Dominion Bridge Co., Montreal, Que.
Electric Steels & Metals Ltd., Welland.
Kennedy & Sons, Owen Sound, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

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HOLDERS, ELECTRIC
Electric Steels & Metals, Ltd., Welland

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Clipper Belt Lacer Co., Grand Rapids.

HOPPERS
MacKinnon Steel Co., Ltd., Sherbrooke.
Dominion Bridge Co., Montreal, Que.
William Hamilton Co., Peterboro, Ont.
Toronto Iron Works, Ltd., Toronto, Ont.

HOSE, FIRE PROTECTION
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal

HOSE, PNEUMATIC
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Gutta Percha & Rubber, Ltd., Toronto.
Independent Pneumatic Tool Co., Chicago.
Quaker City Rubber Co., Philadelphia, Pa.
Wells Bros. Co. of Canada, Galt, Ont.

HOSE, ALL KINDS
Goodyear Tire & Rubber Co., of Canada, Ltd., Toronto.
Gutta Percha & Rubber, Ltd., Toronto.
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.

HOSE, SAND BLAST
Pangborn Corporation, Hagerstown, Md.
Goodyear Tire & Rubber Co. of Can., Ltd. Toronto
Quaker City Rubber Co., Philadelphia, Pa.
Intern'l. Machine Tool Co., Indianapolis.

HOSE, STEAM, SUCTION AND WATER
Gutta Percha & Rubber, Ltd., Toronto.
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.

HUMIDIFIERS
Sturtevant Co., B. F., Galt, Ont.

HYDRAULIC ACCUMULATORS
Dom. Steel Products Co., Ltd., Brantford.

HYDRAULIC MACHINERY
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Machinery Co., Toronto.
Dom. Steel Products Co., Ltd., Brantford.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
West Tire Setter Co., Rochester, N.Y.
Victoria Foundry Co., Ottawa

HYDRAULIC TURBINES
Que.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,

HYDROMETERS, HYGROMETERS, HYGRODNIKS
Taylor Instrument Co., Rochester, N.Y.

INDICATORS, SPEED
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol, Mass.

INDEX CENTRES
Brown & Sharpe Mfg. Co., Providence, R.I.
Dickow, Fred. C., Chicago, Ill.
Ford-Smith Machine Co., Hamilton, Ont.
Garvin Machine Co., New York.
Petrie, Ltd., H. W., Toronto.

INDICATING INSTRUMENTS
Taylor Instrument Co., Rochester, N.Y.

INDICATING SCALES
Can. Kron Scale Co., Montreal.

INDUSTRIAL SITES
City of St. Johns, Quebec.

INGOTS, BRASS, BRONZE, GUN METAL, PHOSPHOR
Thomas Moore & Son, Montreal.

INGOTS, FORGING AND ROLLING
Electric Steel & Metals Co., Welland.

INSULATING COMPOUNDS
Robertson Co., Ltd., H. H., Sarnia, Ont.

INSTRUMENTS, ENGINEERING
Consolidated Optical Co., Toronto.

IRON ORE
Hanna & Co., M. A. Cleveland, O.

IRON, WROUGHT, ROLLED, PIG
Swedish Steel & Impt. Co., Ltd., Montreal

JACKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
The Engineering Co.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Norton, A. O., Coaticook, Que.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.

JACKS, PIT AND TRACK
Canadian Fairbanks-Morse Co., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Northern Crane Works, Walkerville.

JAWS, FACE PLATE
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford.
Sumner Chuck Co., New Britain, Conn.

JOINTERS
Gray Ball Bearing Co., Ltd., Toronto.

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Brown Engineering Corp., Toronto.
Crescent Mach. Co., Ltd., Montreal, P.Q.
Elliott & Whitehall Mach. & Tool Co., Galt.
Gisholt Machine Co., Madison, Wis.
Globe Engineering Co., Ltd., Hamilton.
Homer & Wilson, Hamilton, Ont.
Jones & Lamson, Springfield, Vt.
Toronto Tool Co., Toronto, Ont.

JOURNAL WEDGES
Canada Foundries & Forgings, Welland.

KEY SEATERS
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Morton Mfg. Co., Muskegon Heights, M.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.

KEYS, MACHINE
Whitney Mfg. Co., Hartford, Conn.
Williams & Co., J. H., Brooklyn, N.Y.

KILNS
Can. Blower & Forge Co., Kitchener, Ont.
General Combustion Co., Ltd., Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Sturtevant Co., B. F., Galt, Ont.

KNIVES, MACHINE
Atkins & Co., E. C., Hamilton, Ont.

KNIFE GRINDERS
Gray Ball Bearing Co., Ltd., Toronto.

LABELS AND TAGS
Matthews & Co., Jas. H., Pittsburgh, Pa.

LABORATORIES, INSPECTION AND TESTING (see Chemists)

LADLES, FOUNDRY
Northern Crane Works, Walkerville.

LACING MACHINES
Clipper Belt Lacer Co., Grand Rapids, M.

LAG SCREW GIMLET POINTERS
National Machy. Co., Tiffin, Ohio.

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Robertson, Ltd., H. H., Sarnia, Ont.

LATHES, CHUCKING
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Petrie, Ltd., H. W., Toronto.
Wood Turret Machine Co., Brazil, Ind.

LATHE CHUCKS (See Chucks)

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Armstrong Bros. Tool Co., Chicago.
Hendey Machine Co., Torrington, Conn.
Williams & Co., J. H., Brooklyn, N.Y.

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Wood Turret Machine Co., Brazil, Ind.

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Betts Mach. Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.

LATHES, BORING
Barber Mchy. Co., Ltd., Toronto, Ont.
Bridgeford Mach. Tool Works, Rochester.
Canada Machinery Corp., Galt, Ont.
Lodge & Shipley, Cincinnati, O.
Petrie, Ltd., H. W., Toronto.

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J. G. Blount & Co., Everett, Mass.
Canadian Fairbanks-Morse Co., Montreal.
Geo. F. Foss Machy. & Supply Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Hardinge Bros., Chicago, Ill.
Pratt & Whitney Co., Dundas, Ont.
Seneca Falls Mfg Co., Seneca Falls, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Acme Machine Tool Co., Cincinnati, Ohio.
Hardinge Bros., Chicago, Ill.
Wood Turret Machine Co., Brazil, Ind.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Barber Mchy. Co., Ltd., Toronto, Ont.
John Bertram & Sons Co., Dundas.
Canada Mach'y Corp., Galt, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cisco Machine Tool Co., Cincinnati, Ohio.
G. F. Foss Mchy. & S'ply Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis
Kennedy & Sons, Wm., Owen Sound, Ont.
Lehman Mach. Co., St. Louis, Mo.
R. McDougall Co., Galt.
Niles-Bement-Pond Co., New York.
Perfect Machine Co., Galt, Ont.
Rae Mach. Tool Co., Ramilton.
Smalley-General Co., Inc., Bay City, Mich.
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Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Sidney Tool Co., Sidney, Ohio.
U. S. Ordinance, Toronto, Ont.
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Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.
A. R. Williams Machy. Co., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.
Worcester Lathe Co., Worcester, Mass.

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Seneca Falls Mfg. Co., Seneca Falls, N.Y.

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Intern'l. Mchy. Supplies Ltd., Montreal.
Wood Turret Machine Co., Brazil, Ind.

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Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.

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Can. Machinery Corp., Galt.
Wood Turret Machine Co., Brazil, Ind.
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Garlock-Walker Machy. Co., Toronto, Ont.

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Wells Bros. of Canada, Galt, Ont.

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Bertram & Sons Co., John, Dundas, Ont.
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Cisco Machine Tool Co., Cincinnati, O.
Foss Mchy. & S'ply Co., G. F., Montreal.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Toronto, Ont.
Hardinge Bros., Inc., Chicago, Ill.
Hepburn Ltd., John T., Toronto, Ont.
Lehman Machine Co., St. Louis, Mo.
Niles-Bement-Pond Co., New York.
Rae Mach. Tool Co., Ramilton.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
U. S. Ordinance, Toronto, Ont.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.
Williams Machy. Co., A. R., Toronto.
Wood Turret Machine Co., Brazil, Ind.
Worcester Lathe Co., Worcester, Mass.

LATHES, SPINNING
Bliss Co., E. W., Brooklyn, N.Y.

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Barber Mchy. Co., Ltd., Toronto, Ont.
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Canada Machinery Corporation, Galt, Ont.
Knight Metal Products, Toronto.
Lehman Machine Co., St. Louis, Mo.
Rae Mach. Tool Co., Ramilton.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Worcester Lathe Co., Worcester, Mass.

LATHES, QUICK CHANGE
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Acme Machine Tool Co., Cincinnati, Ohio

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LEAD BURNING OUTFITS
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Standard Optical Co., Geneva, N.Y.

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Can. Winkley Co., Ltd., Windsor, Ont.

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Can. Kron Scale Co., Montreal.

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Bertrams, Ltd., Edinburgh, Scotland.

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Dennis Wire & Iron Works, London, Ont.

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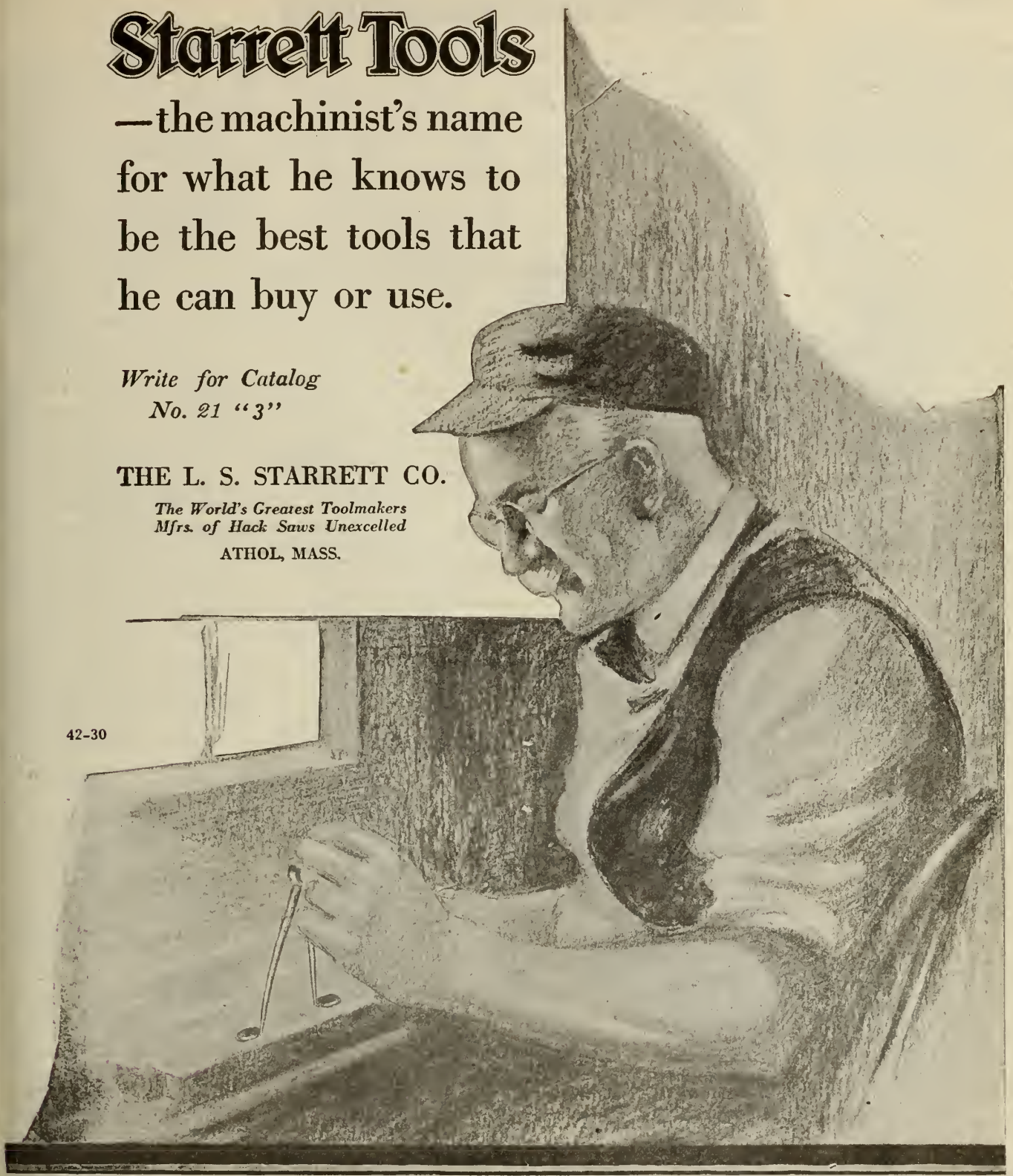

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Elliott & Whitehall, Galt, Ont.
Williams Machy. Co., A. R., Toronto.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.

MACHINERY GUARDS (See Guards)

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Globe Engineering Wks., Hamilton, Ont.
Knight Metal Products, Toronto.

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Globe Engineering Co., Ltd., Hamilton.
Heggson & Pettis Mfg. Co., New Haven, Conn.

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Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.

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Perrin, Wm. R., Toronto.
Petrie, Ltd., H. W., Toronto.

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International Mchy. Sply., Ltd., Montreal

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Chesterman & Co., Jas., Sheffield, Eng.

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See Chemists.

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Lyman Tube & Supply Co., Montreal, Que.

METAL SAWS
See Saws.

METAL, ANTI-FRICTION
Thos. Moore & Son, Montreal.

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E. C. Atkins & Co., Inc., Indianapolis.
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Canada Metal Co., Toronto, Ont.
Deloro Smelting & Refining Co., Ltd. Toronto, Ont.
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General Combustion Co., Ltd., Montreal, Que.

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Petrie, Ltd., H. W., Toronto.

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Frost Mfg. Co., Chicago, Ill.

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Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

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Brown & Sharpe Mfg. Co., Providence, R. I.
Kearney & Trecker Co., Milwaukee, Wis.

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Becker Milling Machine Co., Boston, Mass.
Bertram & Sons Co., John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence.
Canada Machinery Corp., Galt, Ont.
Cincinnati Milling Machine Co., Cincinnati
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Gooley & Edlund, Inc., Cortland, N.Y.
Hardinge Bros., Inc., Chicago, Ill.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Knight Metal Products, Toronto.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.
U.S. Ordnance, Toronto, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

MILLING MACHINES, PROFILE
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Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Brown & Sharpe Mfg. Co., Providence.
Ford-Smith Mach. Co., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dominion Bridge Co., Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.

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Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Elec. Steel & Metals, Welland, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy. Co., A. R., Toronto, Ont

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Frost Mfg. Co., Chicago, Ill.

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Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
Gray Ball Bearing Co., Ltd., Toronto.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Montreal.
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MacGovern & Co., Montreal, Que.
Northern Elec. Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
U. S. Ordnance, Toronto, Ont.
Volta Mfg. Co., Welland, Ont.
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Cleveland Pneumatic Tool Co., Toronto.

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Heggson & Pettis Mfg. Co., New Haven, Conn.

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Graton & Knight Mfg. Co., Worcester, M.

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Nat. Automatic Tool Co., Richmond, Ind.

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NAME PLATES, BRONZE, ETCHED AND STAMPED
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Turner Brass Works, Sycamore, Ill.

NICHROME CASTINGS
Can. Driver-Harris Co., Ltd., Walkerville.

NICKEL
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Pilot Steel & Tool Co., Montreal, Que.

NICKEL STEEL
See Steel.

NICKEL SILVER—SHEETS, ROLLS, PLATES and RODS
Brown's Copper and Brass Rolling Mills, New Toronto.

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Landis Machine Co., Waynesboro, Pa.

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Morrow Screw & Nut Co., J., Ingersoll, Ont
Williams & Co., J. H., Brooklyn, N.Y.

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Wilkinson & Kompass, Hamilton.

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National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
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Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
Hall & Son, J. H., Brantford, Ont.
Jardine & Co., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.

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OIL SEPARATORS
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St Lawrence Welding Co, Ltd., Montreal

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Norton Co., Worcester, Mass.
Rice Lewis & Son, Toronto, Ont.

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OIL STORAGE SYSTEMS
Bowser Co., Ltd., S. F., Toronto, Ont.
St. Lawrence Welding Co., Ltd., Montreal.

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Wells Bros. of Canada, Galt, Ont.

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MacKinnon Steel Co., Sherbrooke, Que.

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Brantford Oven & Rack Co., Brantford.

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Prest-o-Lite Co., Inc. Toronto, Ont.
Davis-Bournonville Co., Toronto, Ont.
St. Lawrence Welding Co., Montreal, Que.
Welding & Supplies Co., Montreal, Que.

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OXYGEN PLANTS (ELECTROLYTIC)
Davis-Bournonville Co., Toronto, Ont.

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Goodyear Tire & Rubber Co., Can., Ltd., Toronto
Gutta Percha & Rubber, Ltd., Toronto.
International Mach. Spls., Ltd., Montreal
Petrie, Ltd., H. W., Toronto.
Quaker City Rubber Co., Philadelphia, Pa

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Bertrams, Ltd., Edinburgh, Scotland.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Gutta Percha & Rubber, Ltd., Toronto.
MacKinnon Steel Co., Sherbrooke, Que.

PARTITIONS, WIRE
See Guards

PAPER MILL MACHINERY
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Machinery Co., Toronto.
MacKinnon Steel Co., Sherbrooke, Que.

PATTERN SHOP EQUIPMENT
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Oliver Machy. Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto.

PATTERN MAKERS' LATHES
See Lathes.

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Jardine & Co., A. B., Hespeler, Ont.
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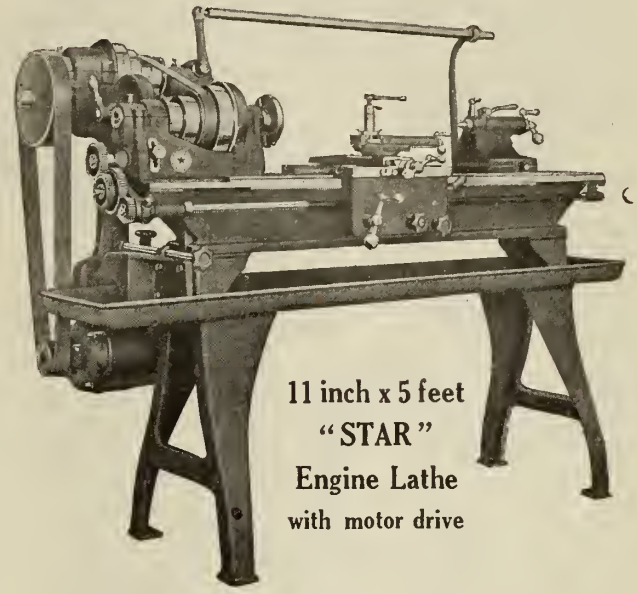

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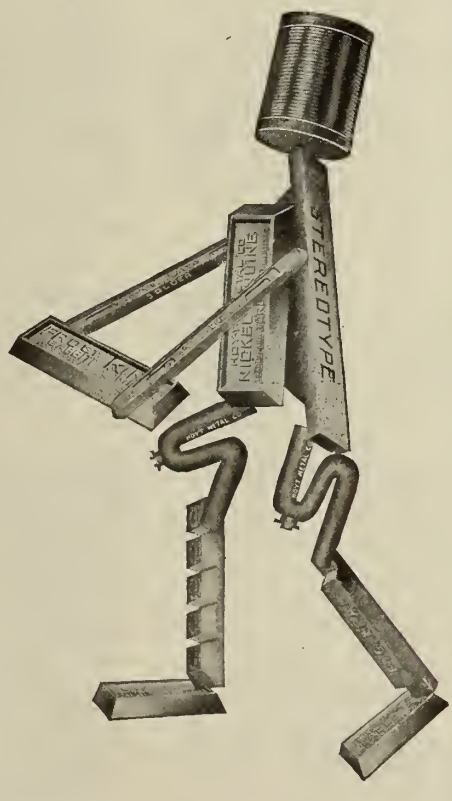

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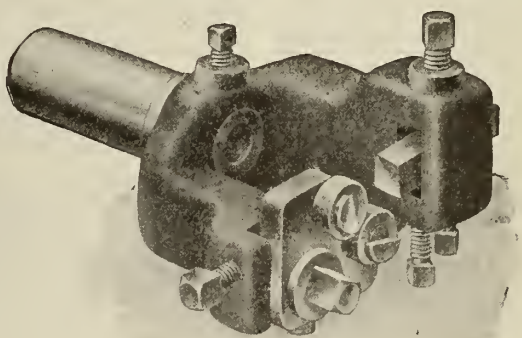

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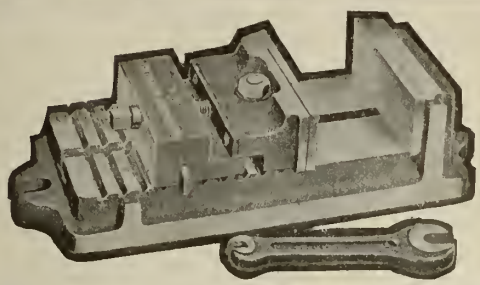

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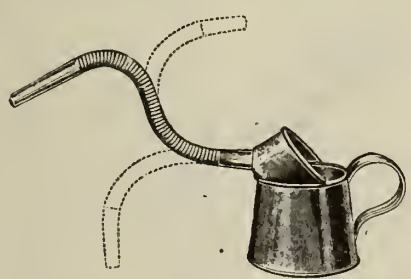

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Diamond Fibre is a super-material that combines great strength with light weight (lighter than aluminum). It is dense, tough and hard; high in dielectric, compression, shearing and tensile strength—does not splinter, split, crack or break.

Diamond Fibre is absolutely free from grit and all foreign matter and therefore takes extreme machining with but little wear on edge tools. It can be sawed, bored, drilled, stamped, turned, tapped, threaded, milled, punched, bent or worked into almost any conceivable form.

Superior to metal, rubber, porcelain, wood and leather for a great variety of purposes. Made in sheets, rods, tubes and special parts machined to your specifications.

Prices, samples and complete information upon request.

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Diamond State Fibre Company of Canada, Limited

455 King Street West

Toronto · Canada

Diamond-F

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Jones & Glasco, Montreal.
Lyman Tube & Supply Co., Montreal, Que

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Garlock-Walker Machinery Co., Toronto
Niles-Bement-Pond Co., New York.
Petrie Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo, O.

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Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

ROLLS AND TABLES
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ROLLING MACHINES, SHEET METAL
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Mesta Machine Co., Pittsburgh, Pa.

ROLL LATHES
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ROLLS, BENDING, STRAIGHTENING
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ROLLS, CRUSHING
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Lufkin Rule Co. of Can., Windsor.

RULES, BOARD AND LONG
Lufkin Rule Co. of Can., Windsor.

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SAFETY APPLIANCE GOGGLES
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Plewes Ltd., Winnipeg, Man.
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Atkins & Co., E. C., Hamilton, Ont.
Elliott & Whitehall Machine and Tool Co., Galt, Ont.

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SAWS — PATTERN SHOP
Atkins & Co., E. C., Hamilton, Ont.

SAWS — SWING
Atkins & Co., E. C., Hamilton, Ont.

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U. S. Ordnance, Toronto, Ont.

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Garvin Machine Co., New York.
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National Acme Co. Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
U. S. Ordnance, Toronto, Ont.
Warner & Swasey Co., Cleveland, O.
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Wood Turret Mach. Co., Brazil, Ind.

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John Morrow Screw & Nut Co., Ingersoll.
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Rice Lewis & Son, Toronto.
Steel Co. of Canada, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.

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John Morrow Screw & Nut Co., Ingersoll.

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Brown & Sharpe Mfg. Co., Providence, R.I.

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Greenfield Tap & Die Corp., Greenfield.
A. B. Jardine & Co., Hespeler.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto.
J. A. M. Taylor, Stair Bldg., Toronto.
Wells Bros. of Can., Galt.
Wilkinson & Kompass, Hamilton.

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Garvin Machine Co., New York.
National Acme Co., Cleveland, O.
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Bristol Co., Waterbury, Conn.
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Wilkinson & Kompass, Hamilton.

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Canadian Machinery Corp., Galt.
Geo. F. Foss Mchy. & Sply. Co., Montreal
Robt. Gardner & Son, Montreal.
Garlock-Walker Mach'y. Co., Toronto.
Hendey Machine Co., Torrington, Conn.
Milwaukee Shaper Co., Milwaukee, Wis.
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Rae Mach. Tool Co., Hamilton.
Standard Equipment & Tool Wks., Montreal.
U. S. Ordnance, Toronto, Ont.
Walcott Lathe Co., Jackson, Mich.
Williams Mchy Co., A. R., Toronto, Ont.

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Knigh Metal Products, Toronto.

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Garlock-Walker Machy. Co., Ltd., Toronto
Jones & Glasco, Montreal.
Niles-Bement-Pond Co., New York.
Can. Drawn Steel Co., Hamilton.
Peckovers, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas.
Rice, Lewis & Son, Toronto.
A. R. Williams Machy. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

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Norton Co, Worcester, Mass.
Rice, Lewis & Son, Toronto.

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Bertrams Ltd., Edinburgh, Scotland.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
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Long & Allstatter Co., Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo, O.

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Can Blower & Forge Co, Kitchener.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Long & Allstatler, Hamilton, Ohio.
A. B. Jardine & Co., Hespeler, Ont.
National Machy. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
H. D. Stoll Co., Inc., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Williams, White & Co., Moline, Ill.
Williams Mchy Co., A. R., Toronto, Ont.

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The Quickwork Co., St Mary's, Ohio.

SHEARS, PNEUMATIC
Toledo Machine & Tool Co., Toledo, Ohio

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Quickwork Co., St. Mary's, Ohio.

SHEARS, SPLITTING
Dom. Steel Products Co., Ltd., Brantford.
Peck, Stow & Wilcox Co., Southington.

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Dominion Sheet Metal Corp., Hamilton.

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Brown, Boggs & Co., Hamilton.
Peck, Stow & Wilcox Co., Southington, C.
Petrie, Ltd., H. W., Toronto.
D. H. Stoll Co., Inc., Buffalo, N.Y.

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Kayser-Ellison & Co., Ltd., Montreal.

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Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont

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Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
National-Acme Co., Cleveland, Ohio.
Niles-Bement-Pond Co., New York.

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MacKinnon Steel Co., Sherbrooke, Que.
St Lawrence Welding Co, Ltd., Montreal

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Modern Tool Co., Erie, Pa.
J. Morrow Screw & Nut Co., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

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Katie Foundry, Galt, Ont.

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Brown, Boggs & Co., Hamilton, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.

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Aikenhead Hardware Co., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Tallman Brass & Metal Co., Hamilton.

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Can. Link-Belt Co., Toronto, Ont.
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Mesta Machine Co., Pittsburgh, Pa.
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All mill supply houses sell them and most mechanics prefer them above all others.

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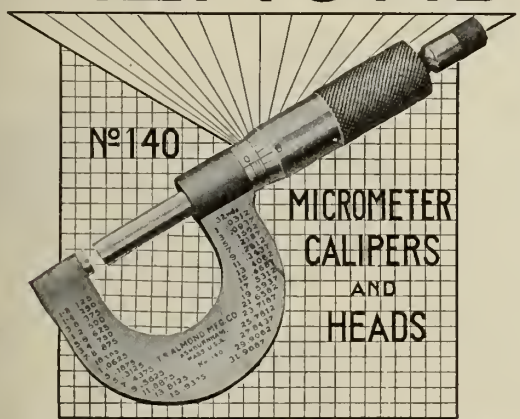

All Almond Micrometers are inspected and adjusted to Johansson Gages and recognized comparison only with these gages.

Almond Service.—Should the Micrometer need readjusting at any time or defect in material or workmanship develop send to Ashburnham and readjustment or replacement will be made without expense.

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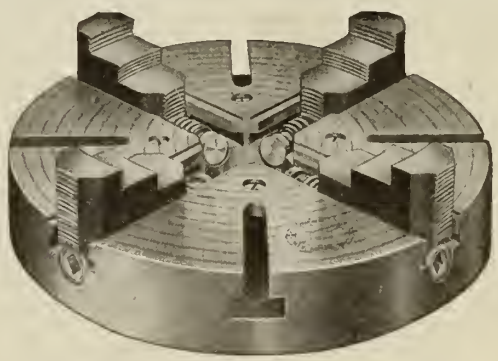

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New York Office: 26 Cortlandt Street

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SAWS SWING
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Marshall, Son & Bunney, Toronto.

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Kayser-Ellison & Co., Ltd., Montreal.
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Marshall, Son & Bunney, Toronto.

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Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co. Ltd., Montreal.
Union Drawn Steel Co., Hamilton, Ont.

STEEL FJAB
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Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Peckovers, Ltd., Toronto, Ont.

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Kayser Ellison & Co., Sheffield, Eng.
Latrobe Electric Steel Co., Latrobe, Pa.
Marshall, Son & Bunney, Toronto, Ont.
Osborne, Samuel, Montreal, P.Q.
Plewes, Ltd, Winnipeg, Man.
Pilot Steel & Tool Co., Montreal, Que.
Ralph B. Norton, Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co., Ltd., Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.

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Joliette Steel Co., Montreal, Que.

STEEL, OPEN HEARTH
Illingworth Steel Co., John, New York

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Kayser-Ellison & Co., Ltd., Montreal
Lincoln Electric Co. of Canada, Ltd Toronto, Ont.

STEEL, SPRING AND REINFORCING
Peckovers, Ltd., Toronto, Ont.

STEEL, STRUCTURAL
Algoma Steel Corp., Sault Ste. Marie
Dom. Iron & Steel Co., Sydney, N.S.
MacKinnon Steel Co., Sherbrooke, Que.
Peckovers, Ltd., Toronto, Ont.

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Atkins & Co., Wm., Sheffield, Eng.
Baines & David, Toronto.
Can. Fairbanks-Morse Co., Montreal.
Drury Co., H. A., Montreal, Que.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.
Firth & Sons, Thos., Montreal, Que.
Hawkridge Bros. Co., Boston, Mass.
Kayser-Ellison & Co., Ltd., Montreal.
Lincoln Electric Co., of Canada, Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Ltd., Montreal
Marshall, Son & Bunney, Toronto, Ont.
Latrobe Electric Steel Co., Latrobe, Pa.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son Toronto, Ont.
Vanadium-Alloys Steel Co., Pittsburgh.

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Armstrong, Whitworth of Can., Montreal.
Drury, H. A., Co., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.
Wells Bros. of Can., Galt, Ont.

STEEL WELDING
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"STELLITE"
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.

STENCILS
Hoggson & Pettis Mfg. Co., New Haven, Conn.

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Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros., of Can., Galt, Ont.

STOCKS, PIPE
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Rice Lewis & Son, Toronto, Ont.
Wells Bros., Co., of Canada, Galt, Ont.

STONES, COMMUTATORS
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Bertrams, Ltd., Edinburgh, Scotland.

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Page Steel & Wire Co., Adrian, Mich.

STRIP STEEL
Peckovers, Ltd., Toronto, Ont.

SURFACE PLATES
Brown & Sharpe Mfg. Co., Providence, R.I.

STRUCTURAL STEEL WORKS
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SUPPLIES, RUBBER MFRS.
Hoggson & Pettis Mfg. Co., New Haven, Conn.

SWITCHBOARDS
Northern Electric Co., Ltd., Montreal Que

SWITCHES, RAILWAY
Can. Steel Foundries, Ltd., Montreal.

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Economy Drawing Table Co., Adrian, Mich.

TABLES, SAND-BLAST
Panghorn Corporation, Hagerstown, Md.

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Cleveland Pneumatic Tool Co., Toronto.

TANKS, AIR, EXPANSION
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, GASOLINE, KEROSENE AND OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. John Wood Mfg. Co., Ltd., Toronto
Dominion Bridge Co., Montreal, Que.
Dom. Forge & Stamping Co., Walkerville.
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
U. S. Ordnance, Toronto, Ont.

TANKS, LEAD LINED
Can. Hanson Van Winkle Co., Ltd.,

TANKS, LUBRICATING, OIL STORAGE
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, PNEUMATIC AND CLOSET
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, RUBBER CEMENT
Bowser Co., Ltd., S. F., Toronto, Ont.
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TANKS, STEEL, WATER PRESSURE
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Dominion Bridge Co., Montreal, Quebec.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal, Que.
Toronto Iron Works, Ltd, Toronto.

TANK WAGONS
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal.
Toronto Iron Works, Ltd., Toronto.

TANKS, WELDED
Can. John Wood Mfg. Co., Ltd., Toronto
Can. Hanson Van Winkle Co., Ltd.,
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TANKS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke
Elec. Steel & Metals, Welland, Ont.
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William Hamilton Co., Peterboro, Ont.

TAPER PINS
Galt Machine Screw Co., Ltd., Galt, Ont.

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James Chesterman & Co., Ltd., Sheffield, Eng.
Rice Lewis & Son, Toronto, Ont.

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Bertram, John & Sons Co., Dundas,
Canada Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garvin Machine Co., New York.
The Geometric Tool Co., New Haven.
J. H. Hall & Sons, Brantford, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
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Murchy Machine & Tool Co., Detroit.
Niles-Bement-Pond Co., New York.
Rickert-Shafer Co., Erie, Pa.
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Modern Tool Co., Erie, Pa.
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Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

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Greenfield Tap & Die Corp., Greenfield, Mass.
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Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Mach. Co., Ingersoll, Ont.
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Wells Bros. of Can., Galt, Ont.

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Cleveland Twist Drill Co., Cleveland.
Foss Mchy. & Sply. Co., G. F., Montreal.
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Greenfield Tap & Die Corp., Greenfield.
Ingersoll Mach. Co., Ingersoll, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
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Pratt & Whitney Co., Dundas, Ont.
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Starrett Co., L. S., Athol, Mass.
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Taylor Instrument Co., Rochester, N.Y.

THERMOMETERS, RECORDING AND INDEX
Bristol Co., Waterbury, Conn., U.S.A.
Taylor Instrument Co., Rochester, N.Y.
U. S. Ordnance, Toronto, Ont.

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Toronto Testing Laboratory, Toronto.

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Jardine & Co., Ltd., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National-Acme Co., Cleveland, Ohio.
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Gisholt Machine Co., Madison, Wis.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.
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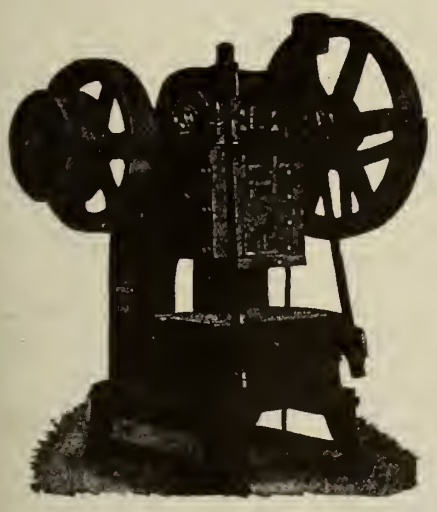

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Brown Hoisting Machinery Co., Cleveland, Ohio.

Brown Hoisting Machinery Co., Cleveland, Ohio.

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National Machy. Co., Tiffin, O.
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Parmenter & Bulloch Co., Gananoque.
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Can. Wire & Iron Goods Co., Hamilton, Ont.
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Page Steel & Wire Co., Adrian, Mich.

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Page Steel & Wire Co., New York.
Steel Co. of Canada, Ltd., Hamilton, Ont.

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Page Steel & Wire Co., Adrian, Mich.

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Can. Driver-Harris Co., Ltd., Walkerville.

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Cowan Truck Co., of Galt, Galt, Ont.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
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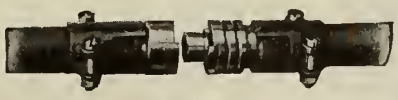

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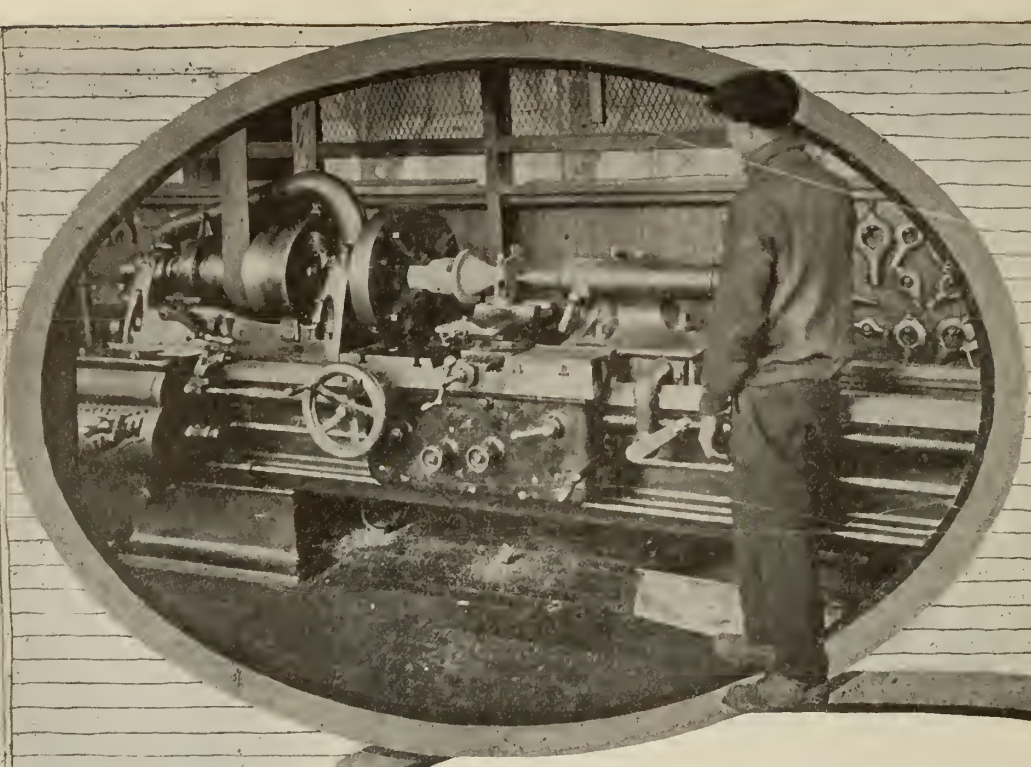

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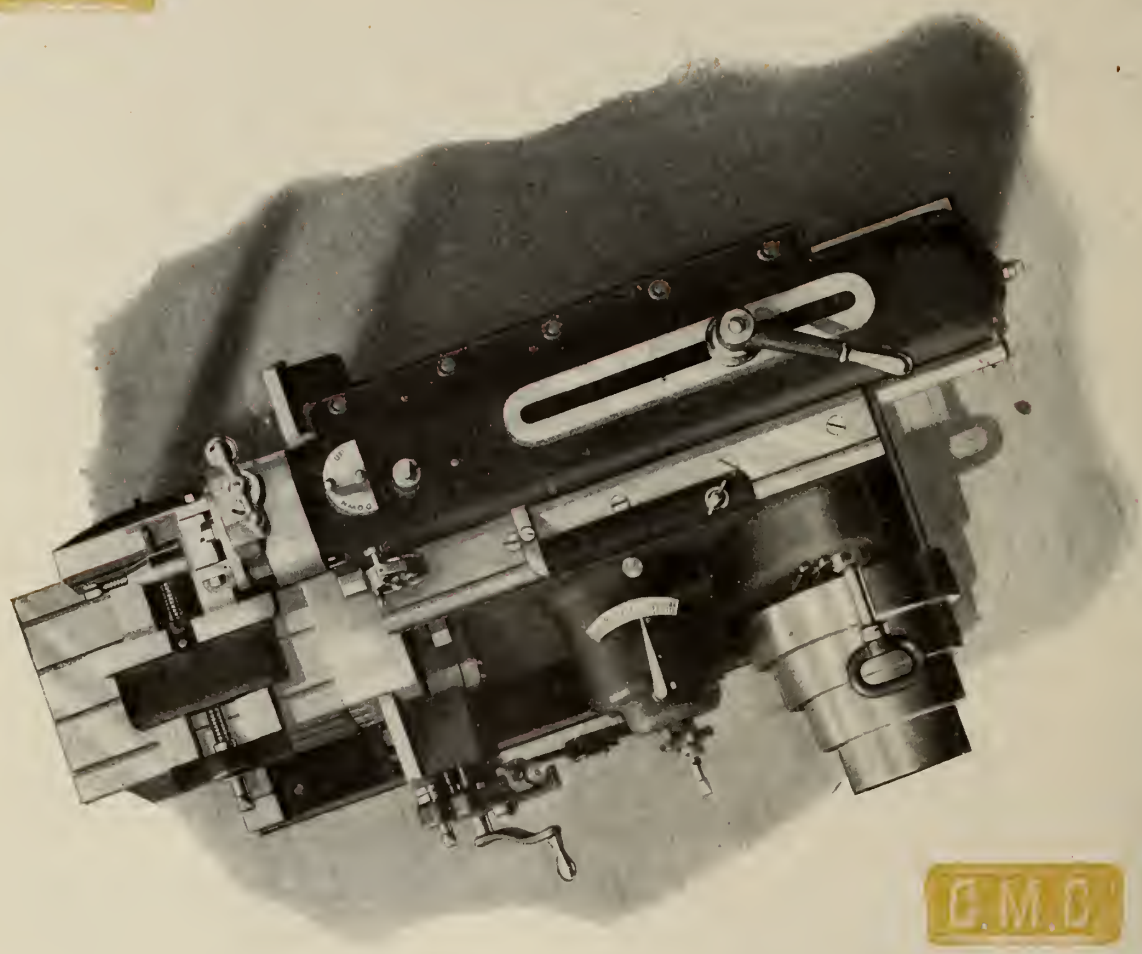

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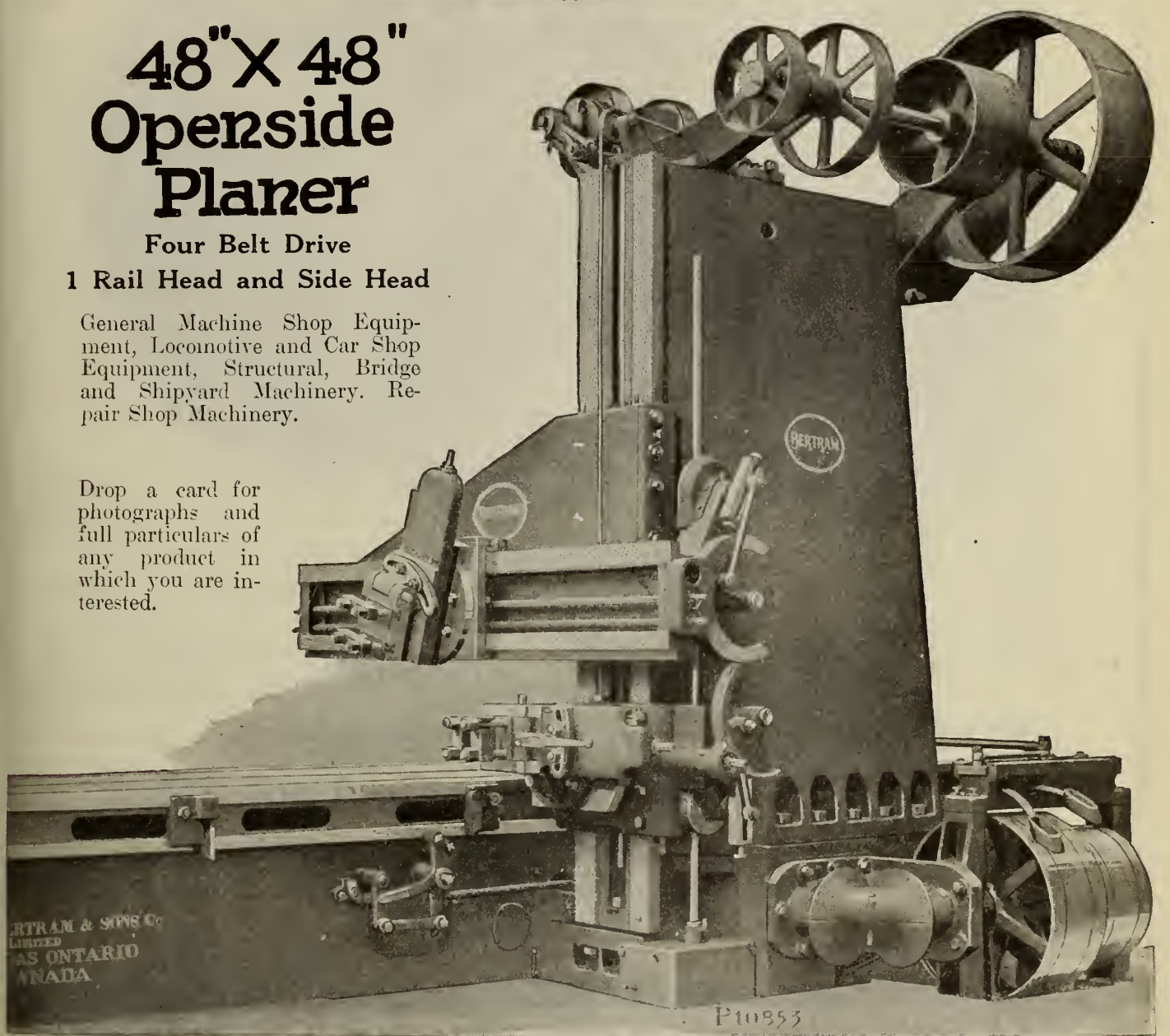

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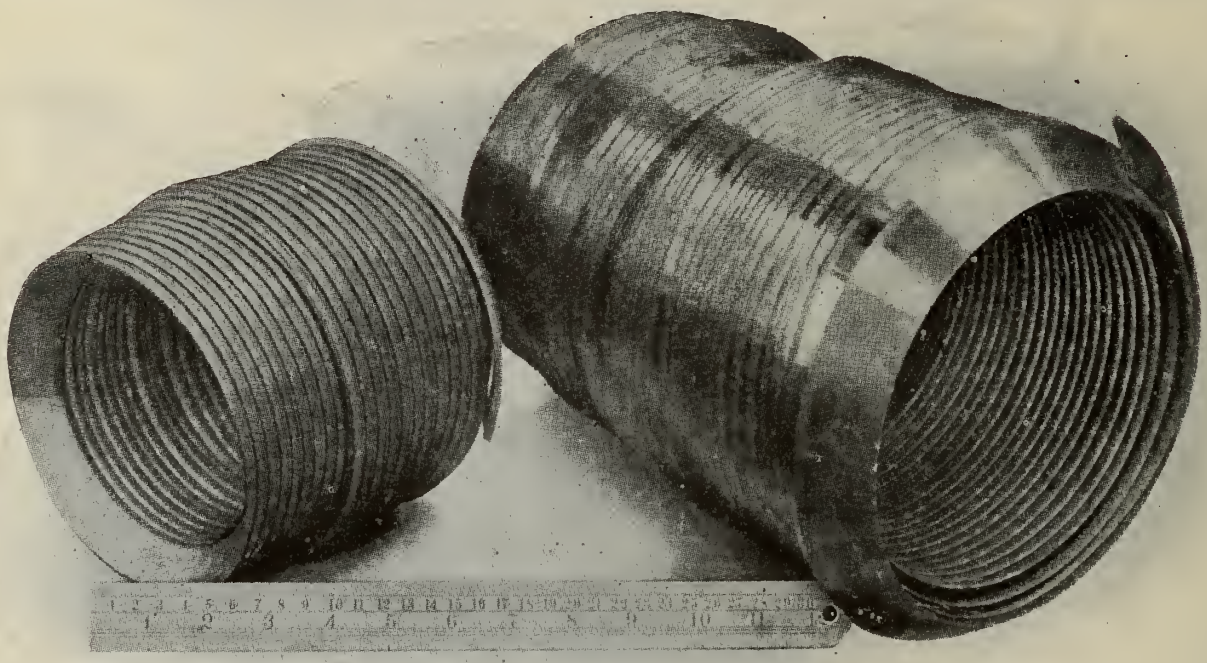

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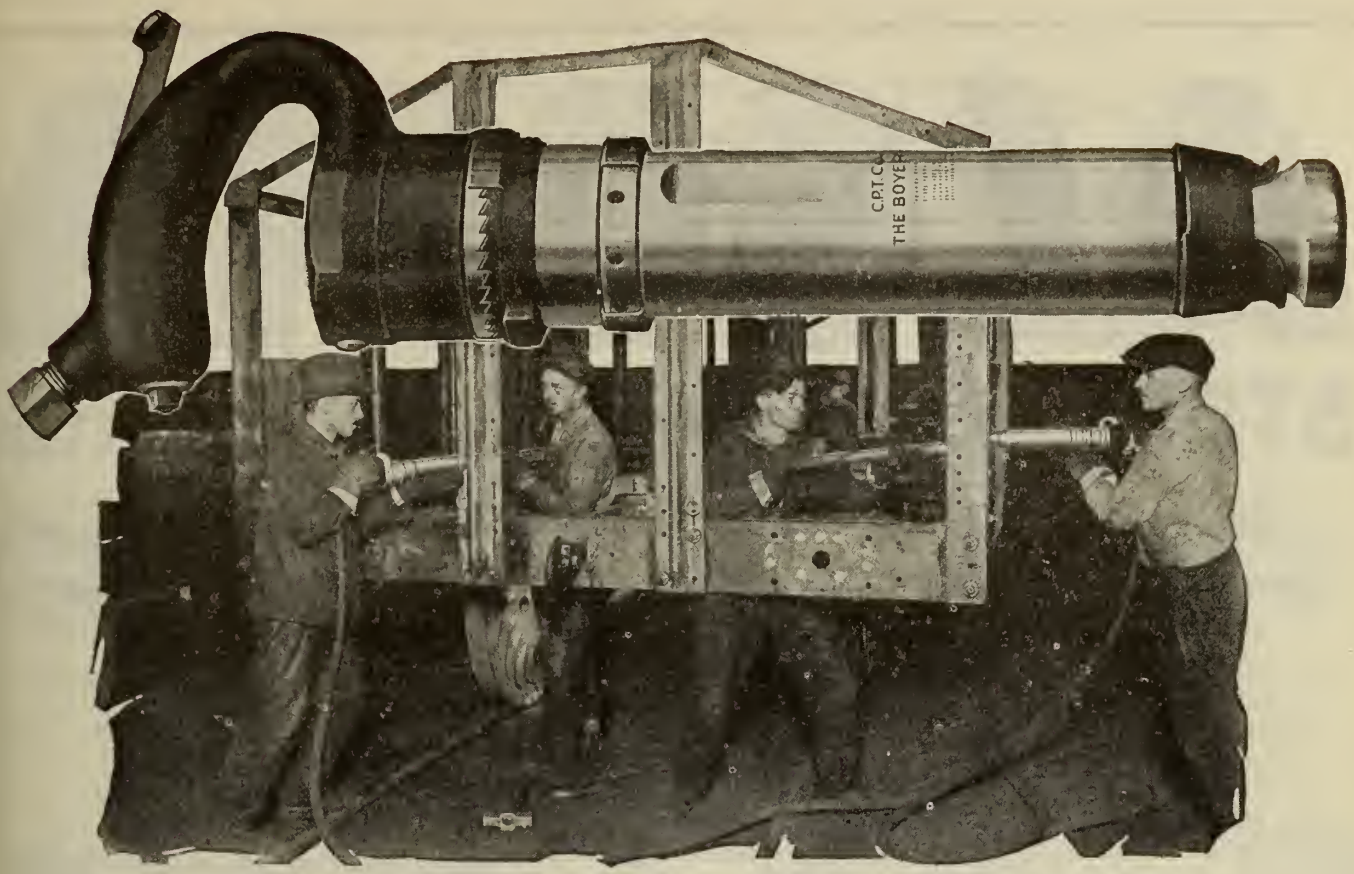

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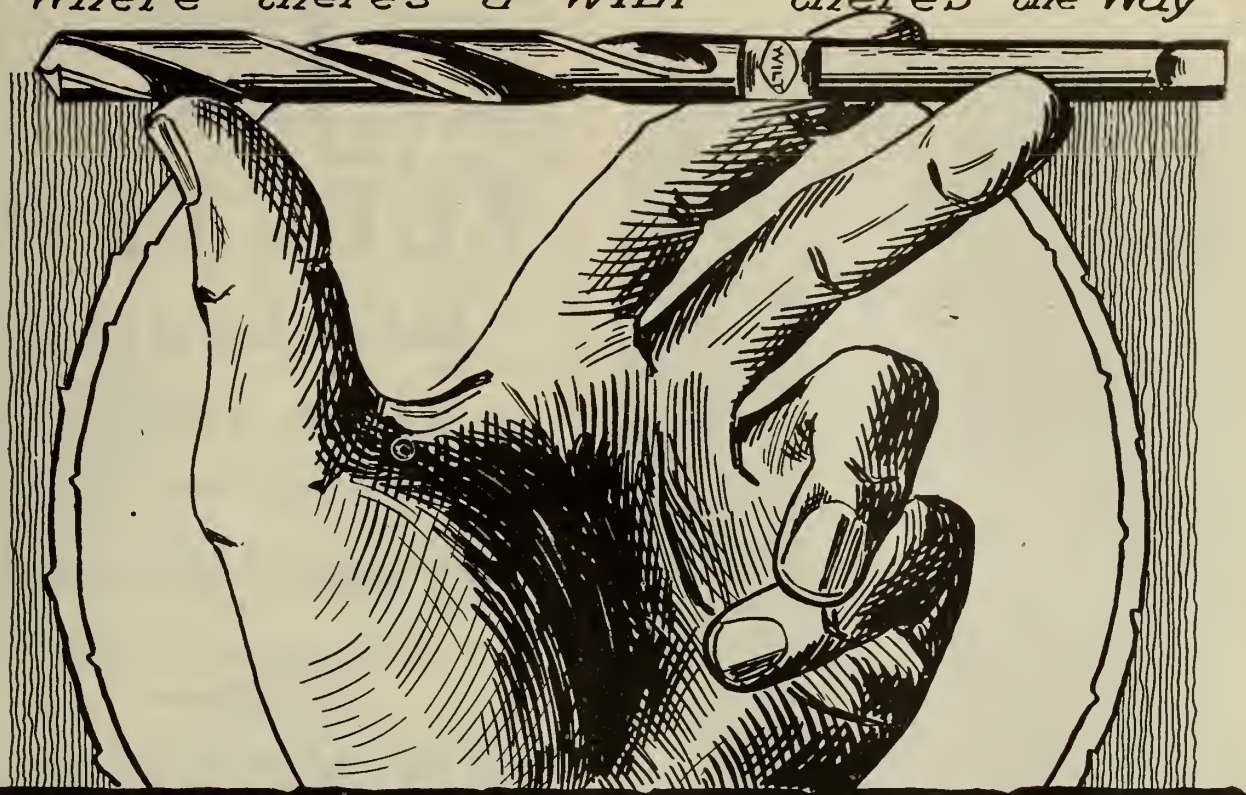

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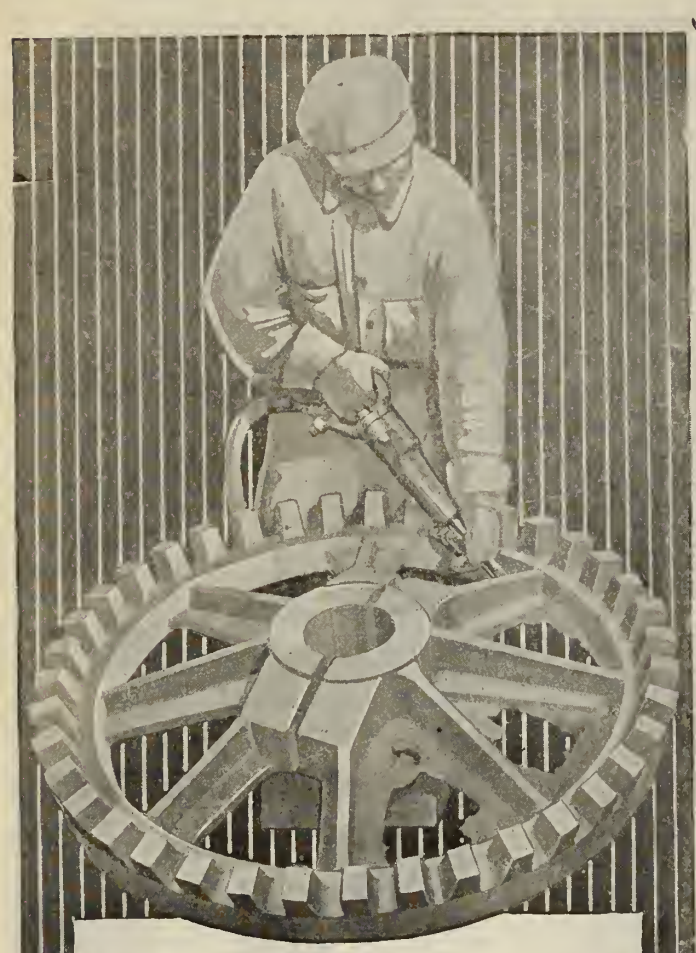

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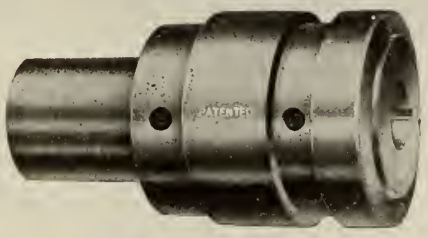

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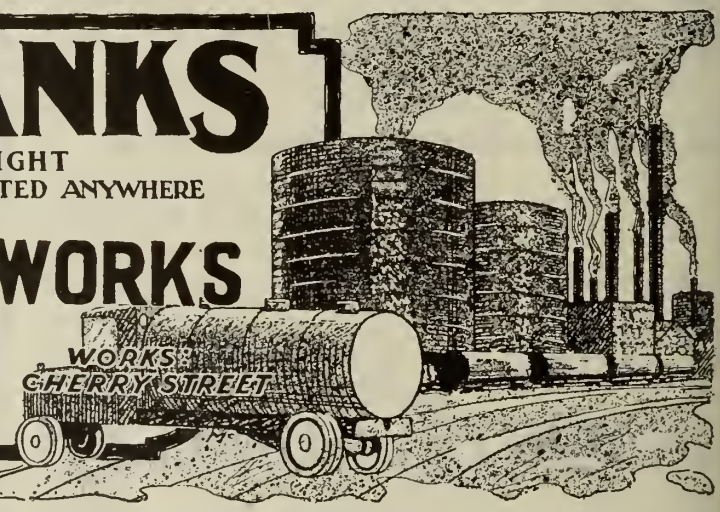

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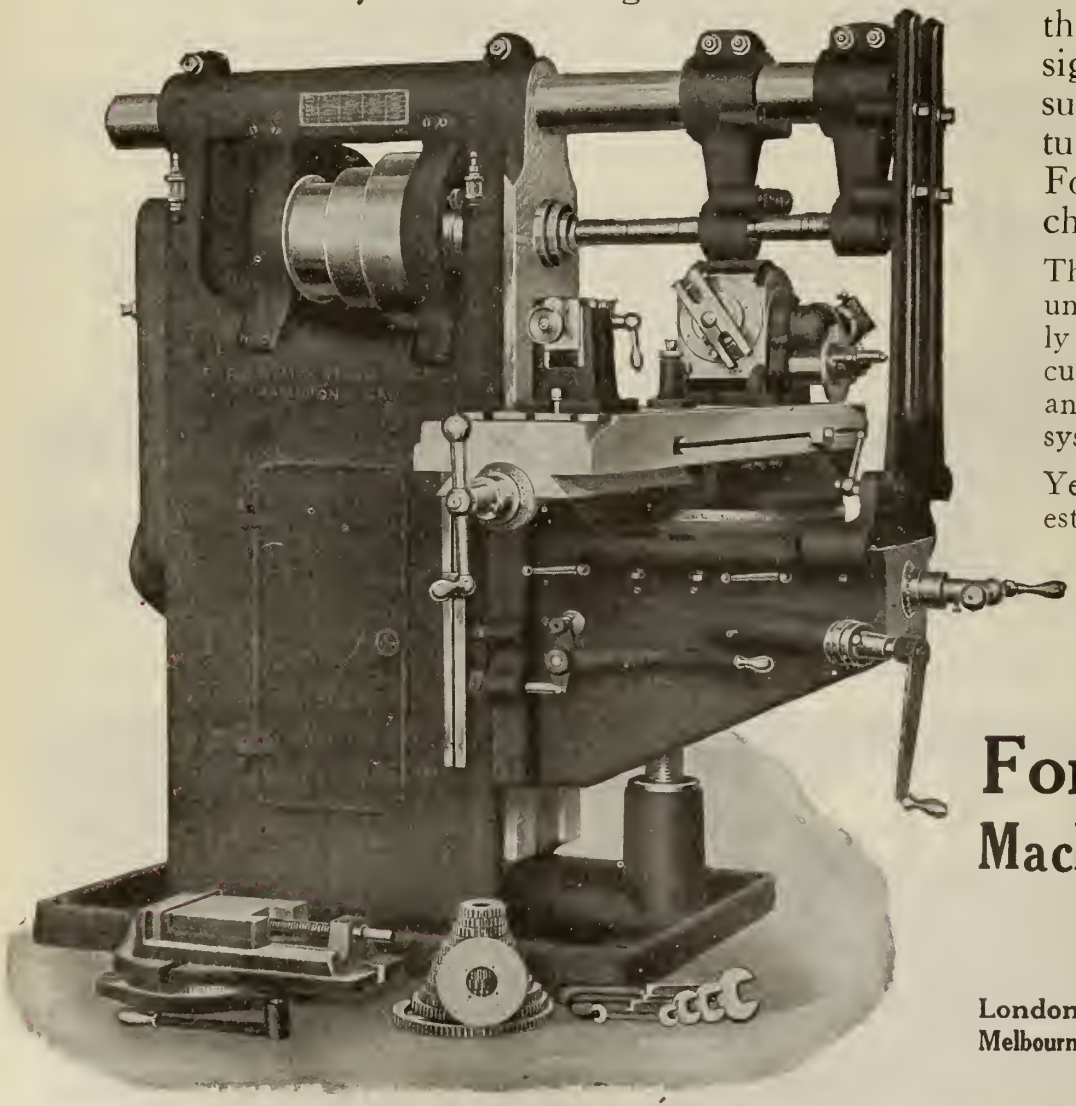

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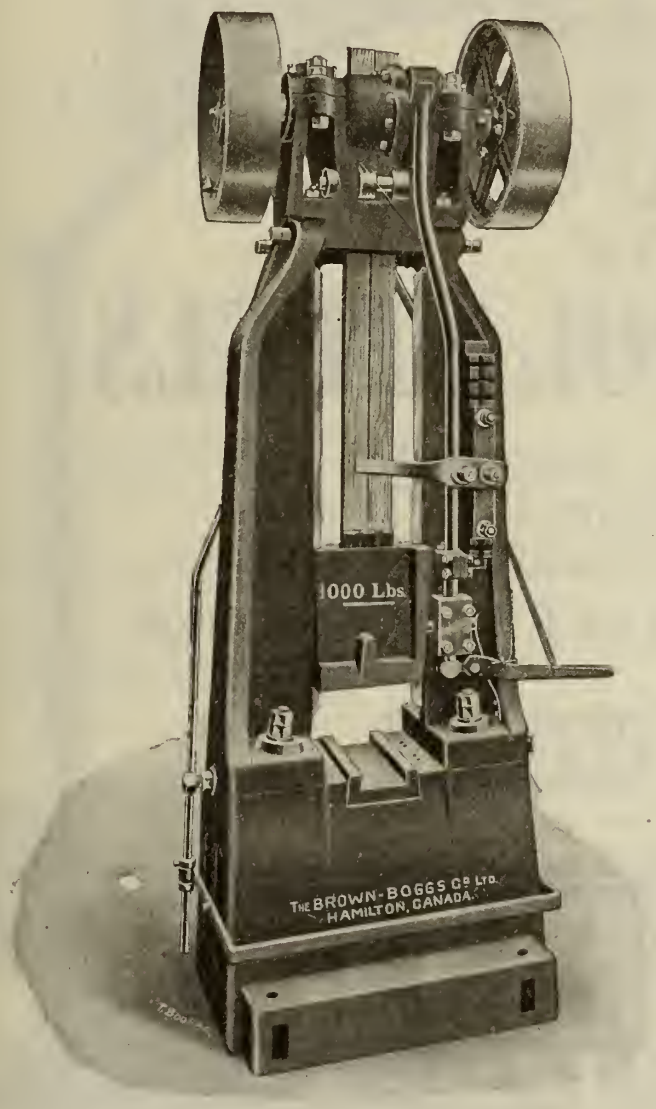

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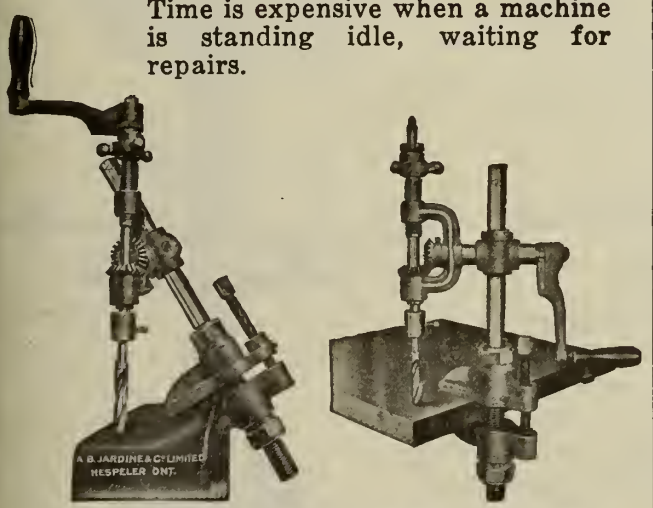

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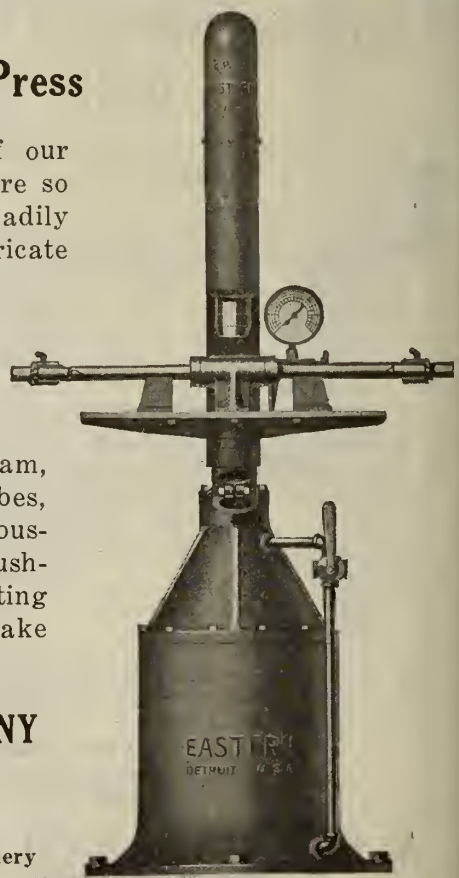

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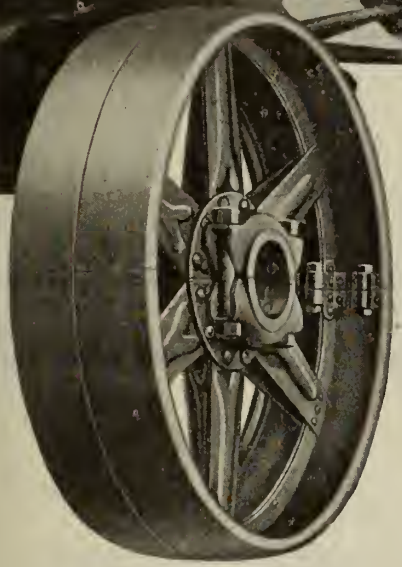

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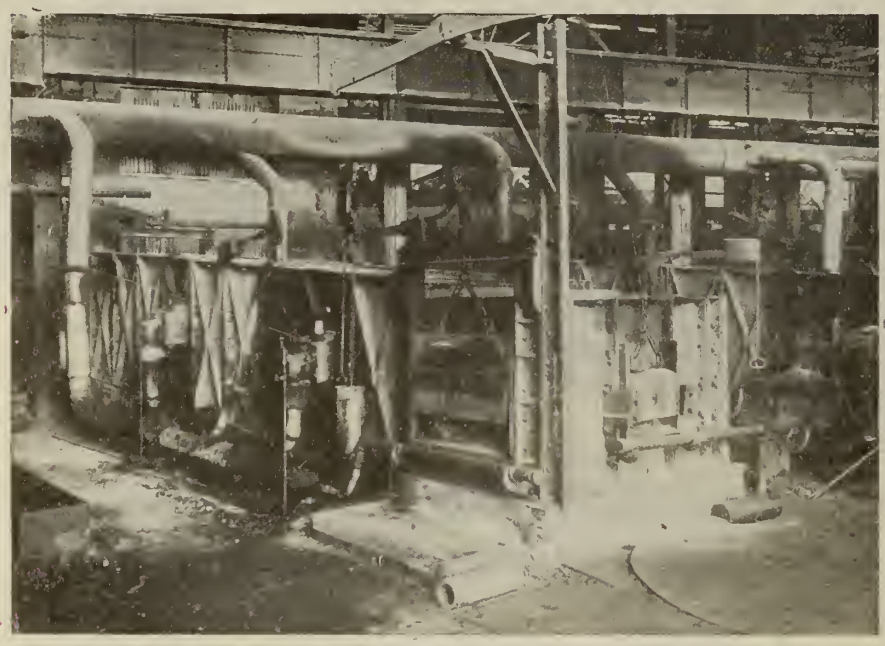

We refer to the "Mecol" Furnace shown in this illustration, installed at the Pointe St. Charles Works of the Canadian Steel Foundries, Limited.

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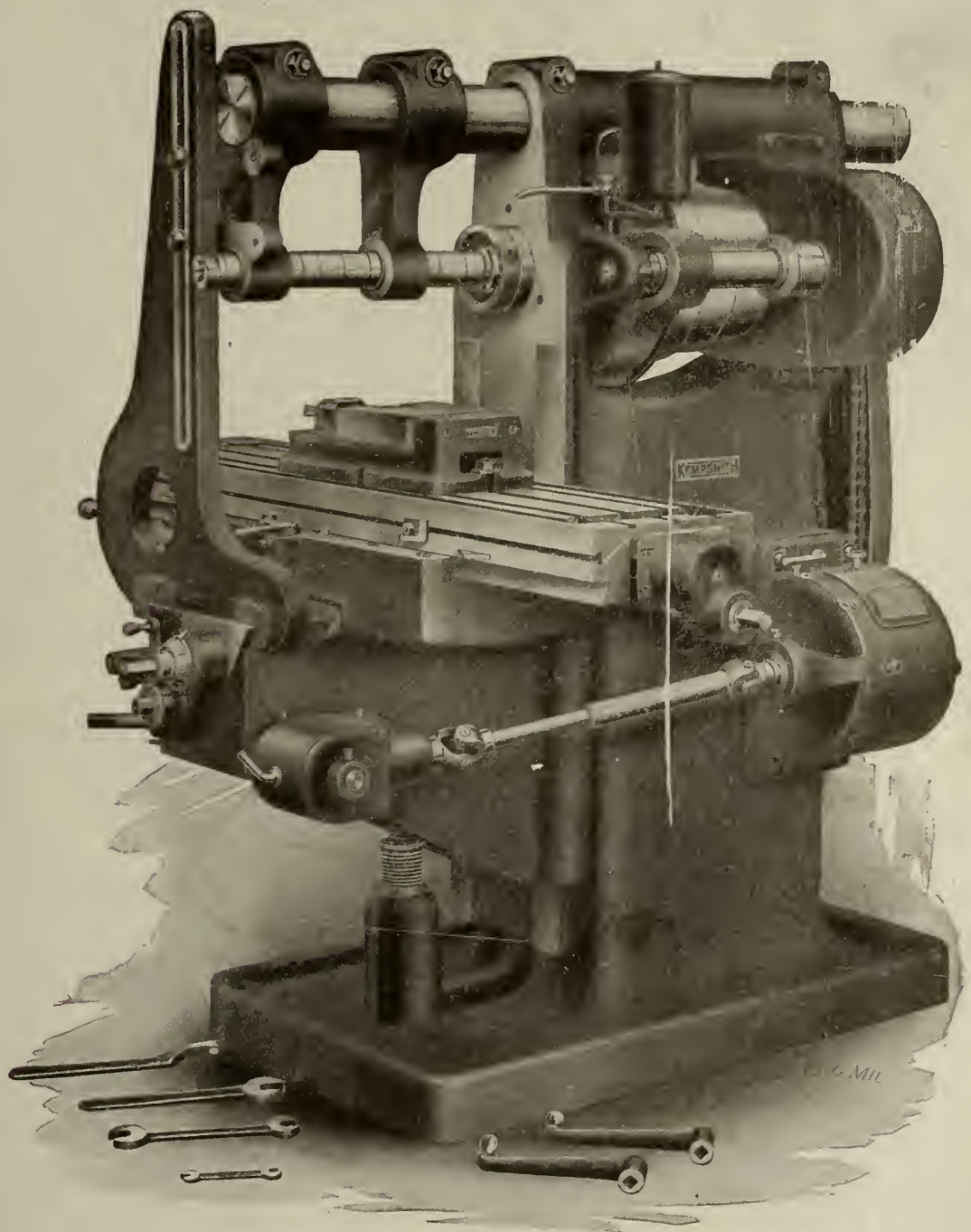

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the issuance of a new catalog of prime interest to all users of milling and gear cutters and small tools. Herein you will find listed styles and sizes of end mills (special and plain) T-slot cutters. Key cutters, thread mills, gear slots—in fact your needs in the small tool line of this class are sure to be covered. Get your copy and note its completeness.

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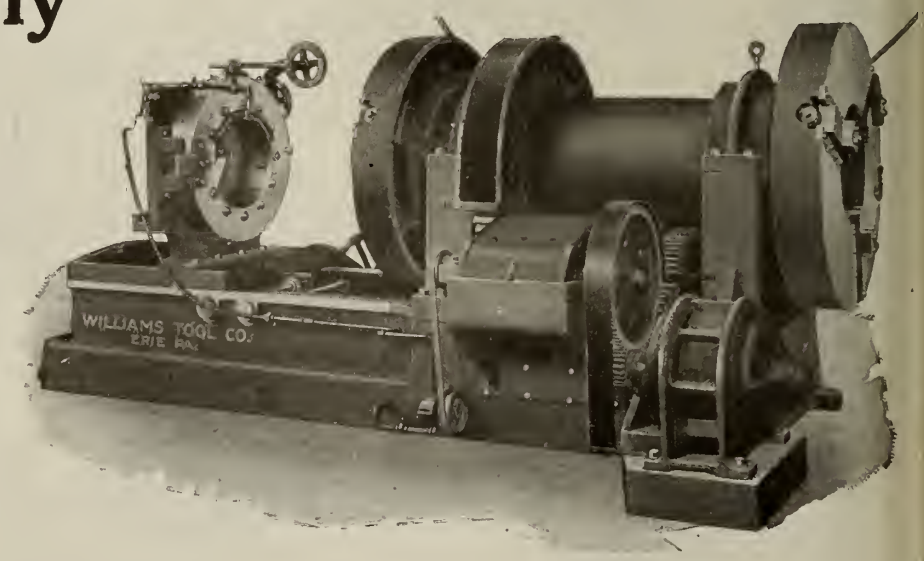

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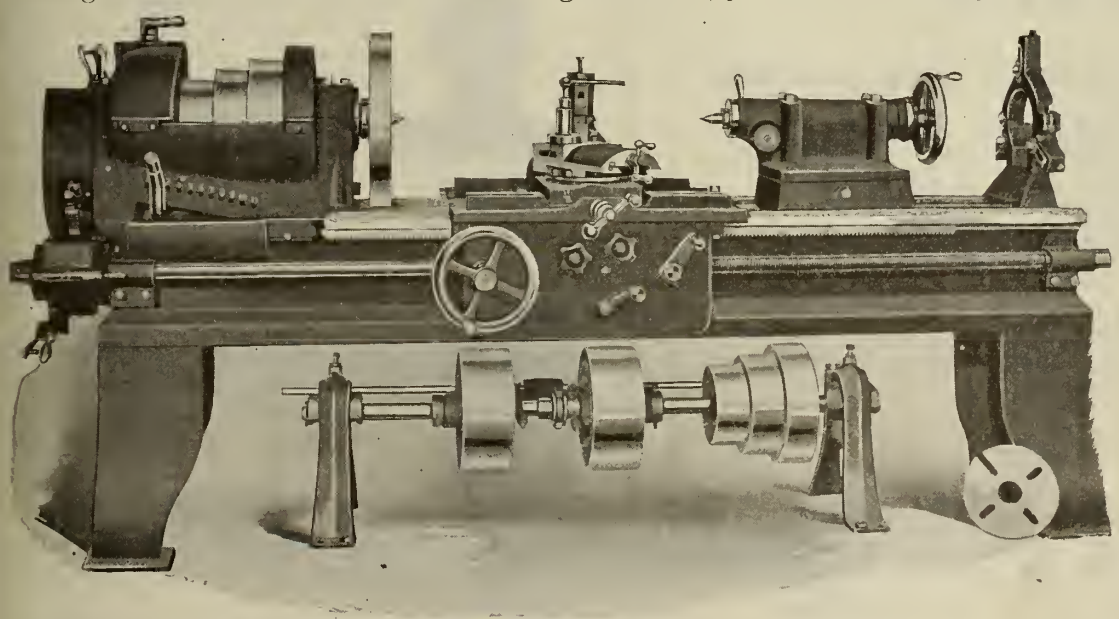

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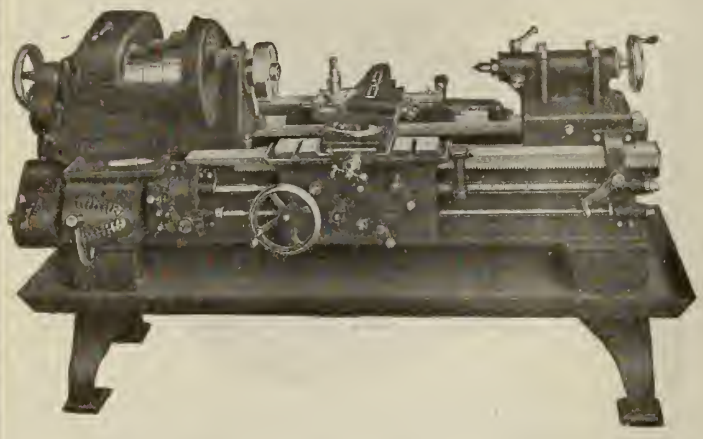

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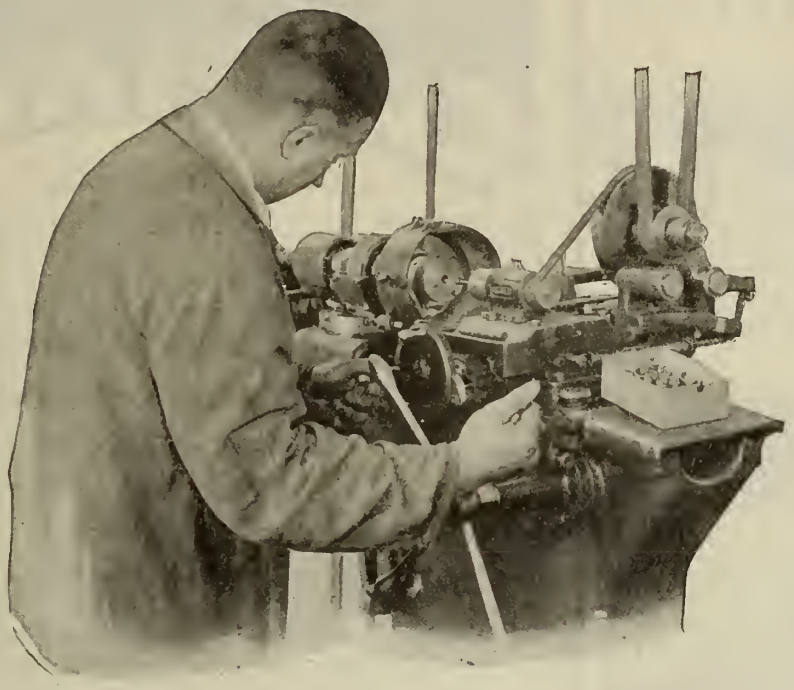

No. 1

The hole in the ball race as shown above was ¾ in. diameter by ½ in. long. It made an ideal job for the Heald Style No. 85, which handles work ¼ in. to 2 in. diameter by 2½ in. long.

Grinding Ball Races

The above photograph shows the Heald No. 85 grinding a small chrome steel ball race. Notice the simplicity of the chucking operation. The ball race was placed in a draw-in collet, the lever thrown to the left, securely holding the work. Removing it was even simpler. The pilot wheel was turned to the right, drawing the wheel from the hole, the work head automatically stopped, water was shut off and by operating the collet lever to the right, the work was released, fairly jumping into the operator's hand.

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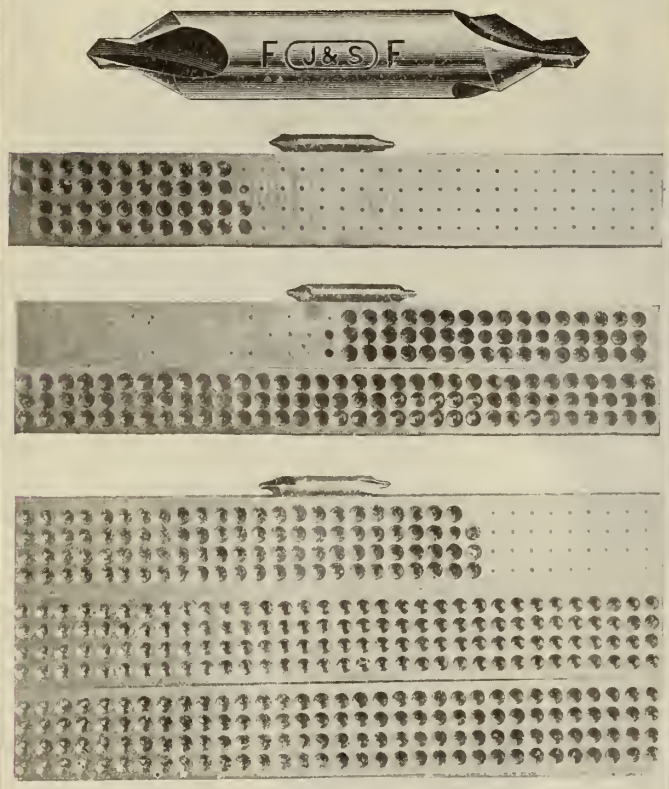

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drilled 153 holes and came to a standstill, refusing to drill any more holes unless the weight pressure was increased. *Time* 25 *seconds per hole. After the first few the holes were very ridgy.*

(C) The "J & S"

drilled 359 holes before breaking. The first holes were drilled *in 7 seconds per hole,* the final holes taking 10 seconds.

Every hole was true to size, perfectly smooth and free from ridges. Enquiries invited.

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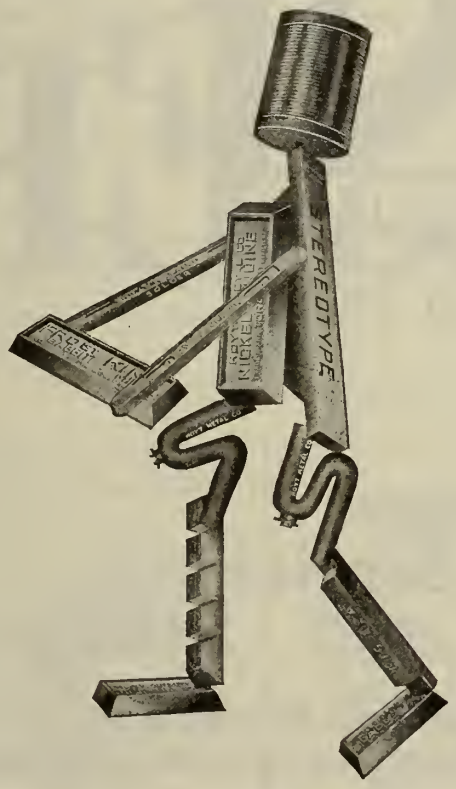

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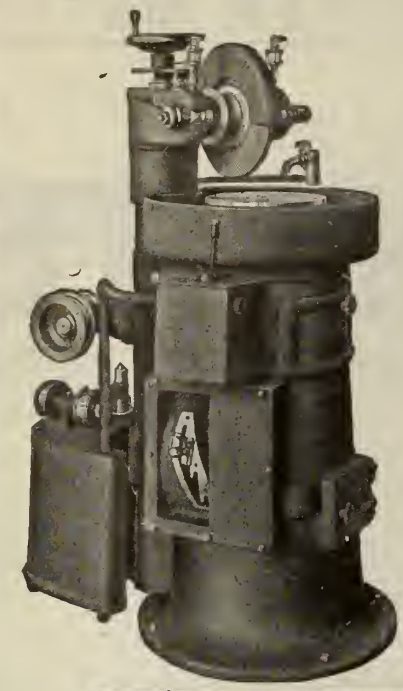

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Built for rapid production on grinding work.

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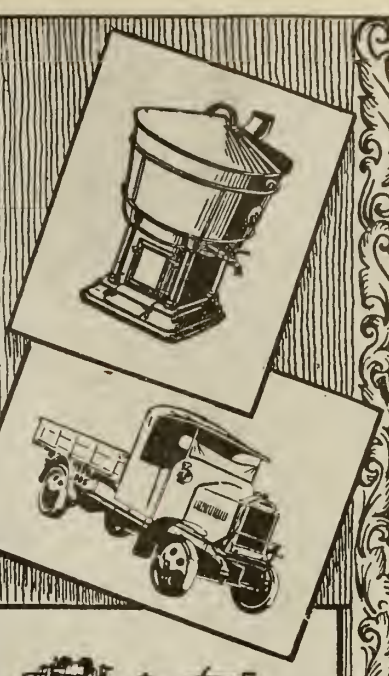

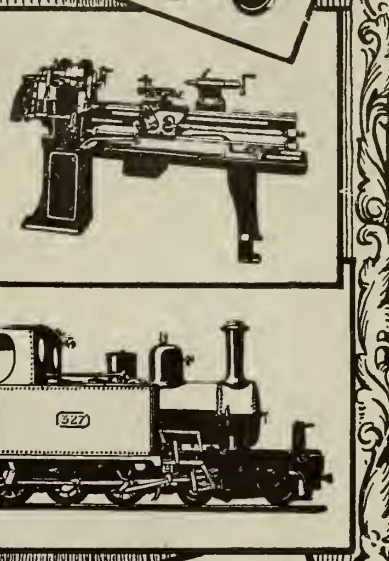

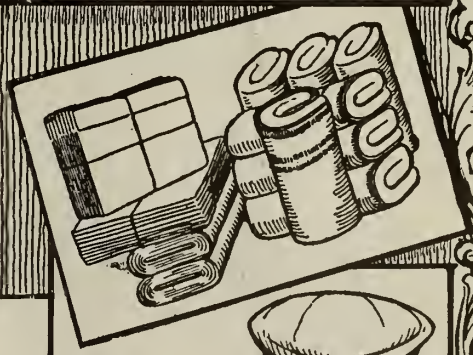

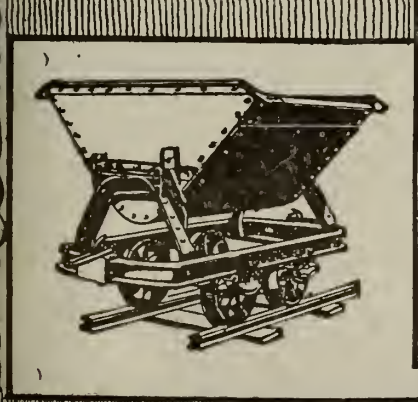

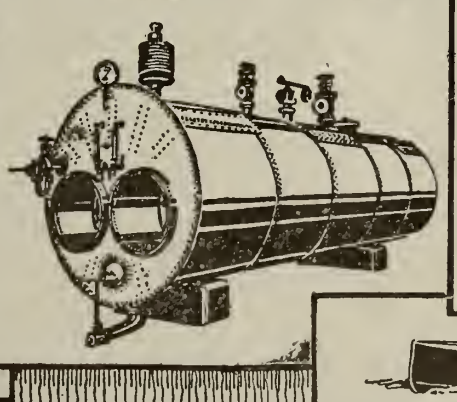

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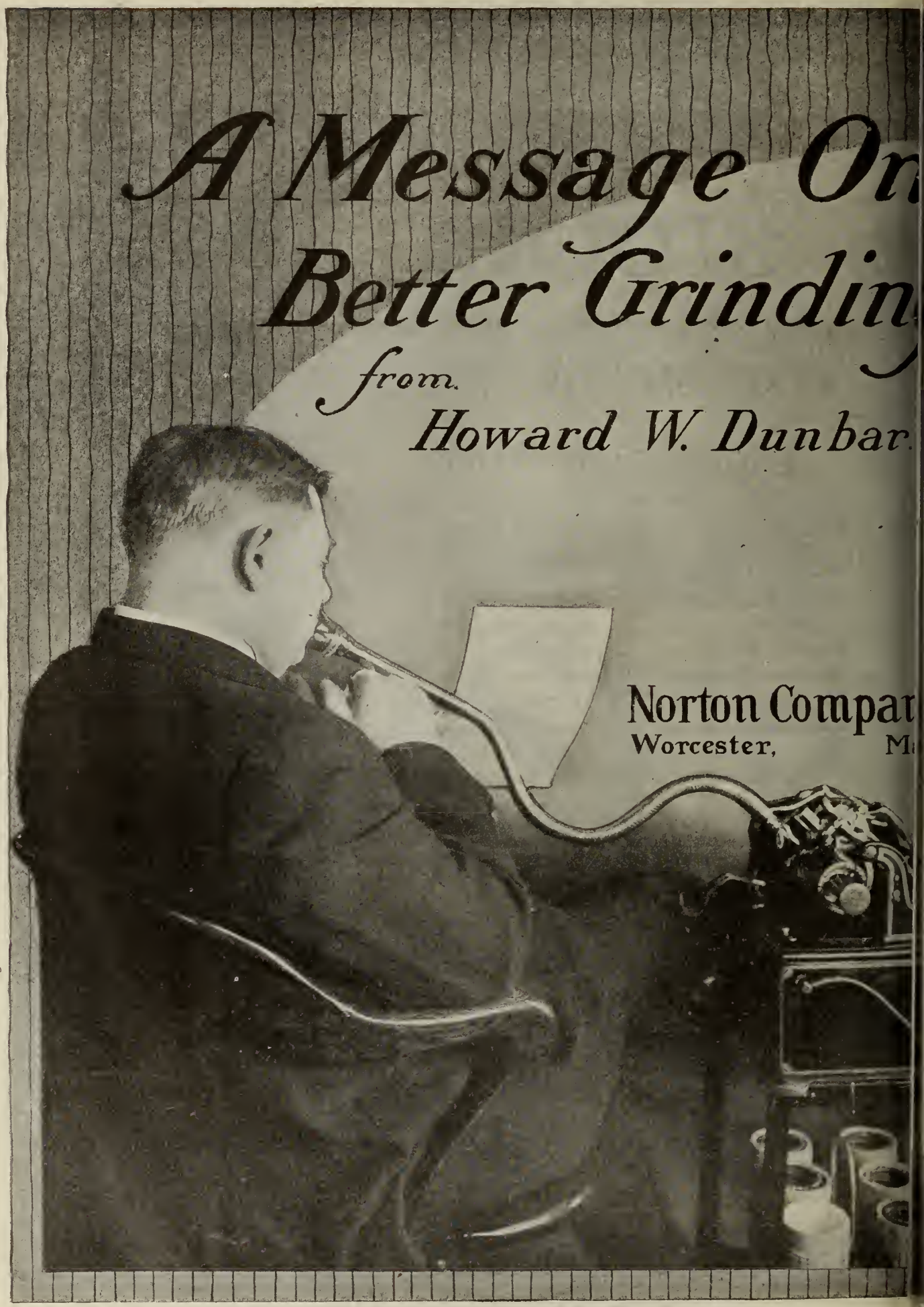

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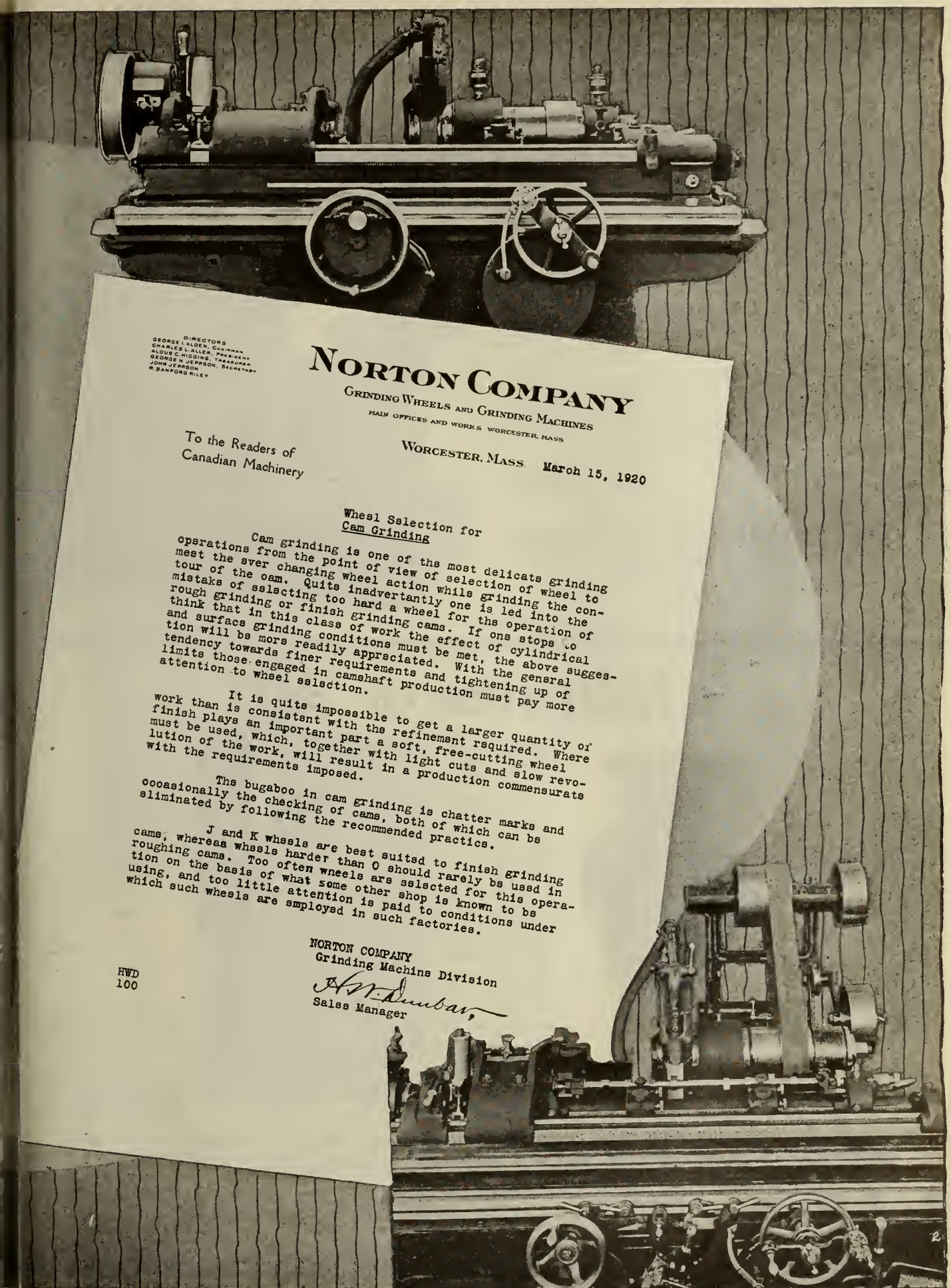

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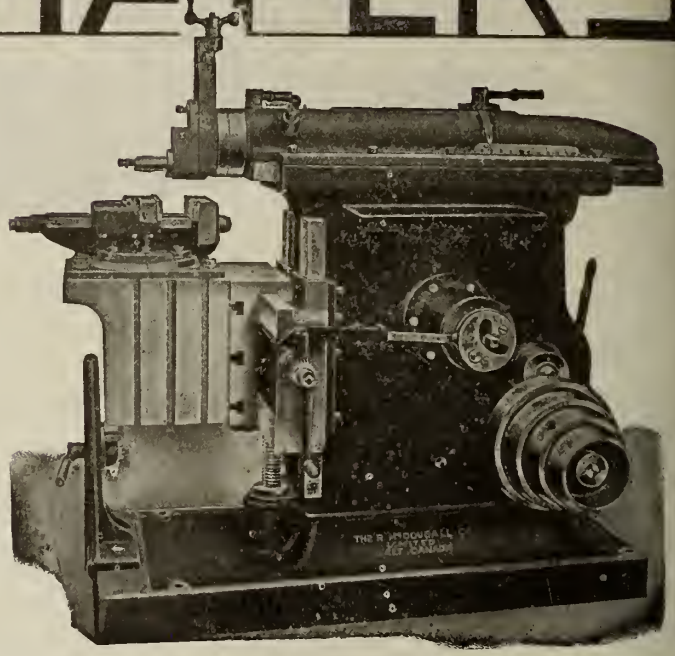

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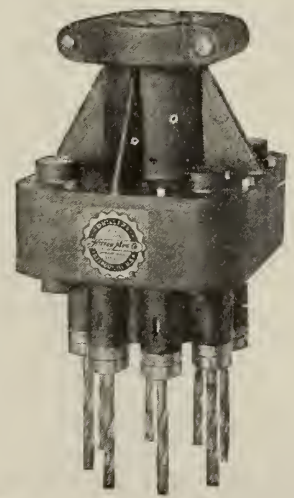

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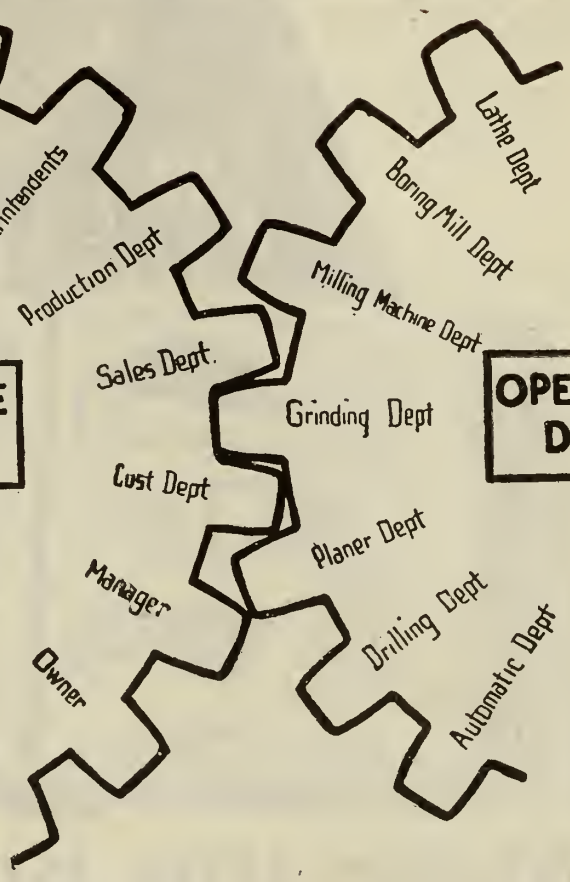

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CANADIAN MACHINERY
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MANUFACTURING NEWS

Vol. XIII, No. 16. April 15, 1920

The Magnetic Chuck, Its Design and Varied Uses

The Magnetic Chuck, as a Work Holder, Has Proved Its Usefulness Beyond Question. The Fundamental Principles of Design, Together With Varied Uses of This Style Chuck Are Discussed

By J. H. MOORE

WHILE magnetic work-holding chucks have passed the novelty stage, and have proved their usefulness and adaptability to varied classes of work, there is unfortunately still that class of mechanic existent who looks at you in a sort of a puzzled manner the moment you suggest his using such a type of chuck. This lack of knowledge on the part of a few is much to be regretted, but is existent only because they have never been enlightened as to their many uses.

The chief trouble is that they are somewhat distrustful of its holding power. They cannot comprehend how electricity can successfully combat with the counter force exerted by the grinding wheel or cutting tool as the case may be. It is only reasonable to believe that were the uses of this type of chuck better understood they would increase in general popularity.

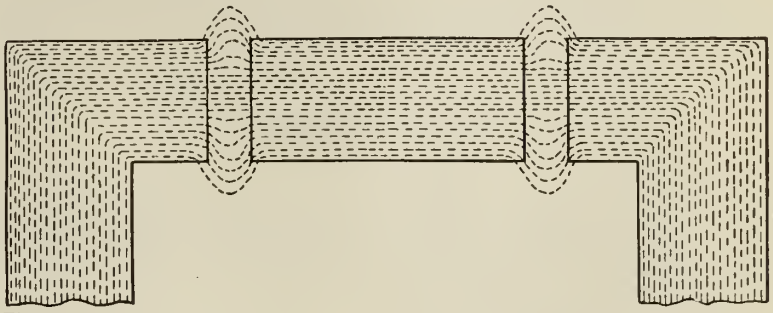


Figure 2.—Neutral pole inserted in the opening of the magnetic circuit on Fig. 1.

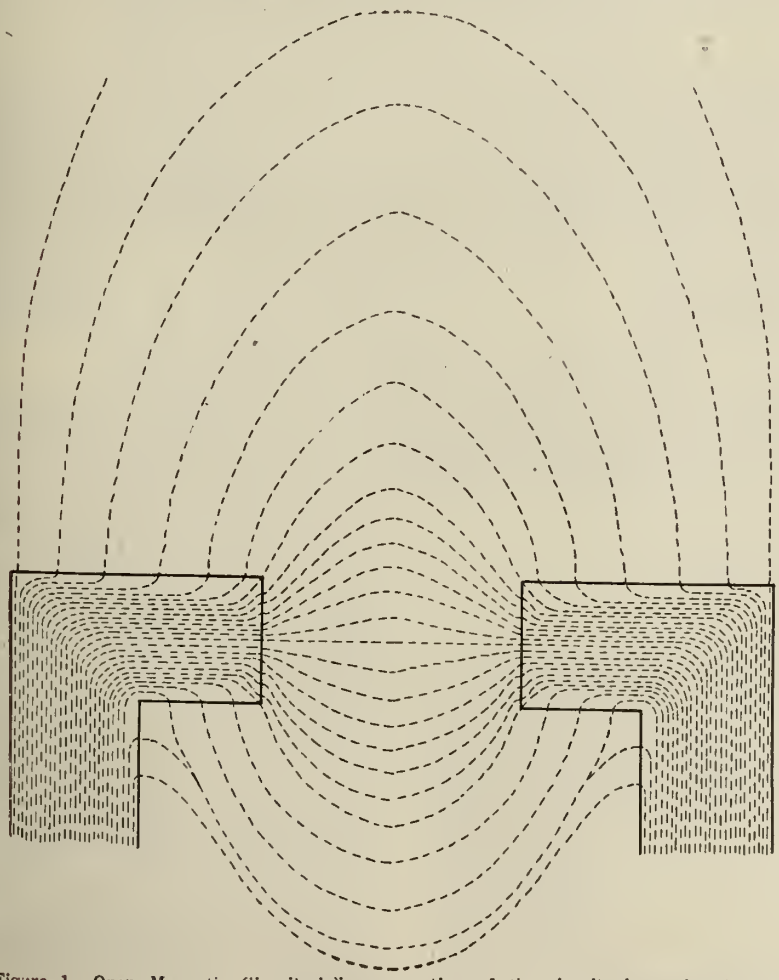


Figure 1.—Open Magnetic Circuit, being a portion of the circuit shown in view with a section cut out.

Believing an article along these lines would interest our readers, we will go into a discussion of the Simmons Unit pole magnetic chuck, illustrating the same by diagrams and photographs. It is through the courtesy of the Taft-Pierce Co., Woonsocket, R. I., that we are able to present this matter, and all illustrations shown are from actual installations.

To commence with, it might be well to consider certain fundamental principles of magnetic circuits as applied to chuck construction.

Magnetic Circuit

The quantity of magnetism that is produced in a given magnetic circuit is determined by the following factors:

1. Magnetic (or magnetizing) force, expressed in ampere-turns.

2. Magnetic capacity (or permanence) which depends upon the material and the dimensions of the circuit.

Magnetic force in electromagnets is produced by electric current passing through a coil of wire wound around a portion of the magnetic circuit. Suppose you had a magnetic circuit of one material throughout, and that you had a coil made up of ten turns, with ten amperes running through it. This would

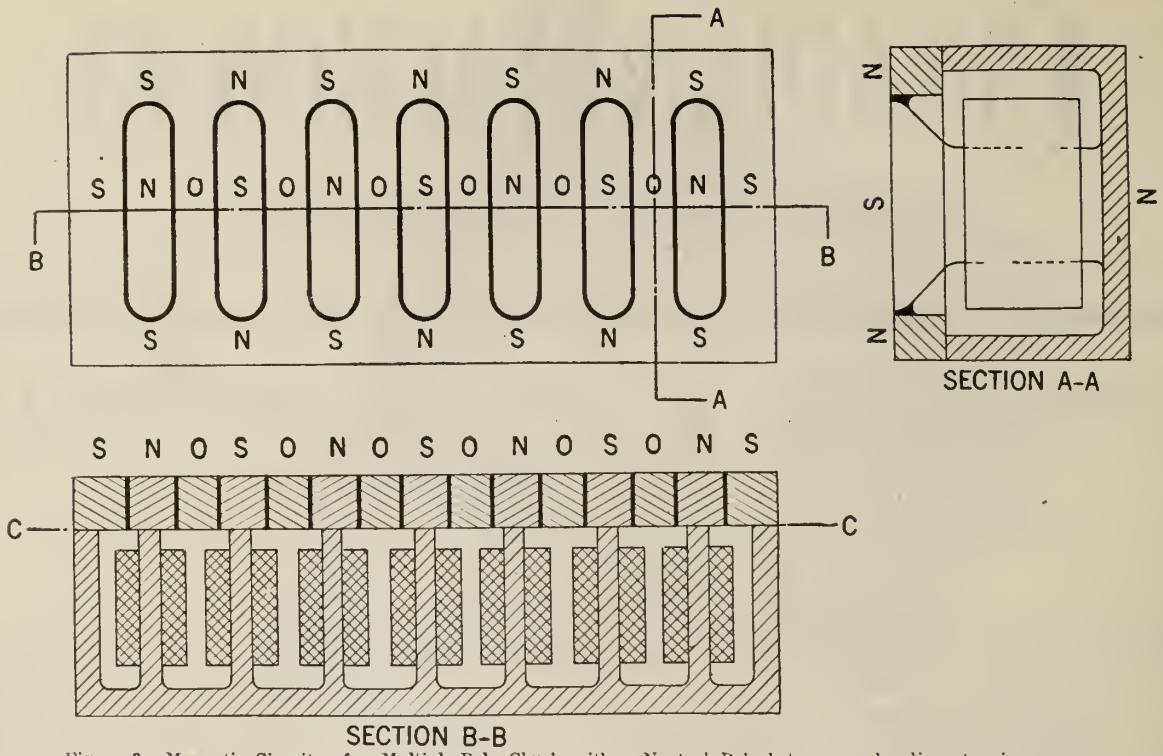


Figure 3.—Magnetic Circuits of a Multiple-Pole Chuck with a Neutral Pole between each adjacent pair.

mean that the ampere turns would be one hundred. The ampere turns that can be used in a given magnet are limited by the space available, and the provisions that are made for carrying off the heat produced in the coil.

The magnetic capacity (or permeance) of the magnetic circuit is determined by the material of the circuit and its dimensions. If the permeance is designated by the letter P we have the following equation: $P = u \frac{A}{L}$. A represents the cross sectional area, and L the length of the path. u is what is termed permeability. u is a property of the material and measures the magnetic capacity of the material. Iron, generally speaking, has by far the highest permeability of all materials. There are a few others that have an appreciable permeability, but even these are far inferior to iron.

The unit of permeability is the permeability of a standard volume of air, so that the value permeability of any given substance is always expressed in terms of that of air. The permeability of iron changes with the amount of magnetism present in the iron. Beginning with low densities, it rises to a maximum value and then decreases approaching 1 (that of air) as the metal becomes saturated with magnetism. Following is given a list of maximum permeability values for several kinds of iron:

From the foregoing it is seen that the kind of iron used has a vital effect upon the efficiency and holding power of a magnetic chuck, not only because of the variation in maximum permeability, but also on account of the value of magnetic density in lines per square inch at which the maximum permeability occurs.

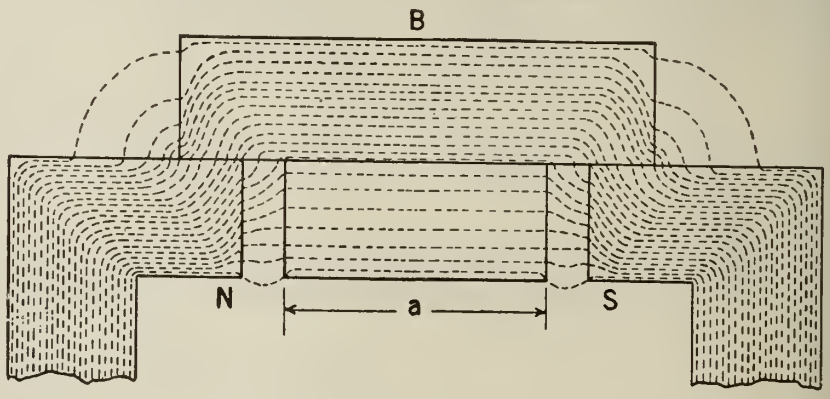


Fig. 4.—Piece of work bridging the neutral pole completely.

The effect of the change in permeability with magnetic density causes what is known as Saturation.

When we open any magnetic circuit the lines of magnetism must jump the gap through the air. This magnetism will take the path of least resistance, and since the distance decreases with the cross-sectional area of the path, and increases with the length, the magnetism will spread considerably around the opening as shown in Figs. 1 and 2. This spreading is termed leakage, and the greater the gap and the magnetic force available, the greater the leakage, as shown by comparison between the two figures.

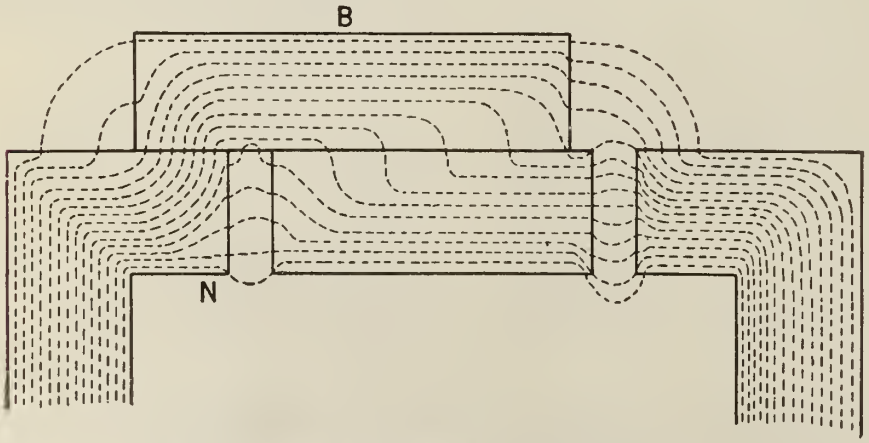


Fig. 5.—Piece of work bridging only half of neutral pole.

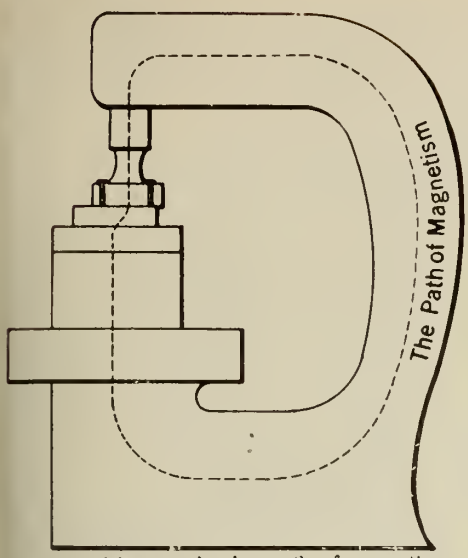


Fig. 6.—Diagram showing path of magnetism that can be shunted around neutral-pole and single-pole chuck.

The quantity of magnetism or flux is expressed thus:

$\Phi = (FP)$, in lines 2

where Φ is the total magnetism, or flux in lines, F is the magnetic force (called a magnetomotive force) and P is the permeance of the circuit.

The former equation given shows the method of calculating P for a given circuit of uniform section and material throughout. When the section of the circuit and the material varies, it is usual to assume various values of flux density, B, measured in lines per square inch, and determine from a saturation curve of the material the magnetomotive force in ampere-turns required to establish that flux in each portion of the circuit. Adding these magnetomotive forces together for each value of flux it is possible to plot a saturation curve of the whole circuit and with this coils can be read directly from the chart.

If the flux is known, the pull then becomes simply a matter of area of contact between the piece and the pole faces of the magnet. Careful scientific tests have shown that the pull under such conditions is expressed thus:

$$P = \frac{1}{8\pi A} \quad \Phi = 0.398 \frac{\Phi}{A}$$

wherein Φ is the magnetism (flux) in lines, and A the area of cross-section between the poles and the piece in square inches.

With these few principles in mind it is now possible to make an interesting comparison of several fundamental types of magnetic chuck structures, bringing out some of the principal advantages and disadvantages of different types of construction.

Basic Magnetic Chucks

In Fig. 3 we show the general design of a multiple-pole type chuck employing

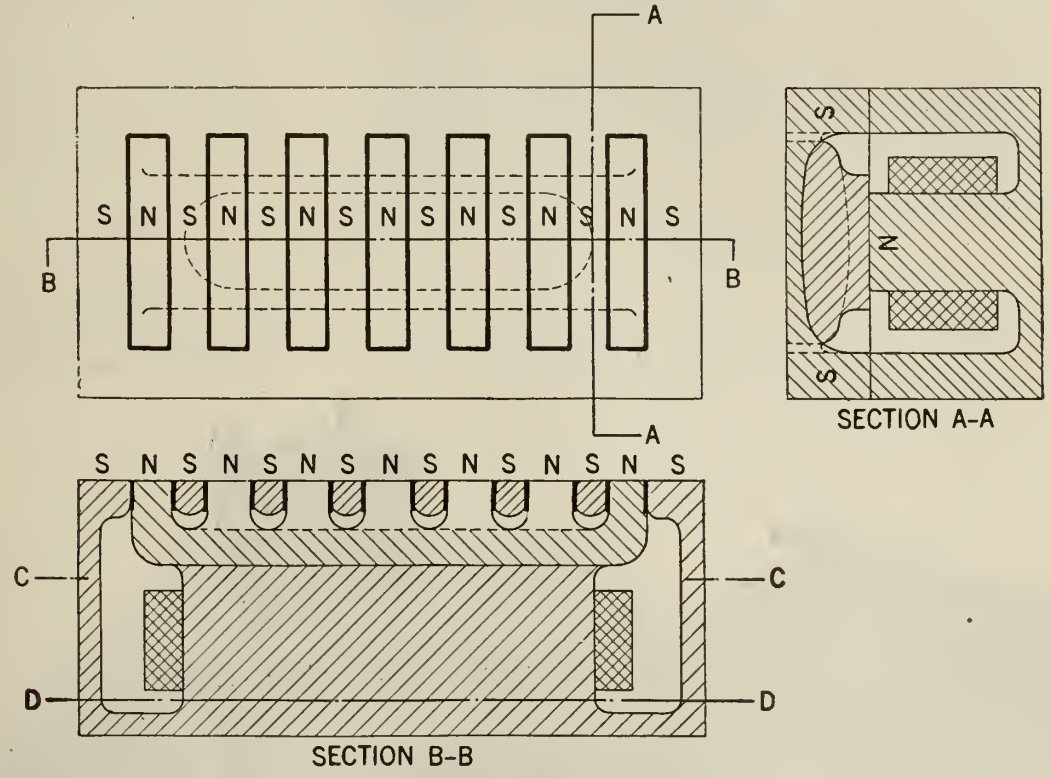


Fig. 7.—Magnetic Circuits of Single-pole Chuck. The slots may run either across or lengthwise of the chuck.

To minimize leakage the air gap must be decreased in length and cross-section to a minimum and the iron must be worked below the saturation point. The dimensions and proportions of the magnetic circuit should also be so chosen as to make the path of least magnetic resistance (called reluctance) definite and coincident as nearly as possible with that considered theoretically desirable.

The pull exerted by a magnet upon a piece of iron included in its magnetic circuit depends upon two main factors, namely:

1.—The quantity of magnetism or flux that passes between the poles and the piece.

2.—The area of the piece in contact with the pole faces.

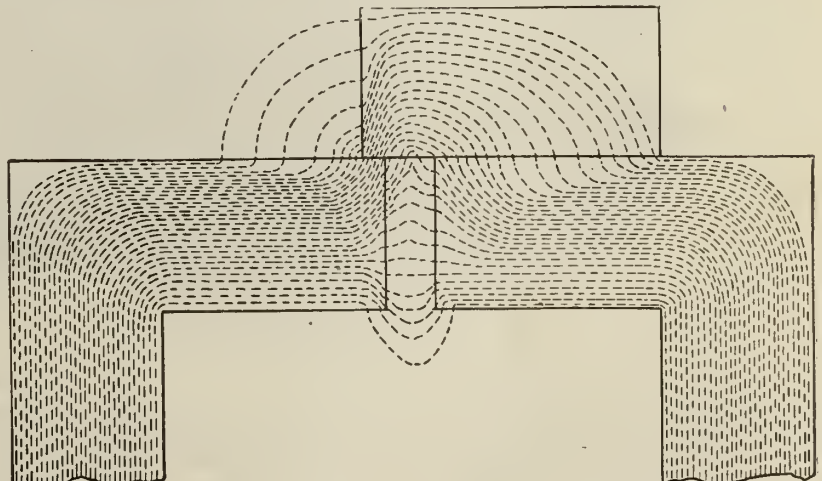


Fig. 8.—A small piece of work, placed non-symetrically, showing saturation on one side.

a magnetic circuit similar to that in Fig. 2. It is made up of a series of pole pairs formed integral with the body of the chuck on one end, each pole being equipped with a coil so wound and connected as to give alternate north and south poles.

sition by filling the space between them and the grid proper with a suitable non-magnetic metal.

The purpose of using a grid with bars between the adjacent poles is to secure an even and uniform spacing of pole faces. The effect of this method of construction is to reduce leakage when there is no work on the chuck and to increase leakage when there is work on the chuck. Referring to Figs. 1 and 2 we see that placing a piece of magnetic material in the gap of the circuit shown in Fig. 1 has reduced the leakage of flux to a comparatively small area by reducing the air gaps. However, in Fig. 4 we see that placing the work, B, over the two adjacent gaps does not lead all the magnetism through the work, but an appreciable portion of it passes through the intermediate piece, a.

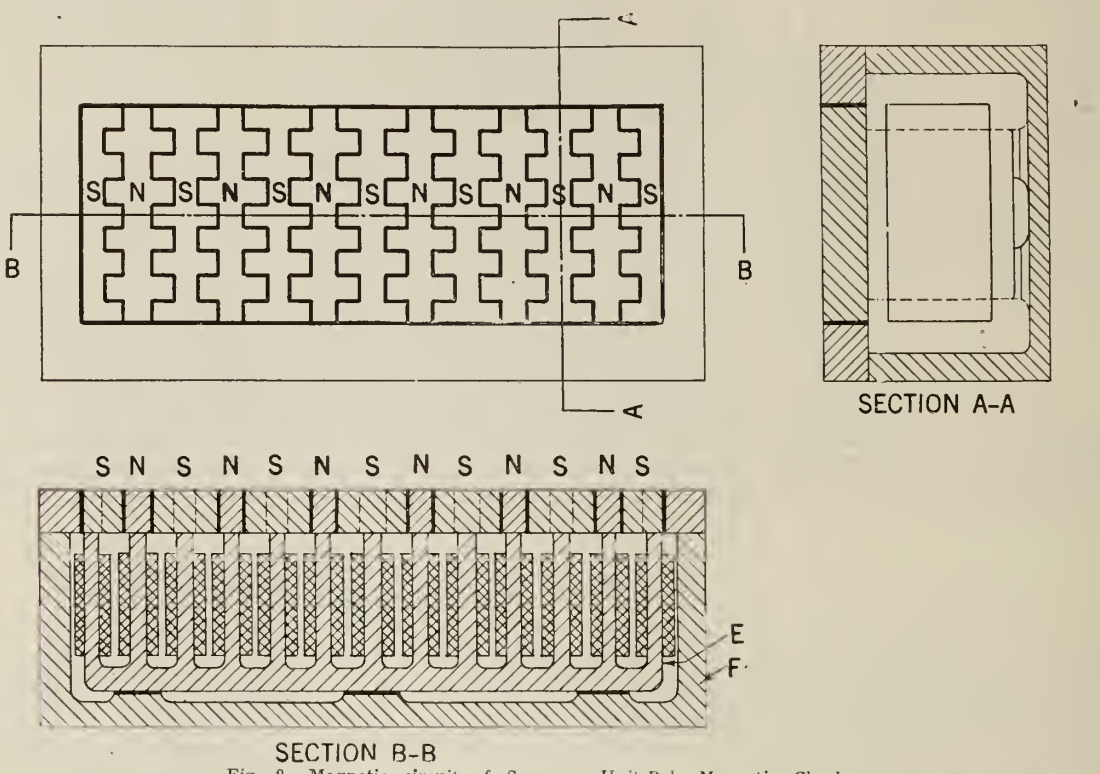


Fig. 9.—Magnetic circuit of Simmons Unit-Pole Magnetic Chuck.

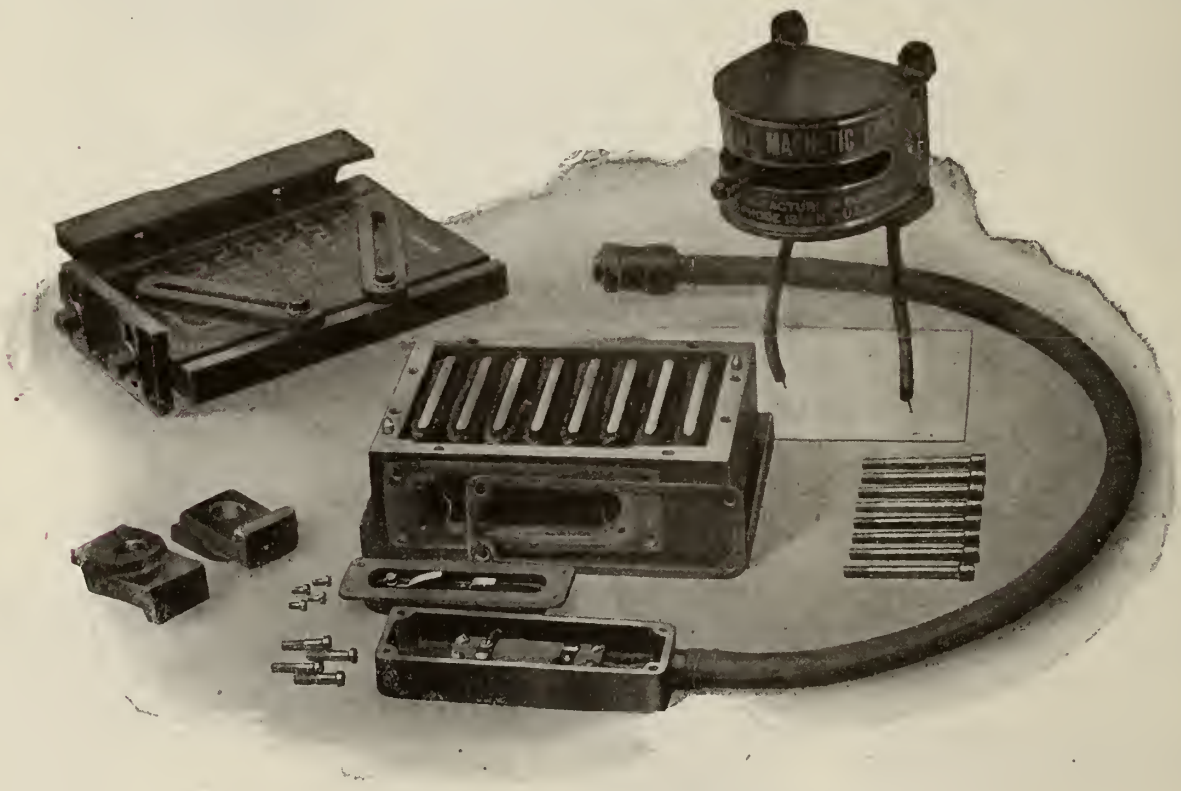


FIG. 10.—Complete disassembled view of 8 x 10 T-slot Simmons Unit-Pole Magnetic Chuck.

The face plate of this chuck is made up of a grid casting, the openings in the grid providing proper space for pole pieces, the pole pieces being held in po-

(To be continued)

Measuring the Temperature of Molten Steel

A Paper Read Before the American Foundrymen's Association on the Comparison of the Different Methods Existent. The Pyrometer, Rod Test and Other Methods Are Discussed

By F. W. BROOKS

A LARGE number of trials and experiments have been carried out by steel makers, along with the very commendable support of the makers of pyrometers, to try and put the measurement of molten steel upon a scientific and fairly reliable basis. Most of the practical investigators have known all along that the measurement of actual temperatures, to any degree of accuracy, is at present too much to aim for, and have contented themselves with the effort of finding some indication, such as a reading on an instrument, which tells them when the steel is at the best temperature to produce either a certain type of casting or a first-class ingot with the particular composition of steel they are handling, and that each time this reading is obtained the steel is at its best pouring temperature. In other words, comparative tests have been their chief aim.

Use of Pyrometers

Of the scientific instrument methods, we may consider thermo-couples, radiation pyrometers, and optical pyrometers. The thermo-couple for temperatures of heat treatment has proved valuable. In the measurement of molten steel, however, only the rare metal couples can be considered, and even these do not withstand the very severe conditions of a bath of molten steel. Protective tubes, such as quartz tubes, have been tried, but have certain disadvantages. The mechanical strength of a long tube at the high temperature is inadequate; the chemical reaction of the slag, in the case of basic operation, is undesirable; and the varying thickness of the coating of slag to the tube, as it is pushed through the slag, causes a varying lag of temperature from the steel to the couple.

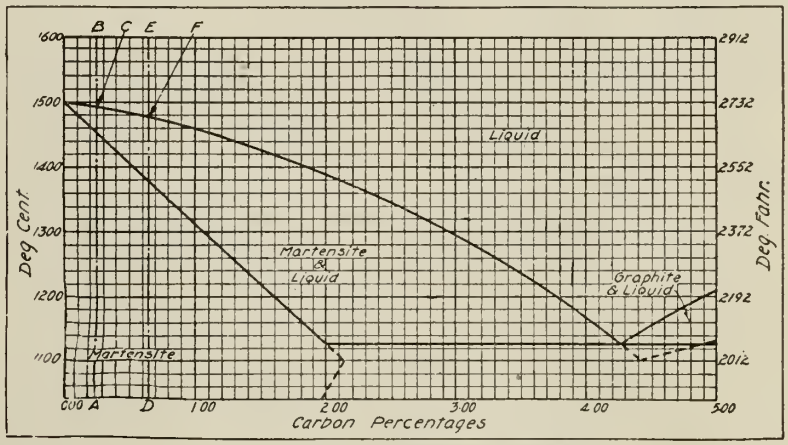
The radiation pyrometers, of which the Thwing or the Foster type of fixed focus pyrometer appear to be most satisfactory, require no focussing, and the method of handling them is simple. Both of these instruments also have an attachment for taking care of the change in black body conditions from true black body conditions when steel is poured from a furnace or from a ladle. The accuracies of these attachments are not so important, as they are the same for each heat, as long as the steel is in a completely molten state. The first obvious objection is that, owing to the slag covering in the furnace, and the difficulty and objection of maintaining an uncovered patch, the temperature cannot be read until the steel is being poured into the ladle. While this only allows for correction of temperature in one direction, it still has several valuable advantages. If the temperature of the steel is too low, preference can be given to the heavy castings of large section, and the pouring operation carried out as rapidly as possible. If the temperature is on the high side, the steel can be left in the ladle, or preference given to all the small castings requiring a relatively higher temperature; but perhaps the greatest value is a check and guidance for the melter and the foundry superintendent on the now existing more or less crude practical methods to be explained later. In the open-hearth furnace, when consecutive heats are being run to the same analysis and same conditions, a certain difference of temperature between the steel and the slag may be assumed; but this is not very reliable.

The principal objection, however, in the use of radiation pyrometers is the difficulty of always being able to focus through a clear atmosphere and onto a clean stream of steel. In actual practice, it is found that smoky atmospheres and incandescent gases are constantly interfering, while in many furnaces the slag comes out of the teeming spout along with the steel, and it is very difficult to know which of the readings recorded represent true conditions, or the same conditions as on the previous heat. There is also a tendency on the part of the observer to record the highest reading on the instrument, and interference of a small amount of incandescent gas can escape notice. The following readings are typical of many tests made of a stream of steel leaving the nozzle of a ladle when pouring castings of easy section of about 30 to 100 pounds in weight and 0.25 to 0.35 per cent. carbon, by the same instrument and the same observer, the resulting castings being of first-class quality.

Heat No. 7			Heat No. 23.		
Mold	Degrees Cent.	Degrees Fahr.	Mold	Degrees Cent.	Degrees Fahr.
1	1510	2750	1	1530	2790
2	1560	2840	2	1540	2800
3	1515	2760	3	1210	2210
4	1740	3170	4	1560	2840
5	1530	2790	5	1490	2710
6	1580	2870			

It is obvious that the readings on the fourth mold of heat, No. 7, and the third of heat, No. 23, were decidedly off, although every care was taken on both these heats to get uniform conditions, and the error is undoubtedly due to incandescent gases and smoky atmosphere. Results, both better and worse, were obtained, and these are given as typical when every care was taken.

Practically the same limitations are noticed with optical pyrometers as with the fixed focus radiation type, the added disadvantage being that with every type of optical instrument there is more of the personal element brought in by the matching of intensities or the matching of colors. On the other hand, they are not so liable to damage by the too close proximity to the molten metal, as an observer has less fear of sticking a long tube up to the stream than of bringing his face too near.



STANDARD CARBON-IRON CURVE.

Of the practical methods known, the film, rod and pouring tests are in constant use at various electric furnace plants, and they are all depending upon uniform conditions existing when each test is made. The use of the film test originated from the crucible steel practice, it being the best practice in making tool steels to first close all the melting shop doors; then to pull the pots after the required stewing and remove the lid and slag; make any additions and then carefully watch the bright surface of the steel for the first sign of an oxide film forming, this being the sign to commence

pouring operations. In the absence of drafts, this served as a fairly reliable temperature indicator, as the crucibles and the mass of steel were usually the same, while the varying composition of the steel could be allowed for by pouring as soon as the first speck appeared, or so many seconds later. In electric furnace practice, this consists of using a steel spoon of uniform capacity, dried out thoroughly over the bath, and giving this a total covering of slag in the furnace. A sample of steel should then be taken, which fairly represents the whole bath, remembering that when a door has been left open for some time the steel near the door has become chilled, and with steel made in an electric furnace where all the heat is applied at the top only, the temperature of the steel directly under the slag is higher than the temperature of the steel near the bottom. Where this is the case, the bath must be thoroughly rabbled before any sample is withdrawn, and even then the sample should be taken at a place equidistant between the electrodes and half way down the bath, so as to arrive at an average temperature. The measurement of the temperature is then indicated by the length of time it takes for an oxide film to completely cover the sample after the sample is taken from the bath. This method is also influenced by the composition and physical condition of the bath, as for molten steels of the same temperature this time varies, principally with the carbon contents, the silicon contents, other alloy contents and the state of deoxidization. Therefore, final comparisons must only be made between steels of approximately the same composition and when the furnace is ready to pour. Care must be taken to keep the sample away from drafts and to have about the same amount of steel in the spoon each time. To show the range of this test it has been noted that first-class high-speed steel ingots of a composition approximating carbon, 0.65; tungsten, 17.5; chromium, 3.75, and vanadium, 1 per cent., were produced when the film (with a later characteristic wrinkling of the surface) was formed directly the sample spoon came through the door, while good castings of about 0.25 carbon and weighing from 30 to 200 pounds were produced when the film took 60 seconds to form after the furnace door.

Factors Affecting Use of Rod Test

The rod test has been used for many years as a rough indication of the temperature of many molten metals. The first publication noted by the author of this test being made a standard practice under uniform conditions was from a large Italian steel works. This test requires the use of rods of steel of both uniform diameter and fairly uniform composition, and consist of plunging the rod into the bath of steel and gently moving it through the bath for a uniform length of time. If the steel is cold there is a deposit of the bath on the rod, if the steel is hot the bath melts away or bites into some of the rod, with all intermediate conditions indicating varying temperatures. The skin of the bar, it will be noted, has an effect on this test; a newly rolled bar with a bright scaly surface tends to show a colder bath than is actually the case. The bar before being plunged into the bath should be of uniform temperature and in some steel works this is taken care of by bending about 12 inches or more of the end of the bar at right angles; holding the bar with the bend in a horizontal plane over the bath until it shows the first sign of sagging and then turning the end of the bar into the bath. This test again depends on the physical condition and the composition of the bath. This test is also very useful for testing the difference in temperature between the top of the bath and the bottom of the bath and is one of the best indications of the value in electric furnaces of the bottom heating type.

Temperature is Indicated by Fluidity of Metal

The pouring test consists of using a spherical spoon of above 5 inches diameter and carefully slagging up this spoon over the bath. Dip the spoon quickly into the metal so as to get a sample of the steel from about the centre of the bath. Withdraw the sample and carefully pour out the steel over the lip of the spoon at a slow, even rate. The temperature of the steel is noted by its fluidity, and by the amount of steel skull that is left on the spoon. This test is the one most commonly used in steel foundries. It is simple and the very nature of the test gives confidence to the man who is responsible for pouring the heat. If he sees every drop of the steel pouring nicely over the lip he feels that in pouring from the ladle itself the castings of small section will fill up and there will be no skulls left in the ladle. This test is subject to the spoon being properly slagged up, the rate of pouring the sample, and absence of drafts.

For all these practical methods too much emphasis cannot be placed upon the fact that they are all comparative tests only, and that they depend entirely upon uniform conditions, and attention to details. In all cases at least two of these methods should be employed. They do not, of course, indicate to the melter the temperature of the steel in degrees, Cent. or Fahr., but they do give him a very good indication of the degrees of temperature that the steel is either above or below the temperatures which will give him the best results for the composition of the steel he is handling, for the weight and for the type of casting he is making. In making steel castings it is important that the foundry foreman or superintendent be present when the final temperature tests are being made. He is in a much better position to know how hot the steel must be to suit the castings on the floor. To tell the melter that the castings are averaging 30 pounds and then to leave the decision regarding the temperature up to him, is not sufficient.

The question most frequently asked while trying out the above tests was: "How accurately can you measure the temperature of the steel and what temperature should the steel be when it leaves the furnace to give the best results?" The first part of the questions refers to the use of the pyrometers. On steel works, where the best conditions for the pyrometer can be obtained, there is still the limitations of the pyrometers themselves. As already explained, only the optical and the radiation type offer a good field for these high temperatures and conditions, and there is little doubt that an error of plus and minus 50 degrees Fahr. in the instrument itself is all that we can ever expect. To an investigator first starting in with a new instrument he has just bought, this may not sound very encouraging, as he naturally feels that if the steel proves to be 50 to 100 degrees Fahr. less than what he is aiming for he will spoil some of his castings. The other limitations of focusing and atmosphere have already been described and values given.

Probably the best reply to the second part of the question is that the temperature in question is that at which the particular steel begins to solidify, plus the loss of temperature from when the reading is taken to when the steel gets to the farthest end of the thinnest section in the casting. A further query to this second part of the question invariably was: "But how are we to know what these two values are?" The first value depends on the composition of the steel, the carbon contents being the principal factor. This can be obtained by reference to a standard carbon-iron curve, such as shown in the accompanying illustration. For a steel containing 0.25 per cent. carbon, trace the line A B till it intersects at C, giving a value on this curve of 1492 degrees Cent. (2720 degrees Fahr.); for a steel containing 0.65 per cent. carbon, trace the line D E till it intersects at F, giving a value 1476 degrees Cent. (2690 degrees Fahr.) and so on. For other elements in the steel commonly used in castings the variation is not of importance and does not compare with the many other sources of error that crop up in reading the temperatures of molten steel in a foundry. The second value depends upon such variables as the heat of the ladle the thickness of ladle lining, time of reading to pouring, whether molds are of dry or green sand, and thickness and lengths of the thinnest sections. All of these factors depend very much upon local conditions, and it is regarding this problem that constant consultation between the man responsible for the steel in furnace and the man responsible for making up the molds is so valuable. Final results are only obtained by the constant comparison of the quality of the final castings with the results obtained by their methods of reading the temperatures of the steel.

Designing Foot Levers for Brake Wheels

This Chart Should be Especially Valuable to Designers Having Any Occasion to Use Foot Levers. The Author Assures Us That These Sizes Can be Depended Upon

By JOHN S. WATTS

THE chart which accompanies this article will be useful in designing foot levers for brake wheels on hoists and other machines, and the dimensions given therein may be used with every assurance that levers made to these sizes will withstand the roughest of treatment without appearing at all clumsy or too heavy.

In calculating the length of lever required, it is necessary to decide the push which can be given by the foot of the operator on the end of the lever, and this chart gives the choice of two amounts, namely, thirty pounds and sixty pounds. A push having the weight of thirty pounds, should be used when the lever is to be operated frequently with the full load on, and sixty pounds may be taken when the full load is to be taken only occasionally, and the operator has not too many other levers to operate.

To use the chart, having the moment in pounds that is required, follow along the horizontal line on the chart for that moment under the push (30 pounds or 60 pounds) decided upon, and we get the width of boss, diam. of shaft, section of arm and length of lever required. The section of the lever at the foot end is common to all as the strain at that point is the same for all levers.

Two shapes are shown for the foot end of the lever; one is suitable for those cases where the operator stands to one side of the lever and the other for when he stands at the ends of the lever. Both styles are simple to make and will afford a good foothold, with no danger of the operator's foot slipping off the lever. In actual use it will be found that there is sufficient surface provided to enable the operator to put his whole weight on the lever without discomfort. If desired the surface where the foot rests may be scored to provide a surer grip, but this is not really necessary except where the lever may get coated with grease or ice.

In order that the chart may be used with intelligent confidence, the basis from which the various dimensions are calculated and the stresses used are given below.

No matter what push may be sufficient to give the required moment on the lever provision must be made to take care of the very probable eventuality, that at some time or other some operator will put his whole weight on the lever, and even jump upon it, thus throwing a weight of say two hundred pounds on the lever suddenly.

For this reason two hundred pounds has been taken as the load in making up the chart so far as the strength required in the lever is concerned, disregarding entirely the thirty and sixty pounds used in calculating the moments for the various lengths.

On account of the shocks to which the lever is sure to be subjected, the stress throughout is limited to 6,600 pounds per square inch.

The moment of the lever, as given in the chart, is of course the length of the lever in inches, multiplied by the push, as noted at the top of the column, namely, thirty or sixty pounds.

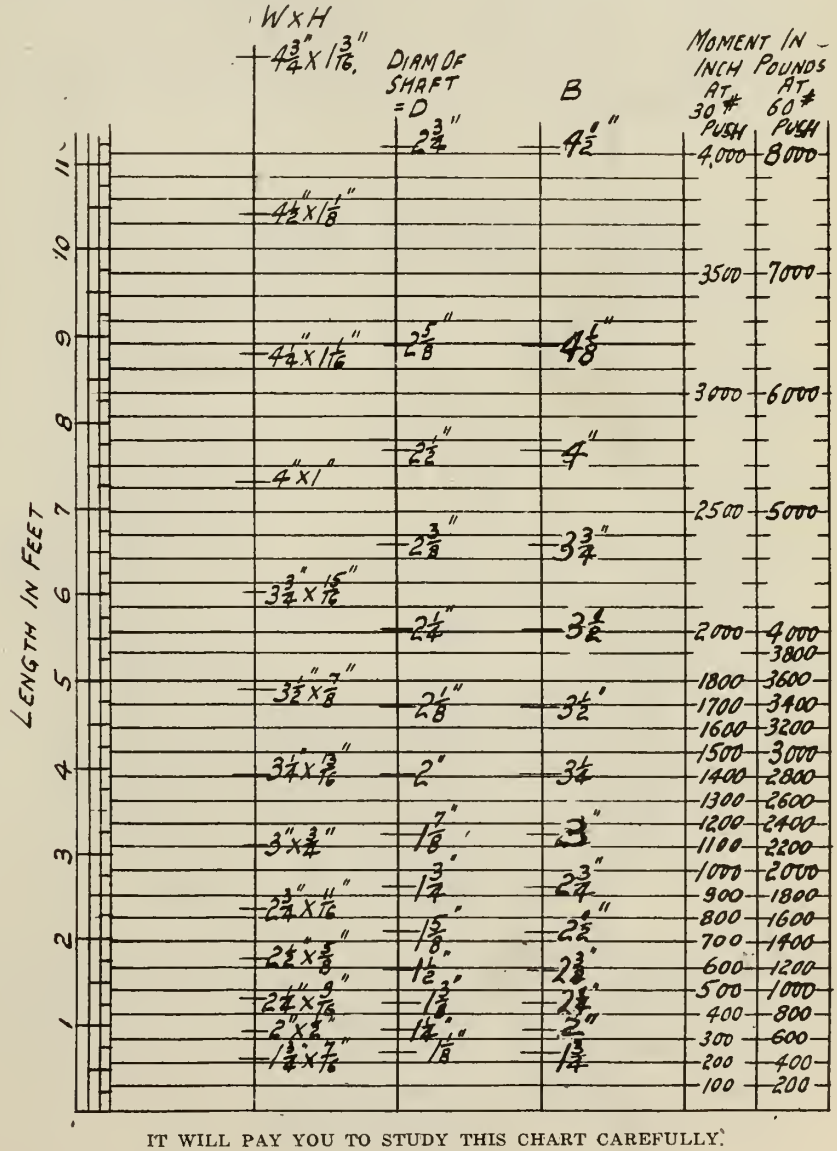
The width and thickness of the lever at the boss end W x H, is that section required to carry 200 pounds on the end of the lever, with a stress of 6,600 pounds per square inch, calculated as a cantilever with a concentrated load at the end.

The thickness of the lever, H, is in all cases one-quarter of the width, as this gives a section which will resist buckling sideways and still not be excessively heavy for the strength required.

For ease of manufacture the diameter of the boss is shown as being equal to the width of the lever arm, W. However, cases will arise when the diameter of the shaft will need to be increased above that shown by the chart to take care of other stresses induced in the shaft at another point. In such cases, so long as the diameter of the boss is not less than one-half inch larger than the diameter of the shaft, the strength through the boss will be equal to that at other points.

It is not essential that the boss be central with the lever arm, as shown, and the shape of the boss that is half circular and half square, is made that way, only for reasons of economy of labor in manufacturing.

The diameters of the shafts given by the chart are the diameters necessary to carry the twisting moment, due to a load of 200 pounds on the end of the



IT WILL PAY YOU TO STUDY THIS CHART CAREFULLY.

lever, with a stress of 6,600 pounds, and is determined from the formulae:

$$\text{Twisting moment} = \frac{\pi}{16} fd^3.$$

The width of the boss E is that found by assuming the width of the keyway to be one-quarter of the diameter of the shaft and making the length B, which is also the length of the key, such that the shearing stress on the key will not exceed 6,600 pounds per square inch. The load being that due to 200 pounds on the end of the lever.

The simplest way to arrive at the length of key required is to take the strength of the shaft as the basis, which is

Torsional strength of shaft in inch pounds $= \frac{\pi}{16} fd^3.$

The shearing strain on the key will be this torsional strength divided by the lever arm of the key, which is $\frac{d}{2}$.

∴Shearing strain on key equals

$$\frac{\frac{\pi}{16} f d^3}{\frac{d}{2}} = \frac{\pi}{8} f d^2.$$

The shearing strength of the key equals

$$B \times \frac{d}{4} \times f$$

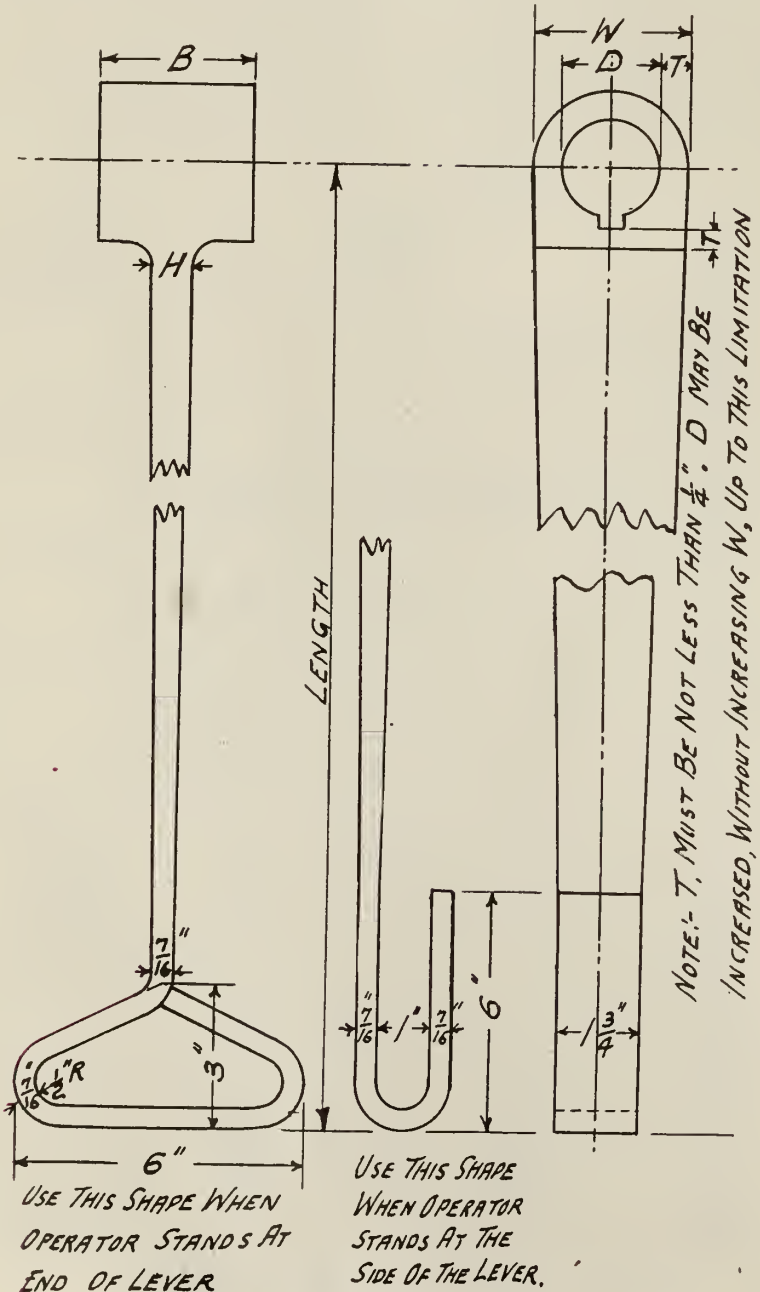
Therefore for equal strength of key and shaft at equal stresses

$$B \times \frac{d}{4} \times f = \frac{\pi}{8} fd^3$$

$$\therefore B = \frac{\pi}{2} \times d$$

$$= 1.5708\ d$$

Or, the length of the key should equal half the circumference of the shaft when the key is to develop the full strength of the shaft.



VIEW OF LEVERS WITH ALL NECESSARY DATA.

ENGINEERING SECTION'S SPRING CONFERENCE

The first spring meeting of the Engineering section, National Safety Council, is to be held in the Engineering Societies' Building, New York, April 27th.

The relation between safety and engineering and the engineer's place in the modern industrial world will constitute the motif of the entire program. C. P. Tolman, chairman, Manufacturing Committee, National Lead Co., and chairman of the Engineering Section, will preside.

The detail program follows:

Morning Session

10 a. m.—The Relation of Safety to Engineering Efficiency—L. A. DeBlois, manager, Safety Section, E. I. du Pont de Nemours & Co., Wilmington, Del.

Discussion opened by F. P. Sinn, assistant to the vice-president, New Jersey Zinc Company, New York City.

Safety Instruction in Engineering Colleges, "The University of Illinois Plan" —Paper by Bruce W. Benedict, manager of Shop Laboratories, University of Illinois.

How to Interest Student Engineers in Safety—Professor G. S. Blessing, Department of Engineering, Swarthmore College, Swarthmore, Pa.

Afternoon Session

2 p. m. — General subject: Safety Standards.

The Movement for Uniform Safety Standards and the Engineering Section's Part—David S. Beyer, vice-president and chief engineer, Liberty Mutual Insurance Co., Boston, Mass.

Round-Table Discussion of:

Proposed Standards for Guarding of Belts, Gears, and Other Power Transmission.

Statement of problem and opening of discussion by Thomas Stanion, manager of Safety and Sanitation Departments, Aluminum Manufacturers, Inc., Cleveland, Ohio.

Evening Dinner

Subject: The Engineer's Place in the Modern Industrial World.

David Van Schaack. Lew R. Palmer. H. W. Forster.

It is expected that there will be a very heavy demand for places at the evening dinner, which will be served in the Hotel Commodore at 7 p. m. at $4 a plate. It is essential that the officers of the section be informed of the number of places to be reserved. All who plan to be present at this dinner are requested to send their reservations to the headquarters of the National Safety Council at Chicago before April 23.

The Betts Machine Company of Rochester, N.Y., are now building an all-geared head to be placed on their heavy-duty engine lathes. The construction is designed for belt or motor drive.

Steel Castings by Electric Furnace Process

The Fundamental Principle of the Electric Furnace, Together With Other Data, is Given. The Methods Adopted by One Firm in Turning Out Steel Castings by Electric Process is Also Described

By J. H. Moore

THE electric furnace as a means of melting scrap, while familiar to many, still remains a mystery to others, so that, before entering on the description of the plant of the Canada Electric Castings, Ltd., of Orillia, Canada, we will proceed to a brief talk on electric furnaces themselves.

The electric furnace is a metallurgical instrument in which any desired temperature up to the point of fusing of the best refractories obtainable can be attained and perfectly controlled. At these high temperatures chemical reactions take place more rapidly than in other processes, and the most refractory metals and alloys can be reduced to fluidity. The flexibility of the electric furnace also gives it a great advantage, and the superior quality of the product obtained is very marked.

Scrap containing valuable alloying metals, such as nickel, tungsten, chromium, vanadium, etc., can be melted without loss of these elements. Steel swarf and scrap, cast iron borings, etc., can readily be used in the electric furnace. The charge can be made up entirely of scrap and turnings. No expensive raw materials are necessary, with the exception that alloying metals can be added, if desired.

The steel from the furnace is finished off under a reducing atmosphere of carbon monoxide and a slag, out of which metallic oxides have been reduced. The steel is, therefore, free from gases and blow-holes when cast.

Generally speaking, an electric arc furnace for steel making consists of a steel tank, lined inside with certain refractory materials, and fitted with loading doors, and a tilting arrangement for pouring. Carbon or graphite electrodes of a suitable size are inserted through the roof of furnace, or, in some cases, the walls, and may be regulated either by hand or automatic control. Usually, both hand and automatic controls are used.

A high tension supply is brought into a transformer house adjoining the furnace and the power is brought down to a low pressure current for the operating of furnace.

The method by which the heat is introduced into the steel bath varies, and is dependent on the type of furnace. Each maker has his own particular method, so that, for our purpose, we will only describe the method employed by the firm whose plant we intend discussing. Before speaking of this, however, let us delve a little further into other points of interest in the electric steel casting process.

By the use of the electric furnace, steel of any composition made by other processes can be duplicated; but, in addition to this, steel which would be impossible by older methods is now obtainable. It is, no doubt, a well-known fact that this system has become an economical means of producing suitable electric steel castings. The electric furnace is a very rapid, accurate and clean method for producing any grade of steel. In any steel foundry, speed is specially important, for, with the heats coming so rapidly one after the other, a smaller furnace can be used than otherwise possible. This feature enables a foundry to produce their required tonnage with less floor space, equipment and a smaller set up of moulds. The steel can also be poured off more rapidly, so that there is less loss by miss-run and cold shut castings, in this way still further increasing the foundry's production.

It is also practical to superheat the steel to any degree desirable, without any hit or miss rule, so that small thin castings are commercially possible.

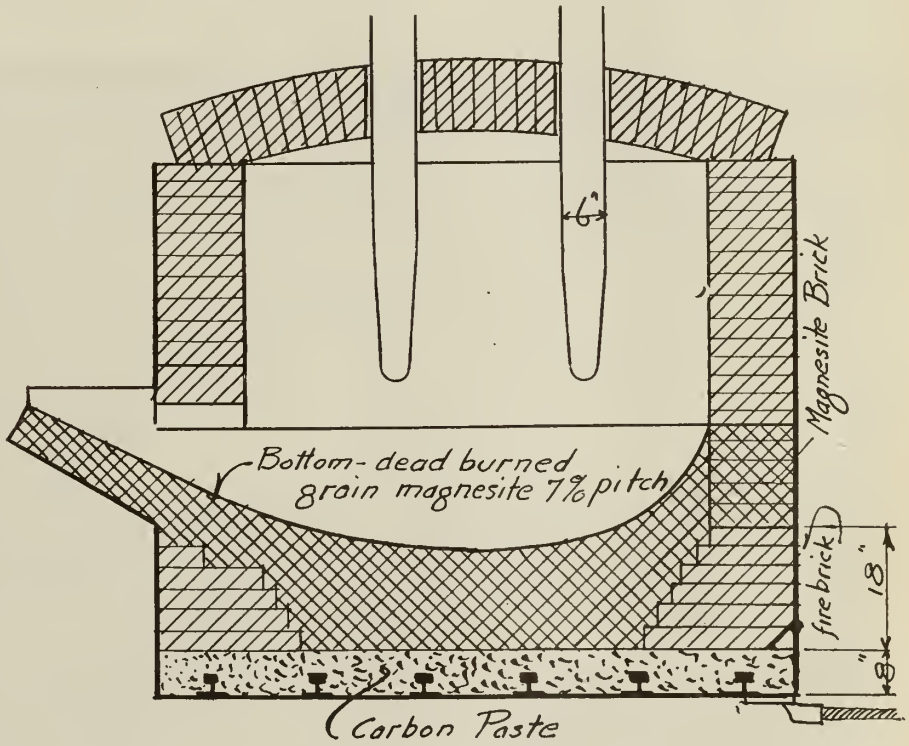
In the ordinary steel foundry making medium and light weight castings, the most favored size of furnace has a nominal capacity of 1½ tons per heat. In some cases, a 3-ton is used, but for average work, a 1½-ton will be found to be sufficient.

The Plant Itself

The Canada Electric Steel Castings Company have found the 1½-ton size ideal for their purpose, and to give readers an idea of the interior construction of this portion of the furnace we show the accompanying sketch.

The furnace was designed and built by themselves, and is what is known as a 1½-ton electric two-phase neutral bottom basic type. The two electrodes going through the roof are 6-inch Acheson graphite electrodes. The regular brickwork is of silica above the slag line, and magnesite is the basic lining used below. It will be noted that six steel rails form the bottom of the furnace, and that the neutral connection is attached to these rails. Carbon paste is rammed between the rails to a depth of 4½ inches. Next comes a further layer of carbon paste 3½ inches thick, after which a backing of silica brick arranged in the form shown was built up.

Into this form the magnesite and pitch was rammed. The magnesite was heated to about 100 degrees Centigrade, and the pitch, in molten state, was thoroughly mixed with the magnesite. The magnesite lining comes level with the pouring lip, as shown, and a magnesite wall is also built up slightly above the slag line. This wall is made 12 inches. The other details will be self-apparent from the sketch.



A SECTION THROUGH THE FURNACE.

The electrodes are controlled by 1½

h.p. shunt wound motors both automatic and hand controls being used. A graphic record is taken of the furnace at all hours.

The current enters the transformer house at 2,200 volts, and is brought and uses about 1,300 k.w.h. per ton of liquid metal, starting with cold scrap. The rate of heats vary, of course, on conditions and requirements.

The benefit of the furnace shown in the illustration is that it can be used for both desulphurizing and dephosphorizing, being a neutral basic bottom furnace.

With the electric furnace, steel castings of medium and light weight are made in the green sand moulds faced with silica sand, and gated very much like iron foundry practice. It is necessary, however, with any steel casting, to add sink heads, or feeders, to take care of the extra shrinkage. Apart from these few differences, the process of preparing the mould is similar to the iron foundry.

The concern we speak of handles all styles of steel castings. The writer saw in preparation parts for different types of machines, and the range of work possible is so varied as to practically defy classification. Enough to say that any castings which should be made of steel is what this firm caters to. Cylinder heads for gasoline engines, agricultural parts, miscellaneous machine parts, etc., etc., readily lend themselves to the use of steel in casting.

One job in particular that claimed the writer's attention was that of casting what is known as the Foley tractor wheel, for use on all styles of trucks. This wheel is somewhat of the same shape as any tractor wheel, and has the regular shaped treads, or grips, to aid the traction. It fastens on the regular wheel of the truck, but is so arranged that when the truck is running on normally hard ground the tractor wheel is clear of the ground, and only the tire is in running contact. Immediately the ground softens and the tired wheel sinks in the ground the tractor wheel takes over the work. Around this wheel is also placed a chain of the usual style adopted.

This tractor wheel, as can be understood, is made in different sizes, and its construction is such that it is especially difficult to mould. By the ordinary method of casting, it is questionable if as good a product could be obtained as by the electric furnace process. The strength of these wheels is the main consideration, so that the analysis of the metal must be perfect. This is where the electric furnace shines, for control of the metal is easily obtained by the electric process. It might be well to add that this firm takes a careful analysis of all metals produced, in order that they can be sure that only first-class material leaves their plant.

In discussing the future of the electric steel casting business with Mr. Lamble, the manager of this concern, we asked his opinion on the outlook for steel castings by the electric furnace process.

"If I say that we hope to enlarge our present premises in the near future, will that give you any idea of our viewpoint of the advancement of this field?" he replied. And we admitted that the reply answered our question admirably. When a firm starts enlarging its premises, they must have not only faith in, but definite knowledge of the future, of the steel casting business.

THE CANADIAN FAIRBANKS-MORSE CO., LTD., ENTERTAIN

The Ontario section of the American Society of Mechanical Engineers, together with various friends, were the guests of the Canadian Fairbanks-Morse Co., Ltd., at their plant on Bloor Street West, Toronto, Thursday, April 8.

The programme really consisted of three parts, the first being a trip through the various manufacturing departments of the concern. About 60 availed themselves of this opportunity, and special guides explained the various operations being performed throughout the plant. The work on the marine engines, and the type Z farm engines, occupied chief place in the limelight. CANADIAN MACHINERY saw so many real features of worth in this plant, that arrangements were made to present through our columns for readers' benefit some of the best of the machines, fixtures, etc.

After completing the tour of machine shop, foundry, pattern room, etc., the guests were brought up to the place they had really scented from afar, namely, the dining room.

This portion of the plant is a comparatively new departure, and will, after final completion, be one of the finest cafeterias, reading room, auditorium and club rooms combined, in any plant in the city. This club is going to be one of the big reasons why the Canadian Fairbanks-Morse employees will be one large harmonious crowd.

Dinner was served to about 100 hungry men, the additional 40 having arrived after work was through for the day. These extra roast beef assimilators were mostly foremen and executives throughout the plant.

The auditorium was next invaded, about 150 or more being present.

It was at this point that music reigned supreme, Mr. Musgrave and Mr. Harold Lloyd started a songfest, and songfest it was. Jolly song sheets with fifty-one choruses were issued, and just about this point the roof of the building raised at least an inch. Mr. Lloyd also rendered some solos, which were very acceptable.

Mr. Watkins, superintendent of the C. F. M., introduced Mr. B. P. Graves, designer of milling machines with the Brown and Sharpe Manufacturing Co., Providence, R.I., whom he stated was here to give an illustrated lecture on "Milling machine practice and design."

For the next hour and a half Mr. Graves talked milling machines in every shape and form. He discussed in detail the new taper nose spindle being equipped on the latest Brown and Sharpe machines, and explained in full why this style nose had been adopted. Various slides of very interesting nature were shown illustrating the different mechanisms in detail. The various type machines were taken up in sequence, and all the functions of the various levers were explained.

After the subject of the machines themselves had been thoroughly explained the question of proper cutters was gone into. Various slides made this subject very clear, and as Mr. Graves remarked, "Next to the machine itself the cutters are second in importance." The new type of coarse tooth cutter, as made by the Brown and Sharpe firm, was discussed and explained very thoroughly.

The third portion of the lecture was devoted to the use of proper milling fixtures. Numerous fixtures were shown in actual operation, and production figures were stated on other slides, illustrating clearly both the nature of the work and the possibilities of milling as a manufacturing operation.

If one were to attempt to pick out the most outstanding feature of the complete lecture, we believe the laurels would go to the new No. 21 automatic milling machine, which is being marketed by the Brown and Sharpe concern. This machine is entirely automatic in action and the production figures are both surprising and encouraging.

At a later date we hope not only to describe this new machine but to illustrate by photographs the various points of interest in its design. We also intend to present some of the fixtures which were shown at the lecture, so that readers have a treat in store for them.

Directly after the lecture everyone present was invited to fire questions at Mr. Graves, and they certainly took full advantage of the opportunity. The questions were, however, answered very promptly and satisfactorily.

To say the entire evening's entertainment was enjoyable is hardly strong enough. To our mind it was an evening long to be remembered by all taking part. It is very seldom so much real enjoyment and education can be assimilated in one evening.

PECULIAR ADVERTISING ERROR

In our April 8 issue, on page 11, there appeared an advertisement of the British Smelting and Refining Co., Ltd., that was an example of how easy it is to make a mistake.

This advertisement was never intended for CANADIAN MACHINERY, but for "Printer and Publisher." In some manner, however, it crept its way into our columns. Of course anyone reading the advertisement would at once notice the fact that it was not suitable for our paper, and therefore not sanctioned by the concern whose product it was advertising.

An Interesting Railway Ballast Cleaner

A MECHANICAL railway ballast cleaner, that eliminates the labor of from four to five men, has been developed by the Link-Belt Company. The machine is known as the Pratt ballast cleaner.

The device is operated by a small gasoline engine, mounted upon a steel frame. A bucket elevator takes up the ballast, elevates it to a shaking screen, through which the dirt passes to a tray beneath to be shovelled off by hand, and the cleaned ballast is automatically deposited in the "ditch" again.

In the early models of this machine, one of which is in operation on the main line of the Pennsylvania Railroad between Philadelphia and New York, it is moved forward by means of a hand ratchet at the rear. In later designs, now being developed, this ratchet will be harnessed to the engine, and the device will go forward under its own power.

One of these ballast cleaners, with five men, one of whom acts as a watchman on main line tracks, is said to do the the work of ten men who formerly cleaned railway ballast entirely by hand. The early machines have been able to maintain a speed of one standard rail length of thirty-three feet every forty-five minutes. One energetic laborer, working ten hours, would require a whole day to cover the same distance. More efficient performance for the mechanical cleaner has been established. It is being tried out on the Baltimore & Ohio, the Central Railroad of New Jersey, the New York, New Haven & Hartford, the Western Maryland, and other roads besides the Pennsylvania.

Other mechanical ballast cleaners have been put forward by various inventors in the past, but according to the L. B. Co. none of them proved practical. One of their most vital weak points was the fact that they would not permit of easy train clearances when in operation in the inter-track space. This cleaner clears trains safely, and, when in operation on a single-track line, can readily be moved to make way for passing trains. On main line, or other double-track systems, the device rests on the ends of ties and finds its locomotion on caterpillars.

The cleaner is said to achieve a saving of $260 per mile on ballast cleaning. Dirty ballast retains water, which freezes in winter, causing rails to split from uneven pressure, and results in short-circuiting of block signals. When the dust pockets are removed, drainage is satisfactory.

The manufacturers of the ballast cleaner are also developing an auxiliary device, operated on the suction principle, which will take up particles of dirt and cinders to a depth of six inches below the surface of the ballast, once it has been treated by the mechanical cleaner.

THINGS WE SELDOM SEE

The man who will work without being watched.

A sales manager who doesn't think he pays the old man's salary.

A salesman who thinks perhaps the quality of the material may have something to do with his making those large contracts.

A stenographer who knows punctuation and will look in the dictionary when she is uncertain about the spelling of a word.

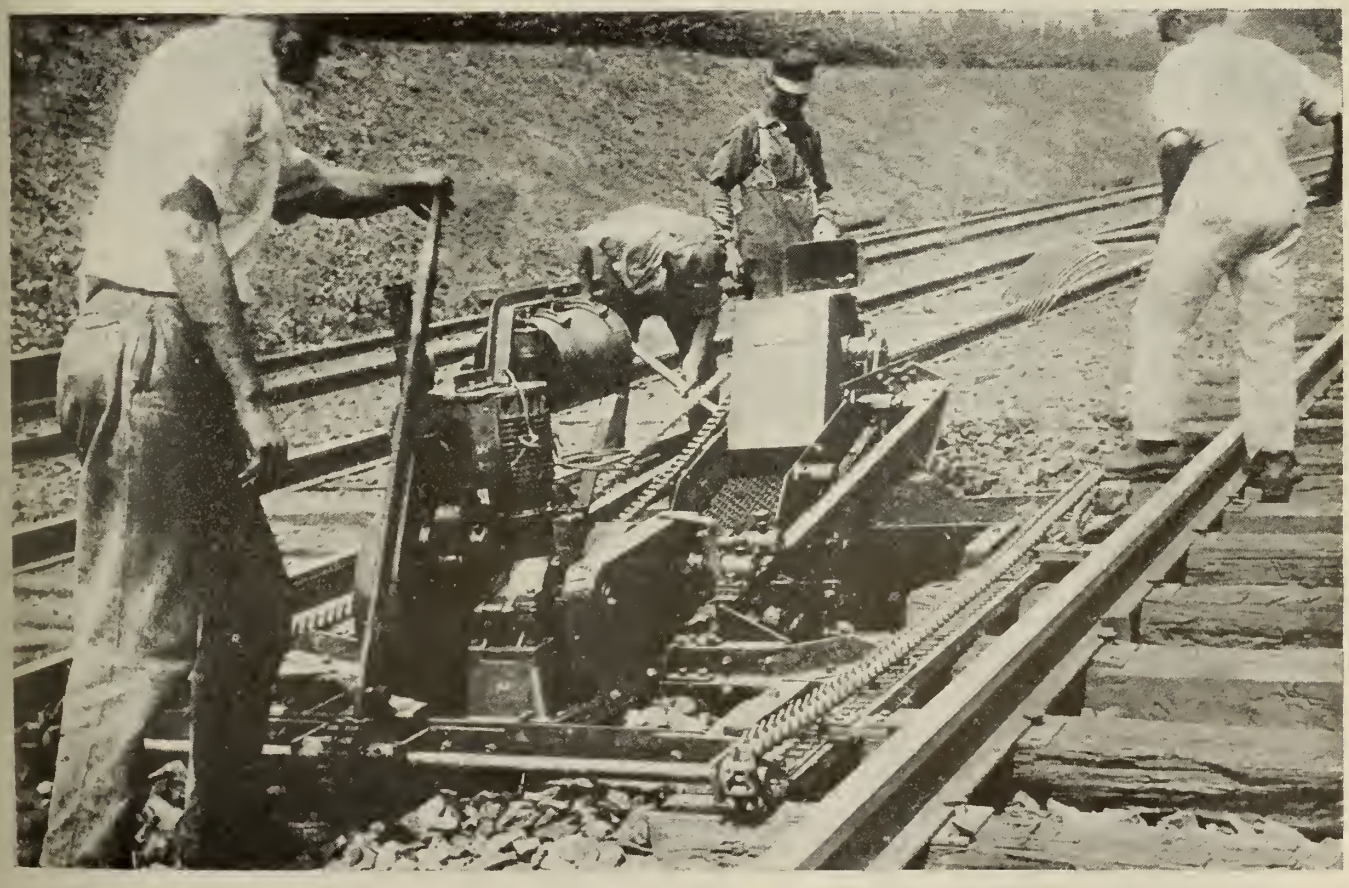
A purchasing agent who doesn't think he does you a favor when he asks you to quote.

A new superintendent who will wait a week before installing a much better system than his predecessor's.

A boss who acts as if he wasn't.

—"Exchange."

In every organization there are two kinds of men. Those who go ahead and do something and those who sit by and ask why the something wasn't done some other way.—"Quiterion."



THIS VIEW ILLUSTRATES THE CLEANER HARD AT WORK.

WHAT OUR READERS THINK AND DO

Is Accident Prevention an Art?

By EIWANTANO

IT may seem strange to speak of accident prevention as an art, but in the writer's belief not only is it an art, but an extremely difficult one to master.

Success in organizing any accident prevention work, depends upon the personality of the safety engineer, upon the style of educational work conducted, and upon the interest which this work is able to arouse in the employees. No hard or fast rule of education work is possible, for such work should be adaptable to changing conditions. One point to be kept in mind, however, is this, that no matter what style of educative tactics are adopted they should be followed out as systematically as possible.

Take, for example, a firm who persist in plastering their factory with bulletin boards only, making no attempt to follow up with steps towards better working conditions. Such a plant is due for disappointments regarding the success of their safety venture. In reality their safety measure is merely a flash in the pan.

No matter what the scheme adopted, keep the old saying in mind, that a change is as good as a rest. When employees have been accustomed to any style of safety propaganda, their enthusiasm usually wanes. It is at this point that the safety engineer has a chance to display his ingenuity and personality.

The up-to-date engineer makes it his business to be familiar with the educational methods adopted by other companies, and can readily embody these ideas in a slightly different manner, thus changing his former tactics, and creating new enthusiasm. By following up the various safety conventions he can secure new ideas, and original methods of securing the interest of the employees.

But to get away from the position of the safety engineer and come down to rock bottom, suppose we were to ask the question, "What does the word Safety imply?" How many various styles of answers do you imagine we would receive?

Psychologists tell us that habits are formed through the paths of least resistance, etc., etc. Be that as it may, we will, no doubt, all agree on one point, that being the fact that safety can easily become a habit if we only allow our inclinations to lean in that direction.

A cautious person is very seldom injured, why? Simply because a cautious individual seldom invites danger, and avoids all unnecessary chances. Can you imagine a cautious person doing some reckless stunt? Of course not, for the very term cautious guards against such a possibility.

Let us consider the other extreme, those careless individuals, who will persist in taking chances. They usually meet with disaster, learning their lesson, in some instances, at a horrible cost, but nevertheless learning their lesson. In a great number of cases, this lesson changes their personality entirely, and makes them more cautious in future. In other words, they see the advantage of playing safe.

Of course, you will find the type of person who does not seem capable of learning a lesson, and keeps on in the careless, foolhardy way which leads to so much trouble, but this latter class is of the hopeless variety, and not worthy of comment.

To overcome the careless type of workman learning his lesson by accidents, the idea of safety educational work was brought into being. The benefits of this work need no praise, as results have proved its wonderful value. In many cases, where accidents were of daily occurrence, the accident toll has been brought down to one or two a year. This is no imaginative incident, for the writer personally knows of such a case where educative literature, combined with proper safeguards, accomplished this record.

From this example, it is plain to be seen that not only is suitable literature necessary, but proper safeguards as well. Wherever repetition work of any nature occurs, there is more than likely a chance of mental sluggishnes setting in. This condition is only natural, for the worker gets so accustomed to the operation that his or her movements become simply mechanical. If you are inclined to doubt this statement, place a guard over any machine, and let the worker become accustomed to the arrangement, then remove the guard and note how quickly an accident occurs.

Another point to be observed is the necessity of securing the co-operation of the employees, for without this feeling, no safety campaign can be the success it should be. This spirit is absolutely necessary to satisfactory results. First, the employer himself must show interest in the work, if he expects in turn to educate his staff to share a like enthusiasm. Each employee should be made to feel that he or she, as the case may be, is a cog in the wheel, and that without their help the machinery of safety cannot run smoothly.

Having pointed out these few necessary stipulations, let us consider some concrete examples, where safety bulletins, safety literature, safety guards, etc., have all in co-operative measure, accomplished results worth while.

Some Examples of Bulletins

At the Lackawanna Steel Co., Buffalo, N. Y., a large sized notice was placed in their drawing office, which read as follows: "Engineers and draftsmen, it is your duty to see that all plans and drawings for machinery, tracks and other equipment, provide for adequate guards,

The Use of Goggles

The subject of the proper use of goggles is one which has been threshed out in many ways, and the method adopted by the Illinois Steel Co. in this regard is well worthy of mention. Having considerable foreign labor at their plant it was considered advisable to use pictures as the best possible warning, so an illustrative chart, entitled, "He took a chance," was prepared.

The chart consisted of four photographs, each picture being accompanied with suitable wording. The first photograph portrayed a workman starting on a chipping job in the foundry, the foreman explaining to him his duties, also the necessity of wearing goggles.

The second photo illustrated, that in this case the workman decided he knew better than the foreman, so he merely fastened the goggles to the top of his hat and started work. Picture No. 3 illustrated the result, for the would-be smart worker received a nasty whack in the eye from a flying chip.

The fourth and last picture showed him coming out of the hospital all bandaged up, a sadder and a wiser man.

Bulletins of such nature have the punch and advantage of being easily understood by the foreign element, as well as by the native population, and as pictures of any nature send their message home, this chart spoken of proved itself well worth the time and trouble spent on its prepaartion.

The Use of Safety Literature

Regarding the different pamphlets is-

sued on safety methods throughout the country, time spent in the reading of these will be found to be exceedingly profitable, for while some may not directly interest you, there is always embodied in these experiences, and talks, some germ of an idea which can be developed, and adapted to suit your own particular line of industry. It is only by an exchange of ideas and experiences that we can hope to further the cause of safety.

The Use of Safety Devices

In this the last portion of the present article we wish to emphasize the need of proper safety devices. The last few years have seen great changes in the safety field. Guards are now being placed on machinery where previously they were considered fads. Employers in general are realizing more and more the benefits to be derived from the proper protection of their machines. Modern lathes of all kinds, rolling mills, planers, etc., etc., are now being equipped with suitable safeguards, and existing models are likewise being protected at the dangerous points.

Notable amongst the various machine tools receiving protection is that of the power press. In the Nov. 6th issue, CANADIAN MACHINERY published an article on safety appliances as adopted to the power press, and in this article described and illustrated some twelve ideas in power press guards which had proved of special value.

As a portion of the article spoken of, we published a set of safety rules, two of which are well worth repeating. The first of these read as follows: "Do not operate a machine until you have been shown how to run it." The second was somewhat of the same nature: "Do not operate any machine in this factory until ordered to do so."

The latter rule is especially noteworthy, for unfortunately we always seem to meet in with the type of workmen who delights in monkeying with some other machine than his own.

As this article is not a detailed attempt to diagnose the accident problem, but rather a short but gentle reminder of the need of safety, and proper safety methods, we will conclude by quoting a very clever saying by "Power," as they see the accident prevention problems.

"The greatest factor operating toward the prevention of accidents is not the prevention device, but the prevention spirit."

Personally, the writer believes this statement to be absolute truth and of considerable value, for no prevention device can be a thorough success without the co-operation of the operator. He must first be infused with the prevention spirit, before we received his co-operation to make the device a success.

BOOK ON FORD CAR

The Norman W. Henley Publishing Co., 2 West 45th Street. New York, have published a revised and enlarged edition of their book on the Model T Ford car, its construction, operation and repair. This book also includes the Fordson farm tractor, the F. A. starting and lighting system, and the worm drive one-ton truck.

The author is Victor W. Page, M.E., author of "The Modern Gasoline Automobile" and other well-known volumes. The book has 410 pages and 153 specially made engravings. It is written especially for drivers and owners, and following are some of the most important contents: The Ford Car, Its Parts and Their Functions; The Engine and Auxiliary Groups; Details of the Chassis Parts; Driving and Maintenance; Overhauling and Repairing; The Ford Tractor, Operation and Maintenance and Repairing of Same.

These various headings give only a general idea of this book, as each of these headings are subdivided into detailed description of all parts, etc.

This volume has the benefit of being written by one who thoroughly understands his subject and is prepared in a way that all can understand it. The price is $1.50 and can be procured either through the publishers direct or by application to our regular book department.

LATEST CATALOGUE

The Brown and Sharpe Mfg. Co., Providence R I., have issued their latest catalogue known as No 137. This is really a revised catalogue as published previously by this concern, and covers their line of milling machines, grinding machines, automatic gear cutting machines, screw machines, cutters, accurate test tools, machinist tools, etc.

A copy of this book will be sent to those interested. Merely write the head office and they will do the rest.

NEW CATALOGUE

The Cochrane-Bly Co., Rochester, N.Y., have issued a loose-leaf catalogue on their line of metal saw machines, saw sharpeners, filing machines, vertical millers, and vertical shapers. A copy will be sent to anyone interested who will write to their office at Rochester.

INTERESTING BOOKLET

The Silver Mfg. Co., Salem, Ohio, have issued an interesting booklet entitled: 'Silver Drills in Service." It is out of the ordinary run of material and really tells a story of service of the Silver drills at the American sector of war. The tale is told by H. D. Parker, who was a First Lieutenant in the Ordnance Department, and we are told that a copy of this booklet will be forwarded to anyone interested.

Useful Information

TABLE OF WEIGHTS AND MEASURES

LONG MEASURE

12 Lines	1 Inch
12 Inches	1 Foot
4 Inches	1 Hand
3 Feet	1 Yard
6 Feet	1 Fathom
5½ Yards	1 Rod or Pole
40 Rods	1 Furlong
8 Furlongs	1 Mile
3 Miles	1 League
69½ Miles	1 Degree
1,760 yards or 5,280 feet	1 Mile
6,075.81 Feet	1 Nautical Mile

SQUARE OR LAND MEASURE

144 Square Inches	1 Sq. Foot
9 Square Feet	1 Sq. Yard
30¼ Yards	1 Sq. Rod
40 Poles or Rods	1 Rood
4 Roods	1 Acre
640 Acres	1 Sq. Mile

CUBIC OR SOLID MEASURE

1,728 Inches	1 Solid Foot
27 Feet	1 Solid Yard
42 Feet	1 Ton Shipping
128 Feet	1 Cord Wood

LAND SURVEY MEASURE

7.92 Inches	1 Link
100 Links	1 Chain
1 Chain	66 Feet
10 Square Chains	1 Acre

ENGLISH MONEY TABLE

4 Farthings	1 Penny
12 Pence	1 Shilling
20 Shillings	1 Pound

AVOIRDUPOIS WEIGHT

16 Drams	1 Ounce
16 Ounces	1 Pound
14 Pounds	1 Stone
25 Pounds	1 Quarter, C
28 Pounds	1 Quarter, E
4 Quarters	1 Hundredweight
20 Hundredweight (2,000 lbs., Can. / 2,240 lbs.. Eng.)	1 Ton

PAPER

24 Sheets	1 Quire
20 Quires	1 Ream

APOTHECARIES' WEIGHT

20 Grains	1 Scruple
3 Scruples	1 Dram
8 Drams	1 Ounce
12 Ounces	1 Pound

TROY WEIGHT

24 Grains	1 Pennyweight
20 Pennyweights	1 Ounce
12 Ounces	1 Pound

CLOTH MEASURE

2¼ Inches	1 Nail
4 Nails	1 Quarter
3 Quarters	1 Flemish Ell
4 Quarters	1 Yard
5 Quarters	1 English Ell
6 Quarters	1 French Ell
37 Inches	1 Scotch Ell

MEASURE OF CAPACITY

4 Gills	1 Pint
2 Pints	1 Quart
4 Quarts	1 Gallon
9 Gallons	1 Firkin
36 Gallons	1 Barrel
63 Gallons	1 Hogshead

DRY MEASURE

2 Pints	1 Quart
4 Quarts	1 Gallon
2 Gallons	1 Peck
4 Pecks	1 Bushel
36 Bushels	1 Chaldron

TIME MEASURE

60 Seconds	1 Minute
60 Minutes	1 Hour
24 Hours	1 Day
7 Days	1 Week
4 Weeks	1 Month
12 Months, or 365¼ Days	1 Year
100 Years	1 Century

DAYS IN THE MONTH

30 days hath September,
April, June and November;
February has 28 alone,
And all the rest have 31;
But Leap Year coming once in four,
February then has one day more.

DEVELOPMENTS IN SHOP EQUIPMENT

KEMPSMITH NO. 4 VERTICAL MAXIMILLER

In many instances the vertical type miller has many advantages over that of the horizontal type. With this in mind the Kempsmith Mfg. Co. has designed the No. 4 vertical maximiller, which embodies several of the features of the No. 4 plain horizontal maximiller, which was placed on the market some sixteen months ago. This maximiller has been designed in recognition of a great demand for a heavy, powerful, conveniently-operated machine that will produce accurate work rapidly.

Much thought and study has been given to such features of design as rigidity, weight, accurate and rapid production, etc.

Only the best materials have been used in its manufacture. Gears used throughout this miller have to pass certain stringent chemical tests before being used, and then are scientifically heat treated for the particular use to which they are to be put. All shafts, especially those in the speed train, which are subject to much strain, are of heat-treated alloy steel.

The main frame members of the machine, including column, knee, saddle and table are of semi-steel. This machine has been carefully designed to give it maximum strength without adding on metal merely to make a heavy machine. Every working part is well proportioned. A large base has been provided which insures stability for the entire machine.

The Knee

The design of the knee is the same as that used on their No. 4 horizontal maximiller, having no openings in the top whatsoever, merely a shallow depression to receive the centre-drive cross-feed screw. The side walls also are practically solid, having but three small openings. This solid construction of course serves to resist clamping strains and the torsional effect of the table overhang. The location of the cross-feed screw in the shallow depression in the top of the knee at the exact centre insures the greatest possible strength and accuracy as the pull is applied directly to the centre of the saddle.

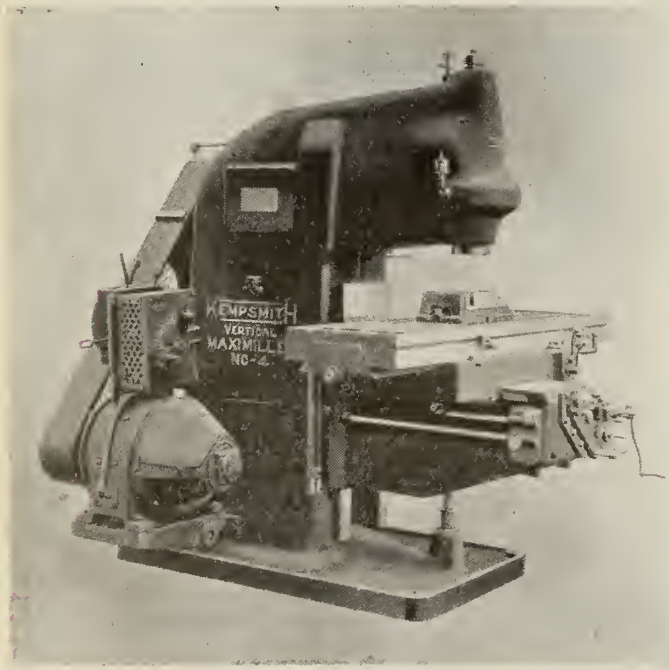
The column has very few and small openings, is well ribbed and has a rib midway of the column height, forming a reservoir for the speed drive oil. This also has a great stiffening effect on the column.

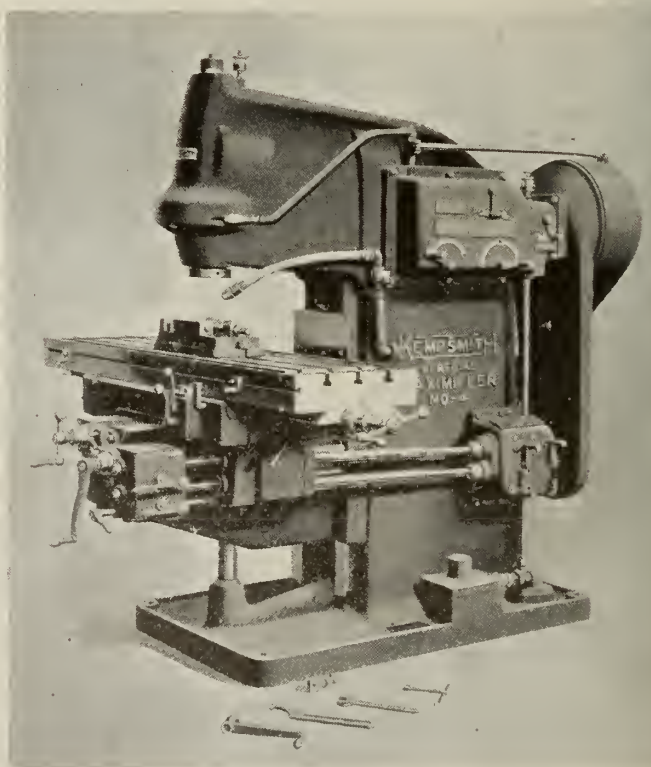
Knee, Table and Saddle

The knee, table and saddle are counterweighted by means of weights inside the column. This provides easy, vertical adjustment of work in relation to the cutter, and makes it unnecessary to have the usual auxiliary vertical slide for the spindle.

The table has a working surface of 70 inches by 18 inches and a longitudinal range of 42 inches. The table gib is of the adjustable taper type with locked adjustment. Unit construction is well recognized because of the easy repair facilities and this has been carried out to the fullest extent in the design of this machine.

The spindle nose is of the Kempsmith patented type; is hardened, and provides for driving face milling cutters in either direction and permits cutter to be quickly and easily removed.





WORKING SURFACE—70"x18"; T-Slots, three ¾". RANGE—Longitudinal, Power, 42"; Transverse, Power, 14"; Vertical, Power, 20"; Nose of Spindle to table in lowest position, 22"; Throat distance, 19". SPINDLE—Taper hole, B. & S., No. 12; Hole through, diameter, 1⅛"; Spindle speeds, number, 18; Spindle speeds, range, 14-355. DRIVING PULLEY—Diameter, 16-¾"; Belt, width, 6"; Pulley speed, R.P.M., 400. FEED—Number of feeds, 18; Range, inches per minute, 5/8" to 25". POWER QUICK TRAVERSE—Rate, longitudinal, inches per minute, 100; Rate, traverse or vertical, inches, 36. FLOOR SPACE—In direction of spindle, 99"; in direction of table travel, 122". SHIPPING DATA—Net weight, 11,050 lbs.; Shipping weight, domestic, 11,800 lbs.; Shipping weight, foreign, 11,075 lbs.

The slow-speed shafts in the spindle train are extremely large and of heat-treated alloy steel. The bevel gears are very large and of coarse pitch and of the spiral bevel type, giving a smooth, silent drive. Extreme rigidity and driving power can be obtained since the usual auxiliary slide for raising and lowering the spindle has been eliminated.

The right-hand design has been used as this is the normal direction of the spindle rotation for standard drills and boring tools. A spindle reverse has been incorporated for the reason that in order to get cutting strains in proper direction on gibs and tables a face mill must be run in the opposite direction to a spiral or slab mill. To reverse the spindle it is merely necessary to throw a small lever a distance of about three inches. The hand lever shown in the front of the machine operates the clutch, which is of the friction plate type. Large diameter friction surfaces are forced together by a combination toggle and plain lever movement which gives the required pressure on the plates with very little effort on the operating handle. It is easily accessible for adjustment for wear. The momentum of the spindle is instantly overcome by means of a brake operating on the reverse throw of the clutch lever.

The driving pulley is 16¾ in. in diameter. It takes a 6-inch double belt and runs at 400 r.p.m. The drive pulley is mounted on ball bearings, and with the clutch is enclosed in a protective housing.

Power Quick Traverse

This machine is arranged with power quick traverse, giving 100 in. per minute travel of the table in either direction and 36 in. per minute on the vertical movement and the transverse movement. The control of these various movements is concentrated and it is unnecessary for the operator to change his position in operating all the quick traverse and feed movements. In case of error on part of the operator engaging wrong levers no harm can come to the mechanism as safety devices are incorporated. Two levers control the longitudinal feed and quick traverse. Operator merely pushes the one required in the direction he wishes the table to travel. The knee and saddle are controlled by a second set of two levers. The unit which shall move is determined by push pins located in close proximity to the respective hand-feed handles.

Lubrication

Much thought has been given to the perfect lubrication of all working parts of this machine. The gears and bearings in the entire speed and feed mechanism run constantly in oil and are lubricated by splash. The balance of the oiling system is centralized at two points, which makes it certain that none will be overlooked.

A pump with about 15 gallons capacity per minute is built into the machine. It is of the centrifugal type and can be disengaged if the nature of the work does not require a cooling fluid.

The spindle is very large in diameter. It is of alloy steel with the front end hardened so as to give a hardened front bearing and spindle nose. It runs in phosphor bronze bearings, which are easily adjustable to compensate for wear. All other shafts in the speed transmission run on ball bearings. The spindle has a No. 12 B. & S. taper hole and the hole through the spindle is 1⅛ in. in diameter. Eighteen spindle speeds are provided, giving a range of from 14/355.

Eight changes of feed are provided ranging from ⅝ in. to 25 inches per minute in geometrical progression. The gears are all heat-treated steel and run constantly in an oil bath. Proper safety devices are incorporated which will slip before a destructive load comes on the feed drive, but takes up its driving function again without attention as soon as the load drops to safe limits.

The change in the power quick traverse rate does not effect the speed rate of the cross and vertical movements, these remaining the same for all movements.

The quick traverse is available even if the spindle and feed are not operating, which is a particular advantage in setting up the machine or in returning the table after completing a cut. The drive may be interrupted at the drive pulley in case the machine is not in use. Oiling directions for this machine are very simple and complete. A small brass plate located on the speed box is all that is necessary to explain their operation to new or unskilled operators.

This machine is regularly arranged for single pulley drive but can be arranged for motor drive through belt, in which case the motor recommended is of 15 h.p., running at 1,200 r.p.m.

NEW THINGS IN MACHINE TOOLS

The Grand Rapids Machine Company are now manufacturing a line of tap-grinding machine for grinding the taper and the clearance on the ends of taps.

The Badger Tool Company of Beloit, Wis., are now making a new line of grinding machine, known as the No. 4. The spindle is fitted with both radial and thrust ball-bearings.

A new compression coupling, for use on shafts between 15-16 and 3 inches in diameter, has been placed on the market by the Cincinnati Ball Crank Company of Cincinnati, Ohio.

The Streine Tool and Manufacturing Company of New Bremen, Ohio, have recently brought out a new toggle forming press for roofing and special shapes, with a capacity up to 12 feet in length. It is also provided with tables for die work.

An interesting spiral fluted taper reamer, that may be used in drilling machines, is now being made by the Gammons-Holman Company of Manchester, Conn. They work rapid and cut freely, the chips resembling fine wool. These reamers are made in all the standard sizes.

The Lapoint Machine Tool Company of Hudson, Mass., have added a new type of broaching machine to their regular lines, which will be known as the No. 3 Duplex. The power screws may be operated jointly or as separate units as desired, and to any required length of broach.

The latest improvement in the 8-inch Hercules gear-hobbing machine, made by the Hercules Machine and Tool Company, of Astoria, N.Y., provides for exhaust adjustment in the centering of the hob. Automatic stops are provided for disengaging the feeds when machining the various classes of gears.

A special design of portable grinding machine, manufactured by the Mummert-Dixon Company of Hanover, Pa., has some very interesting features. The machine is self-contained and the wheel may be operated at any desired angle without interfering with the feneral alignment. Ball-bearing parts assure easy movement.

What has been turned a short-cut lathe has been placed on the market by the O. R. Adams Manufacturing Company of Rochester, N.Y. The headstock is designed to give six changes of speed, with a range from 43 to 375 r.p.m. Speed changes can be made while the lathe is in operation. The spindle is prevented from turning when in a neutral position by the action of a brake.

A two-motor, high-power radial drilling machine, of the Ryerson-Conradson type, is the latest product of the Jos. T. Ryerson and Son Company of Chicago, Ill. These drilling machines are made in sizes of 4, 5, and 6 feet arms. The principal feature in the design is the small number of shafts and gears used, there being only four shafts and sixteen gears in the machine. S. K. F. ball bearings are fitted in the head. The spindle drive is obtained from a vertical reversible motor, direct connected to the drive shaft by a self-aligning coupling. An independent vertical motor is used for raising and lowering the arm.

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The Steel Market

ONE of the topics discussed in the purchasing circles just now is: "When will there be a uniform steel market?" By that we mean, when will there be a price for bars, plate, sheets, shapes, etc., that will be within reasonable distance of uniformity at various points, and from various concerns?

Right now it is proper to state that there is no price in the steel market in this country for available material that can be counted upon as standard or uniform. There may be one or two minor exceptions to this statement, but those who are buying steel will admit that it is not far wide of the mark.

There is the price that the Steel Corporation is asking. It is, to all intents and purposes, the price that was set by the War Board on March 21 of last year. The drawback, of course, is that the Steel Corporation is not able to make deliveries on account of the large tonnage already on its books. Canadian steel makers are dependent for many of their materials on U.S. sources, and they have felt the prevailing high prices and the exchange rates as well.

The independents and the premium mills of the States have another set of prices. The brokers and the jobbers have a brand new schedule, depending very much on the conditions governing each sale.

Canadian jobbers are called upon to keep on increasing the amount they have to invest to finance the handling of a given tonnage. On their turnover they do not make a correspondingly high profit. They are doing business with the same customers they have served in the past, and expect to keep on serving in the future, and they feel in duty bound to secure material for them at as close a figure as possible.

But there is in the situation now less certainty than ever. The scarcity that has been the dominating feature for some time is acute. It is not being overtaken despite the large production of U.S. mills, for the good reason that they are working against bookings that are 130 per cent. greater than capacity.

It may be an uneven and irregular market for months to come. Conditions that might help in smoothing out trouble are not coming to pass, but in their stead we have the added complications of transportation strikes by a group of industrial rebels whose chief aim seems to be the making of intolerable conditions for all rather than bringing about better terms for themselves.

Why the Strike Talk?

STRIKE talk is having its innings in Canada at present, and from past experience it would not be surprising were the strike talk to culminate in strike action.

A workman sees the price of everything he buys going week after week past and beyond his buying power. There are many cases where increased effort on his part would bring increased reward. This is not a blind statement, for there are plenty of records that can be drawn upon to show that in spite of increases in wages, production is less than in former years.

There are other cases, and many of them, where a workman is powerless to increase his income. Increased effort on his part would simply mean increased profit for the firm.

The man who is powerless to increase his income, and whose income is not sufficient to allow him to provide decently for his home and children, has good reason to talk strike.

He sees no other way out. His strike pay will mean added misery, because it is woefully inadequate.

The greatest rebuff that strike talk can get will come when prices cease to rise overnight.

The rising market is getting under the skin of the employer, and it is making the going mighty hard for the man in the shop.

There are increases in costs that are warranted, and can be accounted for. There are increases in costs that are simply cases of personified greed running mad.

One group of employers is forced to keep on paying higher and higher wages in order that the greed of another class may be gratified.

The business of explaining "I am not a profiteer" is being reduced to such a science that it is well nigh impossible to drive the original "gouge 'em" group into a corner and secure them, and thus save the world from their further operation.

We have drifted and skidded and slid into a period of greed, where the finer instincts of kindness and consideration for others are dulled, forgotten or utterly disregarded.

In such a period—and we are certainly in it to the neck—heaven help the man who finds that he cannot increase his earning powers to the point where he can live decently and keep his home in comfort!

And in that same time, pity the firm whose pay-roll is decorated by a long list of men who have separately or collectively decided that they will keep production down to the lowest possible point, and drive wages as far in the opposite direction as possible.

The present situation needs a heap more common sense than we have been exhibiting lately, if we hope to get over the top of it in safety. The fool agitator and the "beat them" employer should back off the map in a good many cases, and when off, stay off for good.

IT IS just a question whether a settlement should be made with the present strikers on the U.S. railroads. When a man has a mad dog to deal with he doesn't negotiate. He travels to the woodshed for the axe and he travels fast, too.

YOU can't blame Mr. Galvanized Sheet for being a bit stiff and chesty as he passes out of stock at 12 cents per pound.

Assassinating Arithmetic

THE Technical School is recognized to-day as one of the wisest provisions a country can make for the education of its youth, yet at times some seeker after notoriety, or perhaps some well-meaning, if misguided, enthusiast, recommends some radical change in the public school curricula which would have the effect of undoing the good of the technical school and leaving the majority of the rising generation without a proper foundation for earning their livelihood.

One such has recently made a statement to the effect that arithmetic should be, perhaps not altogether eliminated, but rendered quite innocuous so far as the public school pupil is concerned. He would eliminate complex fractions, recurring decimals, trains meeting and passing each other, boats going up and down stream, and true discount. While highly pleasing to the youth of the land, and while allowing time for more diverting and entertaining subjects such as sculpture, music and the higher aesthetic attainments, any curtailment of the mathematical subjects mentioned could only be looked upon with apprehension.

Rather should arithmetic, and that other somewhat prosaic subject, grammar, be extended, and made to occupy more of the student's time in the public school. The true function of education is to prepare a man for his life's work and to enable him to profit by the experience or literary genius of others, and when the first of these is lost sight of it avails nothing that he be able to play the fiddle or enjoy himself otherwise if he is unable to earn his daily bread.

As a preliminary to a machine shop apprenticeship or a course of study in any one of the branches of the engineering profession, mathematics is essential, and the more knowledge of this nature a boy can assimilate in the public school, often his only chance, the better equipped he will be for his further training.

After all, the public school, high school and university are only the beginning of a man's real education, and the earlier he stops school attendance the more essential it is that he be given the most necessary and immediately useful knowledge.

A MAN is coming all the way from London, England, to go over Niagara Falls in a barrel. The high cost of carbolic acid has driven folks to do many strange things.

THE KAISER was blamed for the war. Said Kaiser has been wearing wooden shoes and chopping trees in Holland for some months, but still there is a very respectable war story coming through from some corner of Europe, or Asia, or Ireland every day.

THEY do tell that X-ray photos of prospective brides' and grooms' diaphragms give a true test as to the suitability of the marriage. An X-ray of the groom's wad also gives a good indication of his ability to stand the racket.

PEOPLE in the Southern States are starting to deck themselves in blue overalls in order to combat the high cost of clothing. And so overalls 'opped from $2 to $6 per pair. The man who can swat Old Man Hicost right on the jaw has not yet arisen in the land.

THE RIVERS of Alaska are in danger of being robbed of their greatest asset, salmon, because no thought is given to re-stocking the streams. The timber limits of Canada are in danger of being sadly depleted of pulpwood because no good policy of reforestation is generally used. It is an easy thing to hand down a depleted heritage to coming generations.

Resuming an Old Fashion

THOSE who are wont to bemoan the departure of all that is beautiful from the world, with the advent of highly specialized industry, may take fresh hope. In the marine world, where progress follows progress in bewildering fashion, there has suddenly arisen a champion of what at first sight would seem reaction. This gentleman claims that future ships should be built with a receding stem, instead of the straight stem so much in use now.

Those lovers of beauty who used to pause to admire the exquisitely curved stem, finished off, as it usually was, with a more or less artistic figurehead, will claim the defender of the curved stem as one of themselves. It is not in the interests of beauty, though, that the receding stem is being advocated, but in the interests of safety. Both life and property will be much more secure if, in the event of collision, the striking vessel possesses a receding stem instead of a straight one. As most dangerous collisions are end-on ones, where the colliding ship usually strikes the victim on the broadside, the effect of the straight stem is to do as much damage below the water line as above it, the blow taking place along the full height of the stem. With the curved or receding stem, the blow takes effect at first high up on the ship's side, and before the damage can extend downwards the stem has to force its way through decks and frames. The force of the blow is thus absorbed much before the damage can reach a point on the water line or below it, and instead of the collision resulting in the sinking of the ship in a few minutes, there is very little chance of the vessel sinking at all.

There is at least one firm of shipowners who are building their stems on these lines, notwithstanding the fact that by so doing they have to pay larger dockage rates, owing to the extra space occupied by the overhanging stem. The safety feature of this type of construction so much appeals to them that they cheerfully stand the added expense. It is the desire of a good many people, that this form of stem be made compulsory, and a much greater degree of safety attained thereby.

AGAIN this year, with the approach of May 1, it appears that the laborer considers he is worthy of his higher.

MARKET DEVELOPMENTS

Increases Not Reflected in Canada Yet

Greater Tonnage Turned Out Not Reaching the Consumer Here—No Cancellation of Orders is Again Being Brought to Attention of the Customers in Tool Market

CANADIAN consumers of steel read with some interest of increases claimed by the United States mills month after month, but it is a fact that they find it hard to see where there is any of this improvement reflected in the shipments that are coming to Canada. Production was 84% in January, 90% in February and 96% in March, but against these figures there is a booking of some 126 per cent. of capacity. The market in this country is being supplied with a fairly large tonnage of premium goods. Jobbers find it necessary to put in much larger amounts of money to finance a given tonnage, and they do not make a correspondingly high return.

One of the Toronto dealers made the point this week that the old theory about steel being the barometer for all other things had been shot to pieces. "Steel prices at the close of the war were kept down, and it was a long time before the schedule of March 21, 1919, was departed from, but the comparatively low price of steel did not prevent in the slightest degree the price of everything else running away."

Some signs of more caution are noticed in the machine tool market, where some dealers are again calling attention to the fact that they are accepting business without the cancellation allowance. When a customer places an order they regard it as absolute, and deny him the privilege of changing his mind or switching his business.

There are rumors of an increase coming in high-speed drills. The present list has been in existence for some months now. Nothing official has come to the dealers of the reported increase.

The scrap market is dull and listless, but prices are still standing where they were chalked up to several weeks ago.

MONTREAL CAN SEE NOTHING IN THE WAY OF LOWER PRICES

Special to CANADIAN MACHINERY.

MONTREAL, April 15.—While some dealers here are looking forward to better conditions in the early future, as regards delivery of material, few of them anticipate any easing of prices as a direct consequence to greater production and supply. The fact that wages in all lines of industry are of a very high character and the prospects of further demands by some trades on the first of May, gives little hope of relief in the way of lower prices on any line of commodity. In the States this condition of high cost of production is an important factor in the problem of trade development. There is little, at present, to show that the demand for supplies has been seriously affected by the steadily advancing prices, but there is an undoubted tendency to favor British product that apparently is becoming more plentiful on the Canadian market. An interesting feature of present trading is the assurance of dealers representing British manufacturers of prompt shipment of orders for material or equipment.

Despite the announcement that steel mills in the States have been steadily increasing production, the difficulty of dealers in obtaining supplies for their customers seems as great as ever, and it is seldom that full requirements for steel commodities can be satisfied. The situation to-day hardly permits the dealer to quote a definite price on any of the lines that are hard to obtain, owing to the uncertainty that dominates the trade at the present time.

Warehouses in this district are not overcrowded, and while dealers are anxious to supply the needs of their customers, they are in no hurry to stock up heavily at existing prices; not that they look for lower figures, but the high rate that has prevailed on exchange has not been conducive to the carrying of unsold material.

Delivery Still a Factor

The sameness that appears to mark the trading in machine tool circles offers little opportunity to tell of any new developments in the market. The higher costs that are the result of increased wage grants in nearly every line of activity is likewise reflected in machine tools, and manufacturers seldom have to announce a price lower than that previously quoted. On the contrary, quotations are generally of a higher order than the one before. The lower exchange has given some relief to the American trade, and buying in this direction is on a freer scale, but delivery is not all that could be hoped for, with the result that trading in used machinery, when such can be had, is still of considerable volume.

Hard to Get Supplies

There is little that is new in the old material situation, and dealers report a quiet week with less than a normal movement of scrap. The non-ferrous lines have shown a tendency to weaken but dealers show little inclination to alter present quotations, which they claim are a fair average of the figures at which sales are made. Dealers have no difficulty in disposing of steel scraps, particularly in the way of cast iron, the need for which is as pressing as ever; the great trouble appears to be the accumulation of sufficient material to meet the daily needs of the foundries and furnaces. Prices here are unchanged, and may be taken as a normal quotation rather than the actual figure at which a sale would be made as prices are invariably made on the merits of each individual case.

CAN'T MAKE MUCH ON PREMIUM STUFF

Markets Uncertain in Many Lines, But Big Volume of Orders Are In

Toronto, April 15.—As long as the trade has the spectacle of seeing the various industries out in the market bidding for material that the steel mills can turn out, we are going to have fairly high prices. Selling is not yet a problem in the market. It is yet a matter of production more than anything else.

And yet there are indications that some of the companies consider that the limit of prices is here. For instance, it is hard to account for the fact that some of the dealers are refusing now to accept business that has a cancellation clause attached to it. When the order is placed for the equipment, it is regarded as a binding and absolute order, and it is hard to name anything that is considered as sufficient grounds for the breaking of the contract so made.

There are other lines on which contracts are given now, in which the price is given up to a certain date, after which the selling company retains the right to increase the price, but puts a limit on the increase that can be made over the quotations given in the first place. Buyers will feel more assurance under such a plan than where they have no hold whatever in the matter of price increases. Several indications are coming to the surface that indicate a feeling of caution, and a desire for more assurance when placing business for the future.

There were several fairly large propositions in sight in this district, but latest reports indicate that some of them may be held over, the promoters feeling that the time for making large purchases is not very opportune, and they hesitate also to go into the labor market at this time, hoping for something better later on. It cannot be claimed, though, that firms are to any great degree thinking of holding back for the reason above stated.

In Small Tools

Dealers report a good volume of business in small tools and supplies generally. One hears reports again of some price shading that has taken place. This time, the line was carbon cutters, and the quotations on these have been, in one or two cases during the last week or so, let down about ten per cent. There was almost an entire absence of this for some days on all lines, nor can it be said that the practice is by any means general now. It may be quite an isolated case that was reported to CANADIAN MACHINERY this week, but nevertheless it was a bona fide case.

There is also a report that one hears in several places to the effect that high speed drills are due for an increase in price. The prices that are prevailing now have been standing for about four months. The dealers have not received word of an advance, but CANADIAN MACHINERY has information that it considers reliable to the effect that an increase is almost certain to be made in high speed drills in the near future.

POINTS IN WEEK'S MARKETING NOTES

Pittsburgh reports large increases in production of steel, but Canadian buyers fail to see any change in deliveries at their shops.

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There has been no great inconvenience here yet following the U.S. railroad strike, but the trade believes the real trouble will come after they settle the trouble and try to straighten matters out.

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Several of the steel dealers from this district are again in the U. S. steel field seeing if they can get any better service in the way of deliveries.

—

Warehousing interests here find that they have to put up an increasingly large amount of money each time to finance the buying of premium goods, and they are not getting a correspondingly large margin of profit.

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Some of the machine tool houses are calling attention again to the fact that the no-cancellation clause in business placed with them is to be enforced.

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Although nothing has come to the dealers here officially, there is a report in circulation that an increase may be announced in the price of high speed drills.

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Trade continues dull and uninteresting in the scrap metal market. Coppers are unexplainably weak, while there is not sufficient quantities of iron and steel coming in to create any interest.

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Unsettled conditions in the labor market and high costs connected with installations are causing some projects to be held up in the meantime.

Many Theories Exploded

The past few months have shot old theories to pieces. Among them is the one that steel is the barometer of the market. This was always accepted with as much solemnity as the deductions gathered from the volume of shipping that was being done by the Old Country.

We used to believe that if steel prices broke, all was off, and that if they stayed strong, all would do likewise. The steel prices for a long time were held at the March 21 schedule. By this document they were forced down from their war level, and they stayed down for some time. In fact, the U. S. Steel Corporation insists on still keeping them down. But it has not affected other things in the market, and now that premium mills are operating to the fullest extent, no difference is noticed. It looks as though we would have to get out a new set of "Sure Things in Business."

Dealers do not see anything in the near future that is going to bring about a much-desired levelling of prices in the steel trade. By that we mean a condition where a ton of steel plate, or a ton of sheets can be said to be worth a certain definite sum. Just now such a figure cannot be given. In prices it is simply a case of paying for the material and the delivery.

"One man's guess is as good as another as to the future," is the way one Toronto warehouse sized up the situation this morning. Some of the men who have been regarded as leaders in the steel market have had a long string of poor guesses to their credit during the past few months. It is a great time for any person to wreck their reputation in the prophesying business as to what will take place a few months from now."

Sheets are getting no better in regard to the way they are coming in here. Some of the local warehouses have boiler tubes now in from 2 in. to 4 in. sizes. Against the rather small arrivals, there are orders from all over the country. Blue annealed are coming here in large lots now, but it is premium material, and prices are high. Warehouses find it none too easy to get their money back as readily as in normal times. One of the warehouse men stated the case this way: "We are constantly called upon to increase our investment. In almost every case now we have to put up more money to get anything approaching the same tonnage as we have handled before on much smaller amounts. It is impossible to keep the margin of profit up to the amount of increased capital that one must keep employed in the business. Dealers take on premium business because the trade here simply has to be kept supplied, and there is no other way to get the goods with which to do it. A jobber takes a chance when he goes into the market now and buys up three or four hundred tons of sheets at the premium price. Were they to sag in price, who would come to his rescue? It is a fact that dealers are not making as much money on high-priced premium goods as they do in the ordinary way at a much lower figure."

Several Toronto men are in the steel section of United States now. They have been through the territory for some days trying to get a greater tonnage for their customers here.

The railroad strike would be felt in the warehouse business about as soon as any place, but no complaint is made here yet. "Our experience with railroad strikes," commented one dealer, "has been that the trouble starts to come about the time the thing is settled. Then it is that we begin to find out that whole carloads have been lost. It would not take much to upset the transportation business at this time. If the strikes keeps up we will feel it all right, but fortunately we have nothing extra to complain of so far."

The scrap market is weak, although

not enough so to make prices drop. The schedule remains as it has been for the past month. Coppers are weak. There is no very apparent reason why this should be so. The iron and steel section of the trade is also dull, largely from the reason that there is little or nothing coming in. Material is badly wanted. This is shown in several ways, one of them being that many foundries are advertising in papers in their own localities stating that there are in the market for scrap material. In this way there is no doubt that a certain amount of the material is being kept from coming to the larger scrap yards.

STEEL MILLS CLAIM THAT THE PRODUCTION IS GAINING NOW

Special to CANADIAN MACHINERY.

PITTSBURGH, April 15.—The United States Steel Corporation reports unfilled obligations at the close of business in March at 9,892,075 tons, showing an increase during March of 389,994 tons, against increases of 216,640 tons in February and 1,020,075 tons in January. In many quarters in the trade the expectation had been that March would show little, if any, increase, chiefly on the ground that the corporation was already well sold up and would hardly continue indefinitely to sell each month a larger tonnage than it shipped. It was also thought that when the customers of independent producers were buying very little, even the corporation customers might be unwilling to make extensive commitments despite the fact that the corporation's prices are well below those of any of the independents, since the corporation continues to adhere strictly to the Industrial Board price schedule of March 21, 1919. Thus the March increase of 389,994 tons, equal to 28 per cent. of capacity for the month, furnishes surprises in most quarters.

The corporation's shipments during March may be estimated at about 96 per cent. of capacity, against about 90 per cent. for February and about 84 per cent. for January. With shipments at 96 per cent. of capacity and bookings in excess of shipments by 28 per cent., the bookings would be about 124 per cent. of capacity. The excess of bookings is the more remarkable in view of the fact that one subsidiary, the American Sheet & Tin Plate Company, was practically out of the market in March, having opened its books for the present half year last November, and not having yet opened its books for the second half until this week.

Sheet and Tin Plate Market Opened

By booking orders and contracts each month far in excess of the shipment, the corporation gives evidence each month of its purpose to adhere indefinitely to the Industrial Board price schedule, even though the independents all insist upon higher prices, and secure the higher prices on all the tonnage they sell. Another evidence that there is no disposition to depart from the policy is furnished by the American Sheet & Tin Plate Company this week opening its order books for the new period at the Industrial Board prices it has previously held to: Blue annealed sheets, 10 gauge, 3.55c; black sheets, 28 gauge, 4.35c; galvanized sheets, 28 gauge, 5.70c; box, Pittsburgh, plus rail freight to destination. These prices, of course, are for domestic trade, overseas export trade being governed by export conditions. In many instances, Canada is considered a part of the domestic market. As usual, business is taken for the half-year in the case of manufacturing consumers and for the quarter in the case of jobbers, the quarter in this instance being the third. In general, however, the Steel Corporation subsidiaries do not do great deal of business with jobbers. The corporation has some important jobbing warehouses of its own.

It is assumed that the entire tonnage of sheets and tin plates the American Sheet & Tin Plate Company will be in a position to furnish will be taken up quickly by regular customers, and as was the case when books were opened November 15 for the present half-year the business will be done largely by way of making allotments to customers, rated according to amounts the respective customers have received in the past. Present contracts in tin plate will be worked out by some time in July, but the sheet business will not be completed before the early part of August. The delay is due to the restriction in operation early in the year caused by shortage of coal and steel, and by the present shortage of steel. While the company has lately been operating approximately 95 per cent. of its sheet mills, only about 75 per cent. of this is against regular sheet sales, that being the extent of the sheet bar supply, the balance of the operation being by conversion contracts, taken simply to avoid idleness of the mills. The sheet consumers bought the sheet bars and are simply having the company roll the bars into sheets, at set prices for the conversion.

A feature of the market and general industrial situation is that wide variety of views now entertained by various observers. Never, perhaps, was there such diversity of opinion. Some men, particularly bankers, are predicting a "panic" next August or September, though what variety of panic they do not state, since it is practically the universal opinion that through the Federal Reserve banking system put in operation late in 1914 a money panic is practically impossible. Hitherto panics in the United States have been primarily money panics, though the phenomenon may be ascribed to money being the most vulnerable thing, whereby if money panics had not occurred there would have been panics of other descriptions instead.

Then there are other observers who predict that there will be a general readjustment, or "shake-out," not necessarily of particularly panicky character, some time next year, perhaps about a year hence. In both cases the fundamental idea is that there is great inflation and that business cannot be conducted for an indefinite time on the inflated basis.

There are, however, still other observers who insist that no man is wise enough to know that the country cannot continue on the present basis, or even get along with still higher wages and commodity prices. They do not assert positively that it can, but assert that no one can be sure that it cannot.

As to the steel market in particular, there are likewise widely divergent opinions. The monthly ingot report of the American Iron and Steel Institute, just issued, indicates that production of steel ingots in March was at the rate of about 45,200,000 gross tons a year, previous rates having been 44,200,000 tons in February and 40,650,000 tons in January. The March output was much larger than had been expected, for there were various operating difficulties, particularly car shortage. Incidentally, the showing suggests that the real capacity of the country is nearer 55,000,000 tons of steel ingots a year than the 49,000,000 or 50,000,000 tons estimated until quite recently.

From this large output in March opposite conclusions are drawn. One conclusion is that when output was so large, with shipments slightly exceeding output as a little of the steel accumulated at mills in January and February was moved, and with some shipments long on the road reaching consumers, the rate of consumption is seen to be extremely large, and much greater than was assumed, on the basis that all this steel was absorbed without steel becoming plentiful, for the appearances are that steel is still scarce. The argument continues that if the present lines of consumption can absorb so much steel, there will be a scarcity when the railroads come to taking large quantities and when something like normal quantities are absorbed in large construction projects generally. Accordingly steel prices will not decline but will rather advance.

The opposite argument is that whether or not one can observe a diminution in the scarcity of steel the heavy shipments must be making steel more plentiful, since there is much more steel being produced than buyers expected when they pushed up the market by bidding against each other. Accordingly, steel prices will soften, and in the not distant future, even though later on heavier buying might come. The softening would be by way of independent prices dropping to the Steel Corporation level, not of the Industrial Board price schedule itself yielding.

Thus there are opposite conclusions from the same general premises. Meanwhile the market is very quiet as to transactions outside the Steel Corporation sales.

PIG IRON TRADE

The pig iron market continues generally dull but with prices still keeping firm. In some districts a little more action has taken place. The demand for deliveries on contracts keeps insistent and would tend to show that foundries are keeping up production. In the Pittsburgh and Youngstown district the output of pig iron for March showed a large increase over February, and April is expected to show an increase over March. Basic iron in this district is at an average price of $41.50 and Bessemer at $42, valley furnace; No. 2 foundry grade is at a minimum of $43, valley furnace. In the Chicago district the market is dull and prices in some instances have softened a little. There have been no large orders during the week, the biggest thing noted being an order of 1,500 tons malleable for Wisconsin delivery. In the Buffalo centre there has been more activity shown during the past week than for some time, the sales amounting to 10,000 tons. The market is firm, No. 2 plain being on a basis of $45, with $46.25 and $48 for the next two grades. The car situation is better than it has been, and furnaces are increasing their production. The reports from Cleveland show a quiet market, with prices remaining firm, $43 being the base price. Sales have been in the neighborhood of 5,000 tons, the Westinghouse Co. taking the larger part of this amount. Some iron for prompt shipment has been sold by outside interests for $44. Some consumers are asking for deliveries to be hurried up, their request being that last half iron be delivered to them in the third quarter. New York, Philadelphia and St. Louis report a quiet market, though in the St. Louis district there has been a considerable amount of buying for prompt shipment.

U.S. SCRAP METAL

The scrap market all over the United States seems to be suffering from a period of inactivity. This is accompanied in many cases by a softening in prices. In others, the transactions have been so small as to make it impossible to establish prices. Pittsburgh is a case in point. The only transactions have been small lots bought from other dealers, and it is probable that consumers could secure material at less than the quoted prices. Heavy melting steel is quoted at $27 and cast iron wheels from $41 to $42. The Chicago district reports a very soft market, with a decline in prices in most grades. At the same time the railroads are offering a large amount of material, amounting to about 10,000 tons. There has been some selling of heavy melting steel in the Buffalo district, one interest buying about 2,000 tons at a price said to be $25 per ton. Other grades are not showing much activity. In New England, according to reports from Boston, there has been some heavy buying of No. 1 cast scrap, which was on a $45 to $46 delivered basis, besides which a fair amount of No. 2 cast changed hands. Stove plate has been also somewhat livelier, one interest having bought over 1,000 tons of this grade at a price of $33 to $34. No. 1 heavy melting is on a basis of $20 to $21 in this district. St. Louis, New York, and Cincinnati, all report dull markets without any feature of interest.

DUTCH EAST INDIES IRON INDUSTRY

The Mining Department of the Government of Netherlands India has recently issued a comprehensive report on the possibilities of the development of iron mining and iron and steel manufacture in the island of Celebes, Netherlands India. Government engineers have made extensive preliminary studies and surveys of the entire situation, and it appears that either the Government or private enterprise will undertake the development of the field in the near future, although the part the Government may take in the actual control of the industry has not as yet been fully determined.

Iron Ore Deposits and Available Water Power

The largest ore field to which recent investigations have been directed are those of central Celebes in the Larona district, lying near Towoeti Lake. The survey of this field showed 160,000,000 tons of ore, containing an estimated iron content of 5,000,000 tons; and there is believed to be 5,700,000 tons of iron in an additional 210,000,000 tons of ore that have not as yet been completely surveyed and tested. This field holds the best promise for early and profitable development, since it lies within 25 miles of a deep-water bay on the coast and may be very largely worked by electric power, which can be generated from several waterfalls along the Larona River. This river flows from Towoeti Lake to the sea, descending about 300 meters in a distance of 20 miles; about 200 meters of this fall occurs within a length of about 8 miles. In this distance it will be possible to utilize four falls of approximately 45, 25, 30, and 80 meters, respectively, the last-mentioned fall of 80 meters to be attained by the construction of a dam 45 meters high in addition to the natural fall of 35 meters. There is also a possibility of utilizing other falls of about 25 meters above those mentioned, as well as falls below of an additional 50 to 60 meters.

Computing the natural overflow from the Towoeti, Mahalona, and Matano Lakes, together with the average rainfall draining into the river, it is estimated that 2,610,000,000 cubic meters of water are carried annually by the Larona River, or an average volume of 83 cubic meters per second. Having the lakes as natural reservoirs for retaining the heavy rainfall of the rainy season through the dry season, the rate of at least 80 cubic meters per second should be maintained throughout the year.

BOOK REVIEW

"The Relation Between the Elastic Strengths of Steel in Tension, Compression, and Shear," by F. B. Seely, associate Professor of Theoretical and Applied Mechanics, and W. J. Putnam, Associate of Theoretical and Applied Mechanics, has been issued as Bulletin No. 115 of the Engineering Experiment Station of the University of Illinois.

The severe uses to which carbon and alloy steels are put in some phases of engineering, as for example, in automobile and in aeroplane construction have developed a need for more detailed knowledge of the action of steel, under various types of stress, as well as of the factors which affect the physical properties of the material.

Our knowledge of the breakdown of elastic action of ductile materials, particularly in the case of combined loading, is far from complete. The various theories of combined stress lead to results which differ rather widely when applied to various machine parts or to structural elements, such as trick cylinders, flat plates, crank shafts, webs of girders, etc. The maximum shear theory of combined stress for ductile materials as expressed by Guest's law, which has gained rather wire acceptance in recent years, assumes that the elastic shearing strength is one-half of the elastic tensile strength. Available experimental results, have, in general, failed to justify this assumption. The importance of the limitation imposed by the shearing stress upon the elastic strength of ductile material is, of course, generally recognized. It is of special importance to know the relation between the shearing and the tensile (and compressive) elastic strengths for various grades of ductile and semi-ductile steels. The main object of the investigation herein recorded was to determine carefully the elastic shearing strength of ductile and semi-ductile steel and to find the ratio of the elastic shearing strength to the elastic tensile strength with the hope that definite information would thereby be obtained on the breakdown of the elastic action of various grades of steel and on the limits of the theories of combined stress.

Apart from the problem of combined stress there has been also a lack of knowledge of the correct elastic shearing strength of various grades of steel and of the general nature of elastic shearing failure as well as of methods of determining the correct shearing strength from tests.

This bulletin presents the results of experiments with six grades of steel, three carbon steels and three alloy steels, namely, soft, mild, and medium carbon steel, and vanadium, nickel, and chrome-nickel alloy steel. The elastic strength in tension in compression, and in shear is given for each of the six grades of steel.

Copies of Bulletin No. 115 may be obtained without charge by addressing C. R. Richards, director, Engineering Experiment Station, University of Illinois, Urbana.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$42 40
Lake Superior, charcoal, Chicago	57 00
Standard low phos., Philadelphia	50 00
Bessemer, Pittsburgh	43 00
Basic, Valley furnace	42 90
Toronto price:—	
Silicon, 2.25% to 2.75%	52 00
No. 2 Foundry, 1.75 to 2.25%	50 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 50
Steel bars, base, Toronto	5 50
Iron bars, base, Montreal	5 50
Steel bars, base, Montreal	5 50
Reinforcing bars, base	5 00
Steel hoops	7 00
Norway iron	**11 00**
Tire steel	5 75
Spring steel	10 00
Band steel, No. 10 gauge and 3-16 in. base	6 00
Chequered floor plate, 3-16 in.	9 40
Chequered floor plate, ¼ in.	9 00
Staybolt iron	9 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	4 00
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	**3 62**
Structural shapes	**3 72**
Plates	**3 90**
Small shapes under 3"	**3 62**

FREIGHT RATES

	Per 100 Pounds. C.L.	L.C.L.
Pittsburgh to Following Points		
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

	Gross. Montreal	Toronto
Lake copper	$25 00	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	77 00	75 00
Spelter	12 50	12 25
Lead	12 00	12 00
Antimony	14 50	14 00
Aluminum	34 00	35 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$ 7 25	$ 7 25
Plates, ¼ up	6 50	6 50

Price List No. 38

WROUGHT PIPES

Standard Buttweld

Per 100 feet

	Steel Blk.	Steel Gal.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Gal.
⅛	$ 6 00	$ 8 00	$.....	$.....
¼	4 83	6 96	5 31	7 44
⅜	4 83	6 96	5 31	7 44
½	6 42	7 99	7 10	8 67
¾	8 11	10 24	9 03	11 16
1	11 99	15 13	13 35	16 49
1¼	16 22	20 47	18 06	22 31
1½	19 39	24 48	21 59	26 68
2	26 09	32 93	29 05	35 89
2½	41 24	52 07	.....	.....
3	53 93	68 09	.....	.....
3½	68 54	85 56	.....	.....
4	81 21	101 37	.....	.....

Standard Lapweld

Per 100 feet

	Steel Blk.	Steel Gal.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Gal.
2	$29 79	$36 63	$33 49	$39 96
2½	43 58	54 41	49 43	60 26
3	56 99	71 15	64 64	78 80
3½	70 38	87 40	79 58	96 60
4	83 39	103 55	94 29	114 45
4½	95	1 19	1 20	1 45
5	1 10	1 39	1 40	1 69
6	1 43	1 80	1 81	2 19
7	1 87	2 36	2 34	2 83
8L	1 96	2 48	2 46	2 98
8	2 26	2 85	2 84	3 43
9	2 71	3 42	3 40	4 11
10L	2 51	3 17	3 15	3 81
10	3 23	4 08	4 06	4 90

Terms 2% 30 days, approved credit

Freight equalized on Chatham, Guelph, Hamilton, London, Montreal, Toronto, Welland.

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.
4½" and larger 50%.
4" and under, running thread, 30%.
Standard couplings, 4-in. and under, 30%
Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds. Montreal	Toronto
Copper, light	$15 00	$14 00
Copper, crucible	18 00	18 00
Copper, heavy	18 00	18 00
Copper wire	18 00	18 00
No. 1 machine composition	16 00	17 00
New brass cuttings	11 00	11 75
Red brass cuttings	14 00	15 75
Yellow brass turnings	8 50	9 50
Light brass	6 50	7 00
Medium brass	8 00	7 75
Scrap zinc	6 50	6 00
Heavy lead	7 00	7 75
Tea lead	4 50	5 00
Aluminum	19 00	20 00
	Per Ton	Gross
Heavy melting steel	18 00	18 00
Boiler plate	15 50	15 00
Axles (wrought iron)	22 00	20 00
Rails (scrap)	18 00	18 00
Malleable scrap	25 00	25 00
No. 1 machine cast iron	32 00	33 00
Pipe, wrought	12 00	12 00
Car wheels	22 00	26 00
Steel axles	22 00	20 00
Mach. shop turnings	11 00	11 00
Stove plate	25 00	25 00
Cast boring	12 00	12 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜-in. and less	10
Carriage bolts, 7-16 and up	Net
Coach and lag screws	25
Stove bolts	55
Wrought washers	45
Elevator bolts	Net
Machine bolts, 7/16 and over	Net
Machine bolts, ⅜-in. and less	15
Blank bolts	Net
Bolt ends	Net
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square, blank	add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 50
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	25 and 5
Sq. and hex. hd. cap screws	22½
Rd. and fil. hd. cap screws	plus 17½
Flat but. hd. cap screws	plus 30
Fin. and semi-fin. nuts up to 1-in.	20
Fin. and Semi-fin. nuts, over 1 in., up to 1½-in.	10
Fin. and Semi-fin. nuts over 1½ in., up to 2-in.	Net
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$60 00
Open-hearth billets	60 00
O.H. sheet bars	76 00
Forging billets	56 00-75 00
Wire rods	52 00-70 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 70
Cut nails	5 85
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 35½
British Manila rope	0 28
New Zealand hemp	0 28
Transmission rope, Manila	0 47
Cotton rope, ¼-in. and up	0 88

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net

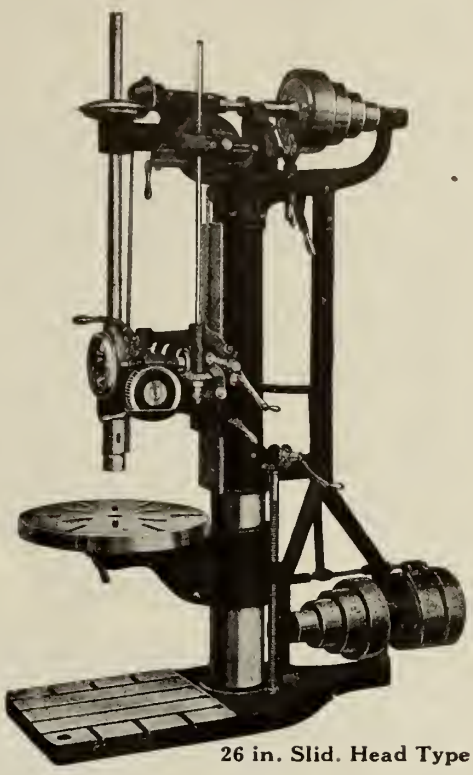
A Complete Line 8 in. to 50 in. Swing
with or withour tapping attachment

BARNES

Upright Drills
Horizontal Drills
Gang Drills

Accuracy—Strength
Convenience of Operation

Carried in Stock by



26 in. Slid. Head Type

The A. R. WILLIAMS MACHINERY CO., Ltd., 64 FRONT ST. WEST TORONTO

MONTREAL ST. JOHN, N.B. WINNIPEG VANCOUVER HALIFAX BUFFALO, N.Y.

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Steel Castings
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Lithographed Ware
Enamelled Signs

made by the Acid Electric process up to fifteen tons. Castings made by this process are free from blow holes, easy to machine, and superior in every way to ordinary Steel Castings.

Castings supplied for shipbuilding, cars, locomotives, all classes of machinery, etc.

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Use P. H. or Imperial Files.

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"They Cut Faster and Wear Longer."

BE FILE-WISE.

Ingersoll File Company, Limited.
John Morrow Screw & Nut Co., Limited
Sole Distributors.
Ingersoll, Ontario.

INGERSOLL

MISCELLANEOUS

Solder, strictly	$ 0 40
Solder, guaranteed	0 43
Babbitt metals	18 to 70
Soldering coppers, lb.	0 62
Lead wool, per lb.	0 16
Putty, 100-lb. drums	8 30
White lead, pure, cwt.	20 00
Red dry lead, 100-lb. kegs, per cwt.	16 50
Glue, English	0 40
Tarred slater's paper, roll	1 30
Gasoline, per gal., bulk	0 35
Benzine, per gal., bulk	0 35
Pure turp., single bbls., gal.	3 60
Linseed oil, raw, single bbls.	3 00
Linseed oil, boiled, single bbls.	3 03
Sandpaper, B. & A.	List plus 43
Emery cloth	List plus 37½
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin, "D," per lb.	0 14
Borax crystal and granular	0 14
Wood alcohol, per gal.	2 70
Whiting, plain, per 100 lbs.	2 75

CARBON DRILLS AND REAMERS

S.S. drills, wire sizes	32½
Can. carbon cutters, plus	20
Standard drills, all sizes	32½
3-fluted drills, plus	10
Jobbers' and letter sizes	32½
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	net
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	20 to 40
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At warehouse]

Rounds and squares	$7 base
Hexagons and flats	$7.75 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	60	75
Class B	27	37
Class C	18	27

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 8 50	$ 9 50
Sheets, black, No. 10	8 50	9 00
Canada plates, dull, 52 sheets	8 50	10 00
Can. plates, all bright	8 60	9 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	11 00	....
Fleur-de-Lis, 28 B.W.G.	10 50	....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28.	....	....
Premier, No. 28, U.S.	11 50	10 50
Premier, 10¾-oz.	11 50	10 90
Zinc sheets	16 50	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	29 50
1¾ in.	31 50	30 00
2 in.	30 00	30 00
2¼ in.	35 00	29 00
2½ in.	42 00	37 00
3 in.	50 00	48 00
3¼ in.	.. ..	48.50
3½ in.	63 00	51 50
4 in.	85 00	65 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	24½
Palacine	27½
Machine oil, per gal.	43½
Black oil, per gal.	18½
Cylinder oil, Capital	82
Cylinder oil, Acme	70
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	$2 60
Union thread cutting oil, antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil, bbls., net	13½

BELTING—No 1 OAK TANNED

Extra heavy, single and double	10%
Standard	10%
Cut leather lacing, No. 1	2 75
Leather in side	2 40

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 60
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	09
Pumice, ground	06
Emery glue	30
Tripoli composition	09
Crocus composition	12
Emery composition	10
Rouge, silver	60
Rouge, powder, nickel	45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 42

WASTE

XXX Extra	.24	Atlas	.20
Peerless	.22½	X Empire	.19½
Grand	.22½	Ideal	.19
Superior	.22½	X Press	.17½
X L C R	.21		

Colored

Lion	.17	Popular	.13
Standard	.15	Keen	.11
No. 1	.15		

Wool Packing

Arrow	.35	Anvil	.22
Axle	.28	Anchor	.17

Washed Wipers

Select White	.20	Dark colored	.09
Mixed colored	.10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades... 15%

ANODES

Nickel	.58 to .65
Copper	.38 to .45
Tin	.70 to .70
Zinc	.18 to .18

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6 x 4 base	45 00	44 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 75	$14 50
Sheets, 3½ lbs. sq. ft.	10 50	14 00
Sheets, 4 to 6 lbs. sq. ft.	10 25	13 50

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .23
Acid, hydrochloric	.03¼
Acid, nitric	.10
Acid, sulphuric	.03¼
Ammonia, aqua	.15
Ammonium, carbonate	.20
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.14
Copper, carbonate, annhy	.41
Copper, sulphate	.16
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.08
Nickel carbonate	.32
Nickel sulphate	.19
Potassium sulphide (substitute)	.42
Silver chloride (per oz.)	1.25
Silver nitrate (per oz.)	1.20
Sodium bisulphate	.11
Sodium carbonate crystals	.06
Sodium cyanide, 127-130%	.38
Sodium hyposulphite per 100 lbs	8.00
Sodium phosphate	.18
Tin chloride	1.00
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated

GEOMETRIC

SELF-OPENING DIE HEADS

"YOU CAN'T BEAT 'EM"

It is not the manufacturers of Geometric Self-Opening Die Heads who make this statement, but the users of the tools.

This is the reason that besides being the originators, we are known as the

LARGEST AND BEST KNOWN MANUFACTURERS OF AUTOMATIC THREADING TOOLS

The big question is: Have you applied Geometric Screw Thread Cutting Tools to your threading work?

THE GEOMETRIC TOOL COMPANY

NEW HAVEN CONNECTICUT

Canadian Agents: Williams & Wilson, Ltd., Montreal; The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg, and St. John, N.B.; The Canadian Fairbanks-Morse Co., Ltd., Manitoba, Saskatchewan, Alberta.

WIETING

INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS PERSONAL AND TRADE NOTES

TRADE GOSSIP

Loan to Galt Industry.—The electors of Galt have endorsed a by-law to grant a loan of $20,000 to the Elliot & Whitehall Machine Tool Co., to erect a new building. This is one of the city new industries. The site is in Jackson Park. The vote carried by a majority of 94 over the necessary two-thirds.

Steel Mills Tied Up.—In the Youngstown district of Ohio there are twenty thousand steel workers idle owing to the inability of the mills to obtain coal. The movement of freight in this district is completely paralyzed, and if the strike continues for any length of time the whole Mahoning Valley will be tied up.

Coal Getting Scarce.—For some days no coal has entered Toronto, due to the railway switchmen's strike over the line. There was no great stock of coal on hand at the time the strike was called, and factories which were depending on a fresh stock coming in shortly are in a serious position. So far the passenger traffic on the roads has not been affected and railway officials do not expect it to be unless the strike becomes general.

Algoma Rail Orders.—The Algoma Steel Corporation of Sault Ste. Marie have booked during the last six months nearly 230,000 tons of steel rail orders for the various roads in Canada. The orders are as follows: 100,000 tons 85-lb. rails for C. P. R.; 50,000 tons 85 and 60-lbs. for the C. N. R.; 35,000 tons 100-lb. A. R. A. section, type A, and a few small lots 85-lbs. section for the G. T. R.

Canada and the Switchmen's Strike.—Due to the strike of switchmen in American railroad yards, nearly 50 freight trains on the C. P. R. and G. T. R. were cancelled on the London division alone. A large number of railway men have been laid off on this side due to the abandonment of trains. At one time there was only one freight train running on the London division of the G. T. R.

Strike Probable at Canadian Vickers.—There is a great probability of a general strike at the plant of the Canadian Vickers, Limited, Montreal. Some time ago the men presented a demand for 90 cents an hour, which the company refused, offering 80 cents. The men have now presented a final demand for 85 cents, and failing the granting of this a general strike will be called. At present machinists are earning 75 cents, carpenters 70 cents, and painters 60 cents.

MARINE

Ottawa.—Officials of the Marine Department state that the St. Lawrence River will be open to the sea by the 19th of April. Although the past winter has been so severe, the opening date will be about the same as that of last year.

Vancouver.—The duty on fuel oil coming into Canada is hitting the owners of oil-burning vessels on the B. C. coast. Steamers running out of Seattle can obtain their oil at $2.03 per barrel, while the Canadian vessels have to pay $2.70 for the same oil in Canada. The owners state that the rise in price during the last year is sufficient handicap, without the added duty.

Victoria, B.C. — The Victoria Shipowners Ltd., have concluded the agreement with the Ottawa Government for the loan with which to build four wooden barquentines in the Cholberg Shipyards. The agreement has been signed, and the vessels, which will cost $250,000 each, will be built right away.

Brockville. — The Canada Steamship Lines have sold the steamer St. Lawrence to the Kingston Navigation Co., which is composed of Kingston business men. The vessel will be placed on the Kingston-Ogdensburg run during the summer. The St. Lawrence is well known on the river, having been for many years one of the crack boats of the Folger fleet when that line was supreme in the Thousand Islands district. The vessel will be transferred to Canadian register.

Bushnell for Central Press Association.

ANY NIBBLES YET, NIC?

Aikenhead's

Recently Appointed Central Ontario Representatives

for

C. E. JOHANSSON, Inc.

We take pleasure in announcing the addition of the well-known Johansson Line of Standards of measurement gages and other tools. We carry a complete stock of sets of Standard Blocks and can make prompt shipments. Consider your needs and let us quote prices.

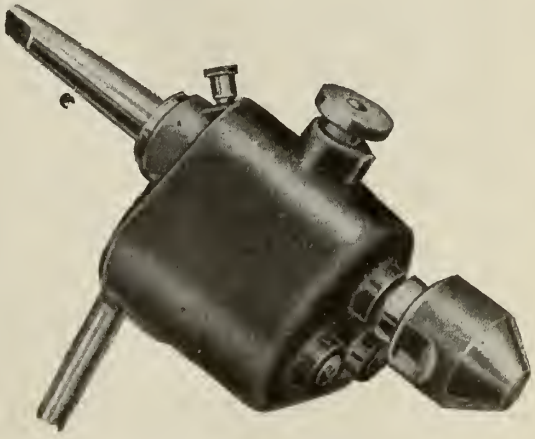
Aikenhead Hardware, Limited

17 Temperance Street, Toronto, Ont.

Aikenhead's

The Home of Good Tools

Every Aikenhead tool represents high-grade construction and modern design. Foremen and mechanics who have had experience with the Aikenhead line never fail to vouch for their reliability under severe strains as well as their long and satisfactory service with minimum upkeep cost. There is an Aikenhead tool for every requirement. Let us know your needs.



Wahlstrom Tapping Attachment

To prevent tap breakage you must first prevent jamming. With the **Wahlstrom** tapping attachments the tap doesn't jam because its oscillating motion frees the chips. It imitates the simple to-and-fro motion of hand tapping. This feature reduces tap breakage to a minimum.

The oscillating motion is changeable to a continuous revolution for tapping in soft materials. Also the tap reverses when the spindle is raised. All these features are absolutely indispensable in economical tapping by power.

The Wahlstrom fits any drill press. It is made in two sizes. No. 1 takes taps of all sizes from 5.40 to ½ inch standard. No. 2 takes taps from ¼ inch to ¾ inch. It has nothing to get out of order.

You can get the Wahlstrom at Aikenhead's. Send for our free trial offer.

Aikenhead Hardware, Limited

17 Temperance Street, Toronto, Ont.

If interested tear out this page and place with letters to be answered

As It Appears from Both Sides of the Fence

At the International Harvester Co., Hamilton, Canada, and in Other Plants Under Same Management, Foremen and Workmen Alike, Receive Valuable Hints in the Ethics of Their Vocation

By J. H. M.

WE occasionally hear some grumpy workman mumble that he wishes he were a boss, that their life is all sunshine—and so on. Luckily, such a type is in the minority, for it is becoming a recognized fact that the foreman's position is by no means all clover.

A foreman, to be a success, must be a diplomat, as well as a clever executive. He must not only obtain production, and quality of product, but at the same time he must maintain a spirit of satisfaction and co-operation amongst his fellow workers. In other words, everyone under his guidance should be made to realize and feel that they have in him an intercessor, if the occasion arises.

In many plants we see a set of rules drawn up and arranged to guide the workman, but here are two groups of rules, for foremen and workmen alike, which present both sides of the case.

The following rules were prepared by the works committee of The International Harvester Co., and they are framed, and placed side by side at the various time clocks scattered throughout the different departments.

By presenting both sides of the case, the workman is made to feel that he is placed in the same category as his foreman, and that by following up such rules, he can expect his foreman in turn to fulfil his obligations. Co-operation and harmony are the natural results.

RULES FOR FOREMEN

1. Be fair, have no favorites and no scapegoats. A foreman has to act as judge many times every day, therefore, he MUST be just.

2. Make few promises and keep them. A foreman must be exact in this particular. Sometimes a foreman forgets that his job requires a standard of truth and honor.

3. Don't waste anger—use it. Anger is valuable and should not be used carelessly. Keep your most forceful language for special occasions.

4. Always hear the other side. Never blame a worker until he has been given a chance to give his point of view.

5. Don't hold spite—forgive. When you have to scold a worker, go to him later and show him his faults in a friendly way.

6. Never show discouragement. Never let yourself be beaten. A foreman must have perseverance and the never-say-die spirit.

7. Notice good work as well as bad. Let the workers see that you can appreciate, as well as condemn.

8. Watch for special ability. Take a keen interest in your workers. Put each one where he can do his best.

9. Observe the rules of seniority, whenever it is possible.

10. Take your full share of blame. This is the most difficult of all. The foreman who can share both blame and praise with his workers has discovered the secret of managing men.

11. Prevent accidents. Educate or eliminate the careless men. The good foreman is known by his men.

RULES FOR WORKMEN

1. There is always more than one side to every question. Look for at least two sides before you speak or act.

2. Stand for what is just, right, and fair for yourself, and the company on all occasions.

3. Do not be afraid to express your honest opinion, but be reasonable and patient.

4. Try to do your work efficiently, and avoid increasing the worries of your foreman.

5. Remember that every piece of work slighted or inefficiently performed is a direct loss in wages for some of your fellow-workmen, and also a loss to you.

6. Take criticisms kindly. The person giving it has your best intentions in view. He may be wrong, but give him the benefit of the doubt.

7. No one can foretell your day of opportunity. It comes early to some, late to others. The only way to be ready is to do your duty every day.

8. Master monotony, then all other jobs are pleasure.

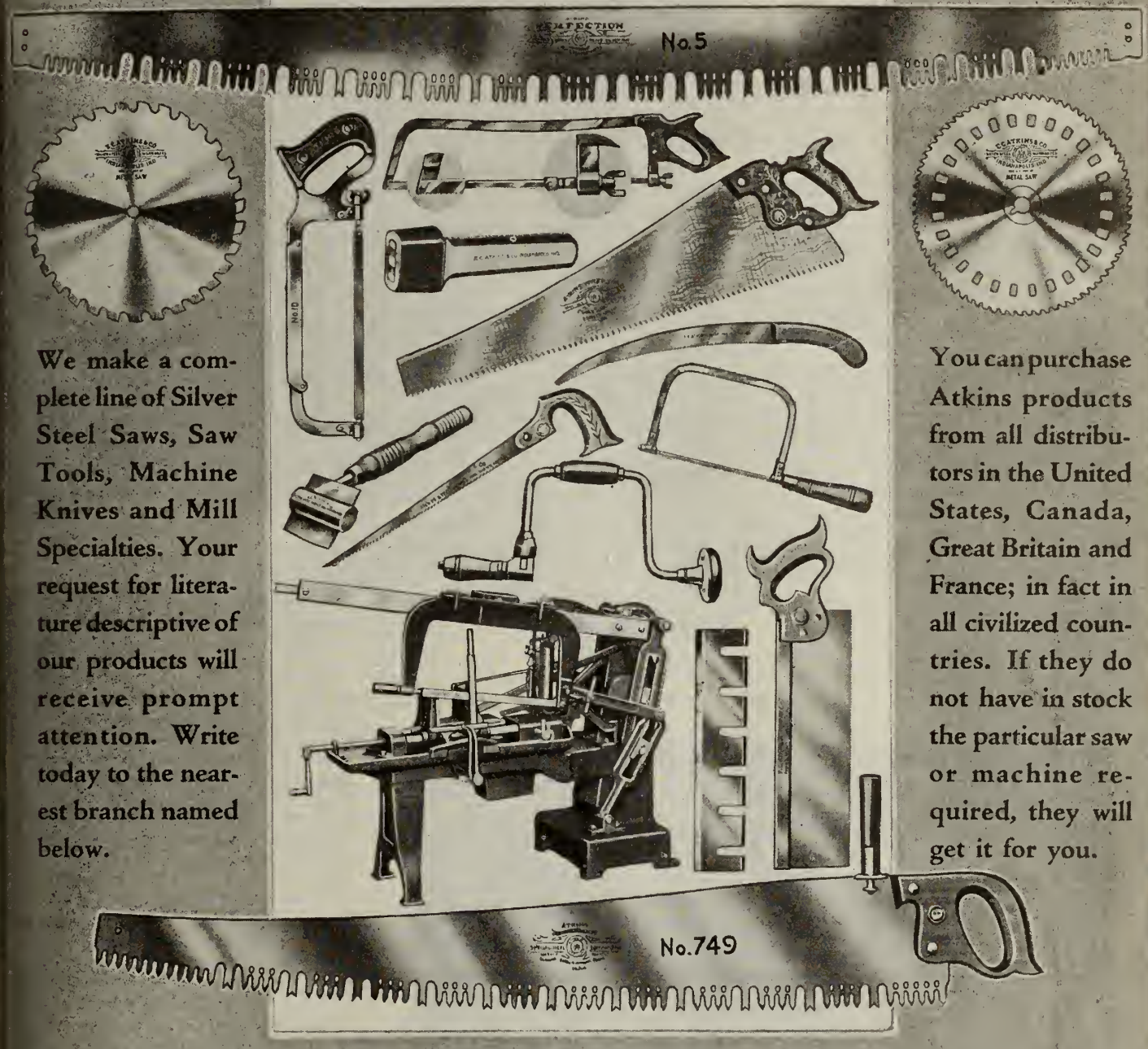
9. Take an interest in the success of your fellow-workmen, help them to succeed.

10. Don't hesitate about asking your foreman questions. It is better to make him mad that way than to spoil a piece of work.

"Finest on Earth"

ATKINS
SILVER STEEL
SAWS and TOOLS
A Perfect Saw for every Purpose

"Finest on Earth"



We make a complete line of Silver Steel Saws, Saw Tools, Machine Knives and Mill Specialties. Your request for literature descriptive of our products will receive prompt attention. Write today to the nearest branch named below.

You can purchase Atkins products from all distributors in the United States, Canada, Great Britain and France; in fact in all civilized countries. If they do not have in stock the particular saw or machine required, they will get it for you.

E. C. ATKINS & COMPANY, INC.

Established 1857

Home Office and Factory: INDIANAPOLIS, INDIANA

Canadian Factory: HAMILTON, ONTARIO *Machine Knife Factory:* LANCASTER, N. Y.

Branches carrying complete stocks in all large distributing centers as follows:

ATLANTA, CHICAGO, MEMPHIS, MINNEAPOLIS, NEW ORLEANS, NEW YORK CITY, PORTLAND, ORE., SAN FRANCISCO, SEATTLE, VANCOUVER, B. C., SYDNEY, N. S. W., PARIS, FRANCE

Handling Devices for Heat Treatment Room

THE W. S. ROCKWELL CO. have issued a very interesting pamphlet on handling devices in the heat-treatment room. The information contained therein is of such value and interest that we reproduce some of this material.

In the metallurgical heat-treatment operations the automatic type of furnace is to be preferred whenever the nature of the material to be heated, and the method of handling it, conform most advantageously to the automatic principle of heating and handling.

There are, however, some classes of heat-treating, carbonizing, etc., to which the automatic furnace is not readily adaptable. For such classes of work there have been developed various devices for charging and discharging material from stationary hearth furnaces, the aim being to save as much manual labor as possible. These devices vary from the simple forks used for handling material from a charging table, as illustrated at Fig. 1, to the more elaborate charging machines illustrated at Fig. 2.

When enough work is handled to require a fairly large battery of furnaces, the charging machine shown at Fig. 2 is well warranted. This machine greatly reduces the labor cost of handling boxed material and permits of the work being accomplished in much less time than by hand-handling.

An air hoist equipped with proper balancing devices seems to be the handiest mechanical means of operating charging machines of the character shown, though electrically-driven outfits of practically the same character have been developed.

Note the general style of the steel work supporting the door-lifting mechanism on the furnace illustrated. This steel work lends itself quite readily to the attachment of light crane rails.

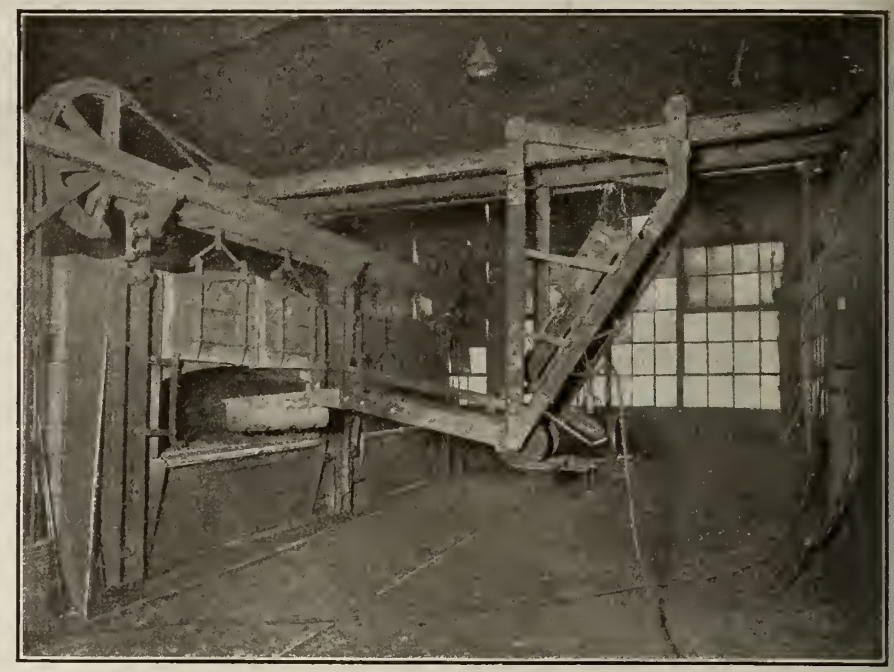


FIG. 2—A TWIN-CHAMBER UNDERFIRED HEAT-TREATING AND CARBONIZING FURNACE. The charging machine, operated by air hoist is attached to a crane, the wheels of which run on the rail protruding slightly from the front of furnace.

The lever for raising and lowering the furnace doors swings in a plane well removed from the crane rail.

It is unfortunate that when a rather heavily built charging machine is used the tendency is to increase the size of the carbonizing boxes. Experience has proven that the lighter the case or depth of carbonization desired, the lighter and smaller should be the boxes. When the carbonizing boxes are too large, the pieces in the centre of the box do not come up to heat anywhere near so fast as those near the outside of the box. The result is that on a short heat, say of four hours, the pieces in the centre of a fairly large box do not show nearly as much depth of carbonization as the pieces near the outside of the box. For this reason, to get the required depth of case on the pieces in the centre of the box, the heat has to be held considerably longer than would be necessary were smaller and lighter carbonizing boxes used. Unnecessary prolongation of the heat results in a waste of fuel and reduction of output.

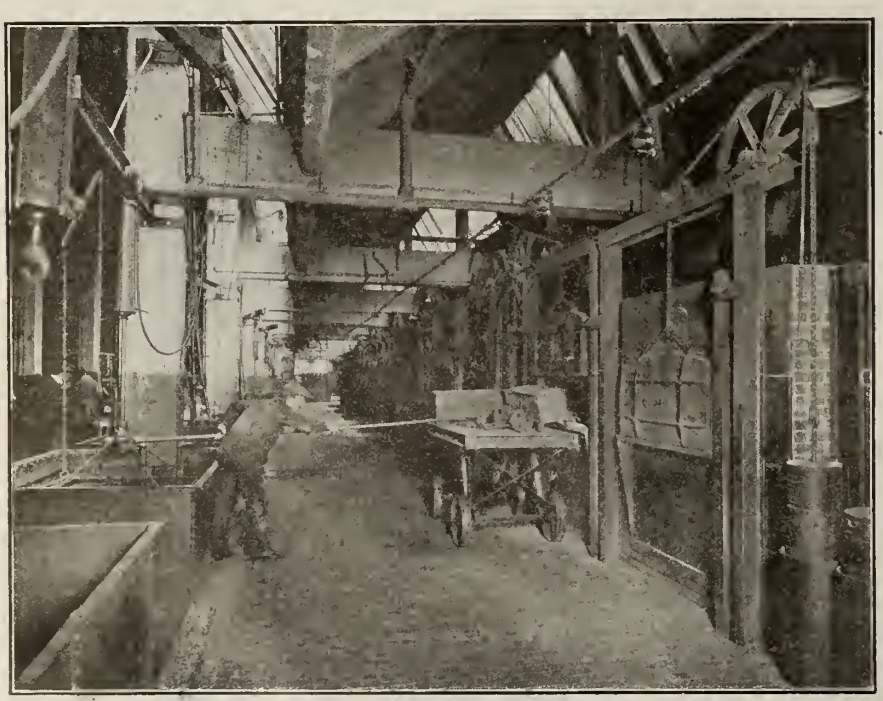


FIG. 1—TWIN CHAMBER UNDERFIRED HEAT-TREATING AND CARBONIZING FURNACE, ILLUSTRATING TRUCK FOR HANDLING CARBONIZING POTS OR BOXES.

A charging and discharging device to suit the particular class of work is an important feature of any furnace installation, but this detail is not so essential as the use of good material when constructing the furnace, and the selection of a furnace so designed as to afford maximum heating efficiency and minimum fuel consumption.

The ideal heating condition in a furnace is attained when the packing box or piece to be heated is completely enveloped by gases of uniform temperature. The underfired furnace, with combustion chambers below the hearth, more nearly insures this ideal heating condition than any other type of furnace. All the furnaces illustrated are of the stationary, underfired type, although this concern builds the sidefired and over-

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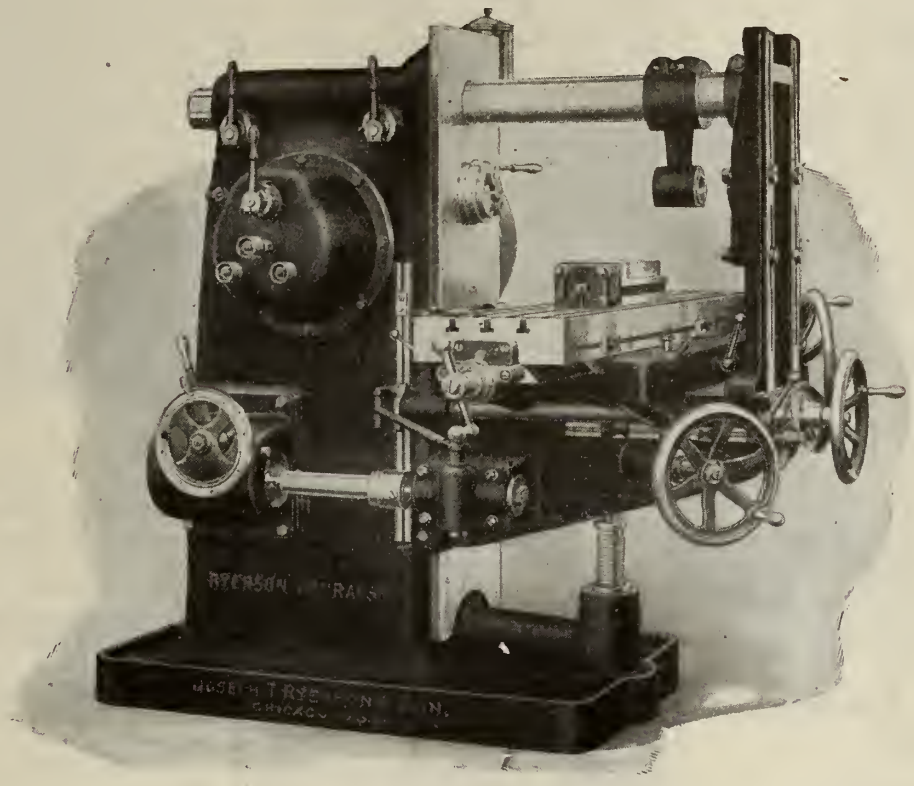

In designing this machine we not only aimed to meet, but also to anticipate modern milling requirements. Our main object was to provide a tool with great power, rigidity, convenience of operation and adapted to light and heavy manufacturing and jobbing work.

The most striking feature in the design of this machine lies in the application of the helical drive. We have overcome the inability to secure a sufficient range of speeds when using helical drive gearing, and can secure 12 spindle speeds ranging from 17 to 290 R.P.M. in practically geometrical progression.

The New Bulletin 5015-E gives complete information

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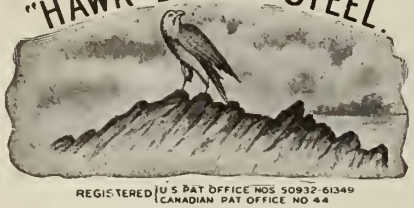

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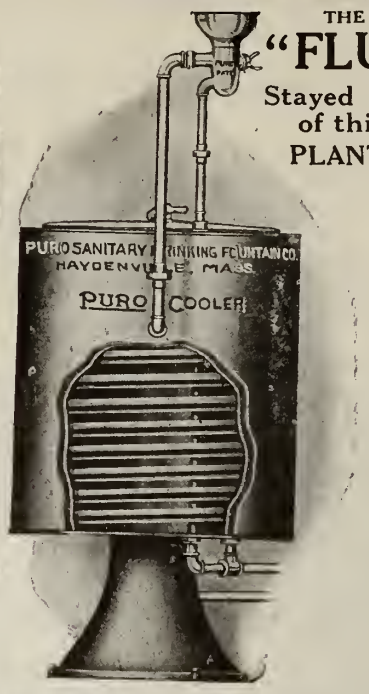
In addition to ideal heating and good handling conditions, economy of operation must be thoroughly considered. A source of marked fuel economy are the economizer hoods provided over the exhaust ports of the furnaces illustrated. These economizers recover a considerable portion of the heat which would normally be lost in the spent gases, returning it to the furnaces by preheating the air supplied to the burners for combustion. These economizers not only insure a decided fuel economy but also aid greatly in the thorough and rapid vaporization and combustion of the fuel oil.

THE "FLU" Stayed out of this PLANT



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MONTREAL NOTES

W. S. Leslie, president of A. C. Leslie and Co., of Montreal, is leaving for a three or four months' trip to England and the Continent.

Owing to the break in a conduit under the Lachine Canal it is possible that the passage of vessels will be delayed until well into May, as it is expected that close to a month will be required to effect repairs.

If weather conditions continue, it is expected that the River St. Lawrence will be free of ice by the end of the present week and that the laying of buoys will be started at once. Early spring activity is already noticeable in and about the harbor.

Robt. McClury, formerly works manager of the John McDougall Caledonia Iron Works, is now associated with the J. and R. Weir Company of Montreal.

At a recent public meeting in the town of Longueuil, Quebec, held under the auspices of the South Shore Board of Trade, Dr. Desaulniers, M.L.A. for Chambly, outlined a policy that he proposed to place before the Provincial Government for the extension of waterworks systems throughout the province.

Daily meetings are being held between the Montreal Harbor Commissioners and business interests of the city, for the purpose of rearranging a schedule of wharfage rates for the port. New groupings and classifications are being made, and it is stated that these readjustments will be of a permanent character and that any future rise or fall in rates will be based on the new classification. Shippers are highly pleased at the amicable arrangement that is being carried out.

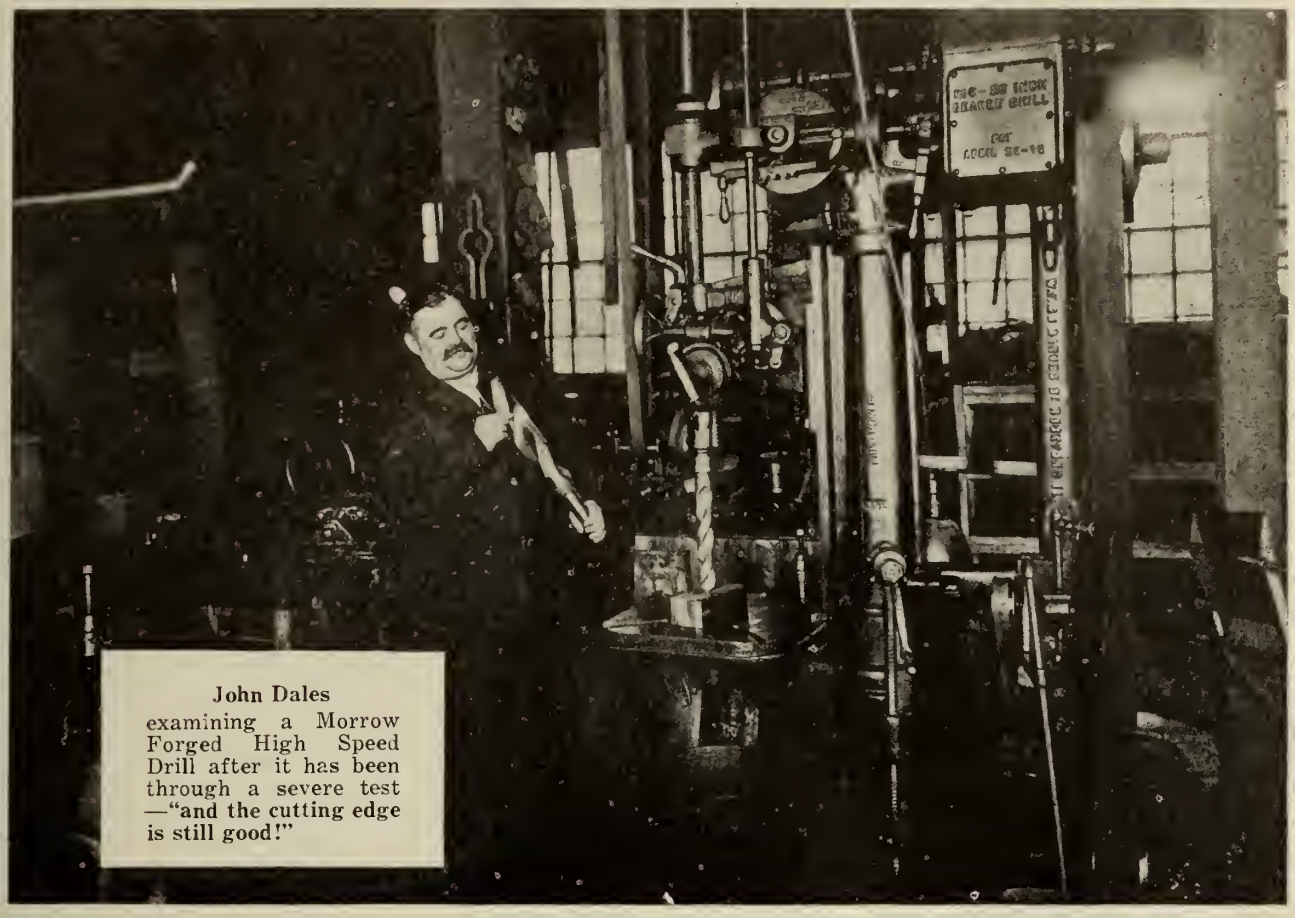
OXYWELDED TANK HOLDS TIGHT

One of the debris of a $400,000 fire that swept two blocks of Tampa's industrial district last December practically the only salvage was a 12,000 gallon oxywelded oil storage tank, which was afterwards found intact excepting for dents and scars that were later removed. Inspection showed that the oxywelded seams held tight at every point, no leak developing anywhere in the welds.

The tank contained 5,000 gallons of gasoline at the time of the fire. When the platform supporting it was consumed the tank fell to the ground, smashing a 5-inch outlet pipe. Roofing, beams and framework fell in and burned on top of the tank. Also a brick wall of an adjacent building collapsed, hurling tons of the brick on the conical top of the tank and bending the cone head below the level of the top tank ring. The tank was located approximately in the centre of the burned area.

This example of the strength and endurance of oxywelding is noteworthy because the usual shocks and strains to which the tank was subjected and because the tank itself is typical of oxywelded structures of the kind. The specifications of the tank are: Diameter, 16 feet; depth, 8½ feet (11 feet including the cone head); bottom ring, No. 10 gauge iron; top ring, No. 12 gauge iron; conical top, No. 14 gauge iron.

The tank was built by the American Welding & Tank Company, of Tampa, Fla., who have been engaged for a number of years in plate welding, building water tanks, smokestacks, pressure tanks, storage tanks, etc. The tank is in service to-day, as good as the day it was finished.



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TRADE GOSSIP

T., H. & B. to Build Bridge.—The Board of Railway Commissioners have ordered the T., H. & B. to proceed with the construction of the highway bridge at King Street, Hamilton. The present bridge is not equal to the work it has to do.

Work Started at Ojibway.—Work has been commenced on two blast furnaces at the plant of the Canadian Steel Corporation at Ojibway near Windsor. The total cost of the completed installation will be $100,000,000. The difficulties of obtaining an adequate supply of labor is still a pressing question, even with the high wages offered.

C.N.R. Earnings.—The Canadian National Railways show an increase in earnings for the week ending March 31, of $46,677 over those of the corresponding week last year, being equal to 1.7 per cent. Every week for the month of March showed a gain, as follows: March 7, 23.4 per cent.; March 14, 9.7 per cent.; March 21, 5.9 per cent., and March 31, 1.7 per cent.

Canadian Cars in U. S.—In answer to a question asked in the House of Commons by Mr. Joseph Archambault, the Minister of Railways, stated that the number of Canadian cars in the U. S. was 59,716. The different railways had belonging to them in the U. S. as follows: C. N. R., 10,840; C. P. R., 15,482; G. T. R., 21,028, and other Canadian railways, the balance of 12,366.

Copper Mountain Mill to Start. — Operations will be commenced by the Canada Copper Corporation at their Copper Mountain Mine, at Allenby, B. C., about August next. Men are working on the branch line between Allenby and Copper Mountain. They will soon be starting on the building of the trestles, of which seventeen are needed in four miles.

Mine Workers Convene.—District No. 26 of the United Mine Workers is holding its annual convention. The district includes Cape Breton Island, the Peninsula and New Brunswick. The convention is being held at Truro, N. S. William Houston, International board member of District 18, Western Canada, is present at the invitation of the local body.

Ocean Rates Increase.—From April 1 passenger and freight rates on the North Atlantic will undergo a substantial increase. This announcement follows a conference held in Paris between the representatives of the North Atlantic steamship lines. The increase will be in the neighborhood of 10 per cent. on existing rates as far as passenger rates are concerned.

Valuing Dominion Plant at Sydney.—With reference to the talk of a merger of Nova Scotia Steel and the Dominion Steel Corporation, appraisers are now busy making a valuation of the various plants of the Dominion Corporation at Sydney. The appraisers and accountants employed are working for one of the largest appraisal firms on the continent.

Aiding Small Industries.—The British Columbia Industrial Department has come to the aid of the Acme Box Company, of Vancouver, to the extent of $600 to extent the plant. The firm are manufacturing small wooden boxes, berry crates, etc. The department are also loaning $500 to two Vancouver men, returned soldiers, for the establishment of a small canning factory.

That Shipping Merger.—The merger of shipping, shipbuilding and steel making enterprises that has been so long talked of, is again to the fore, and it is confidently stated that the Dominion Steel Corporation, the Nova Scotia Steel & Coal Co., the Canada Steamship Lines and several of the leading shipbuiding interests will amalgamate. After consolidation, the ramifications of this enterprise will be world-wide.

New Woodstock Industry.—Arrangements have been completed by which the Kentucky Car Liner & Bag Company, of Shelbyville, Ind., will establish its plant in Woodstock, Ont. The company already has a considerable Canadian trade, and it is to look after this and develop it that the Canadian branch is being established. The company manufacture car lines for lining the interior of freight cars and packing bags.

Unfilled Orders of U. S. Steel.—On March 31st, the unfilled orders of the United States Steel Corporation were 9,892,075 tons. This is an increase on the outstanding orders for February of 389,994 tons. The increase has been going on now from month to month for ten months. The present figures are the highest since August, 1917, when the outstanding orders amounted to 10,407,049 tons.

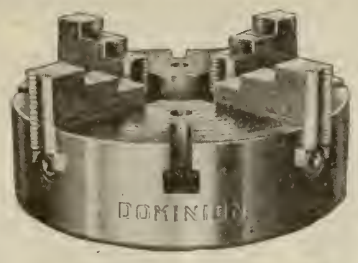
Coming to Canada.—The American Institute of Chemical Engineers will hold its annual summer meeting this year in Canada. This will be the first time in the history of the institution, and they will visit Montreal, Ottawa, and Belleville. The visit to Belleville is on the personal invitation of Mr. L. E. Allen, C.E., president of the Good Roads Association. After visiting Belleville they will go to Shawinigan Falls, P.Q.

Longshoremen Get Increase. — The Syndicated Longshoremen and the Shipping Federation of the Port of Montrea have concluded their annual meetin prior to the opening of navigation. A a result an agreement has been conclud ed under which the men get an increas of 10 cents per hour for day work an time and a half for night work, wit ten-hour working day and a nine-hou night shift. The day rate will be 7 cents per hour and the night rate $1.0 with double time for Sundays.

Making Additions.—Additions to the foundry which will more than doub their present output, are to be made b the Brown Boggs Co., Limited, Hamilto The installation will eventually include

25-ton travelling crane, a new heating system and all the latest improvements in foundry equipment and shop conditions. There will be a wash-room and lunch-room, 64 x 20 feet, finished in white tile with steel lockers, enamelled wash basins and space for ten shower baths. There will also be a first-aid room large enough for three stretchers, fully equipped to give aid in any kind of accident. This equipment will be one of the finest foundry installations in Canada.

Interesting Judgment. — Mr. Justice Lennox has given judgment in the case of Hugh Perry against the British-American Shipbuilding Co., of Welland, for $1,231.74, damages for wrongful dismissal. The plaintiff was under contract to the defendant for 12 months as a riveter, the terms being that he received his passage from England and $60 a week for a fifty-hour week. The contract was not up till May but plaintiff was discharged in October, the company claiming that he was not an expert riveter, and furthermore had disorganized the yard. Justice Lennox found that the question of efficiency was not an issue, the plaintiff having been tried for two weeks before engagement by the company. He found no evidence that the plaintiff was disorganizing the yard, but thought that the fact of the plaintiff being so much higher paid than the other men would cause dissatisfaction.



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MARINE

Windsor.—The death is announced of Capt. J. C. Burns, one of the oldest lake sailors, at the age of 81. The deceased passed away at his home in Anderdon Township, and is survived by ten children.

St. Johns, Nfld.—The sealing season this year has been a total failure, the catch being the lowest for a generation. The combined catch of the four steamers, "Sable Island," "Neptune," Eagle" and "Thetis,' 'was only 20,456 seals. The total catch of the fleet is not expected to exceed 40,000 seals.

Toronto.—Toronto waterfront is showing all the signs of the nearby opening of navigation. Steamers are being painted and freight sheds are receiving goods for shipment. The first trip across the lake has been made. Ferry boats to the Island will soon be starting, and the C. S. L. boats on the Niagara route will start their season by the end of April.

New Glasgow. — The Nova Scotia Steel & Coal Company successfully launched the "Canadian Miner" from their yard on the Pictou River recently. This is the sixth vessel to be launched from this yard. The steamer is of the 2200-ton class. The christening honors were performed by Mrs. McMillan, wife of the superintendent.

Sydney.—The Cabinet is still considering the question of the Sydney Dry Dock. It is understood that there is a very good chance of a favorable decision, in which case construction would be begun at once. Mr. Burchell is keeping in close touch with the situation, and is spending a good deal of time in Ottawa while the subject of the dock is before the Cabinet.

Sarnia.—The steamers of the Northern Navigation Company will use Point Edward as a calling port instead of Sarnia owing to a change of schedule. This was announced by the manager, Mr. Gildersleeve. He also announced that their steamer "Noronic" would leave Sarnia on May 1 to proceed to Detroit, where she will be utilized as a floating hotel. She will remain there until the opening of the season on June 10th.

PERSONAL

The death is announced from Woodstock of Mr. Whitelaw, the pioneer manufacturer of that city. The deceased gentleman had reached the ripe old age of 93, and had enjoyed good health till a few days before his death. Mr. Whitelaw was born in Scotland in 1827 and came to Canada in 1840, where he established the Whitelaw foundry in Woodstock. He was a member of the City Council and was also on the Light Commission. He is survived by two daughters and one son.

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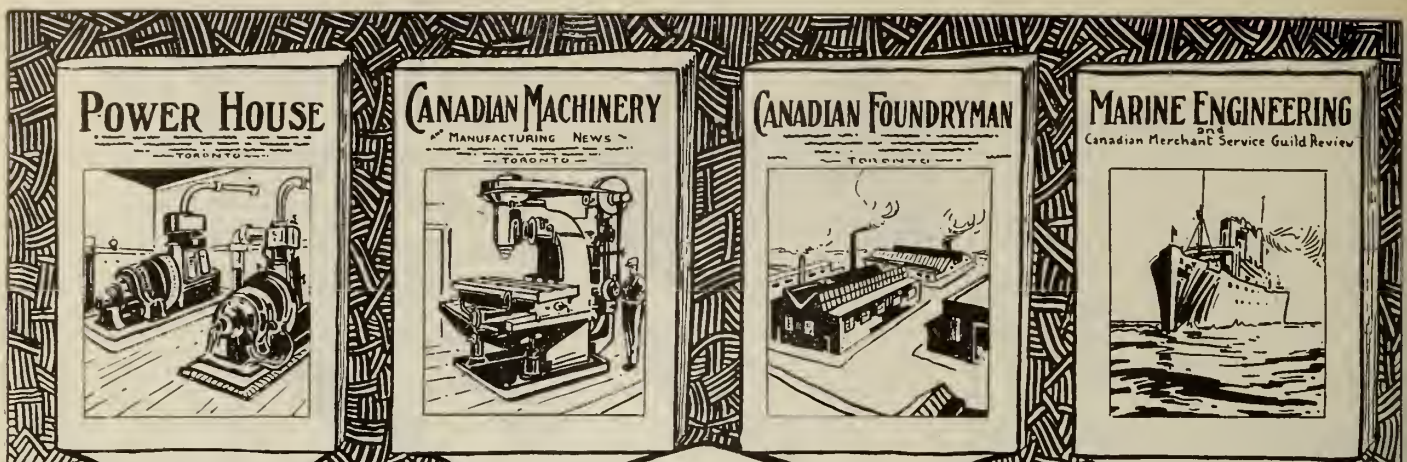

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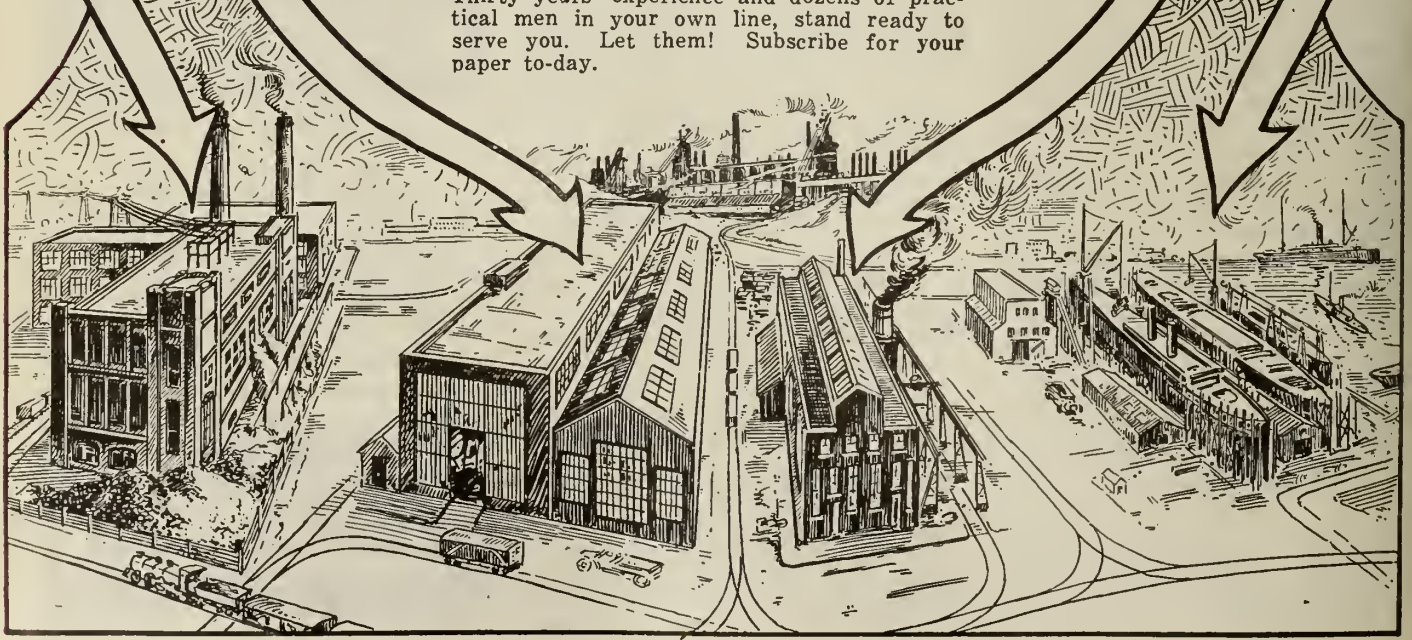

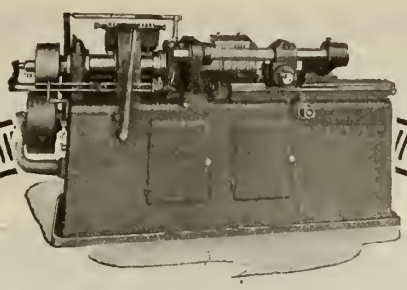

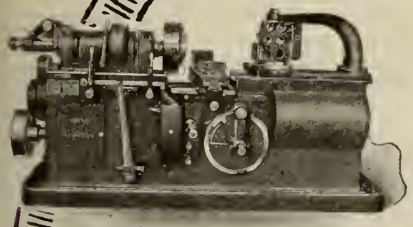

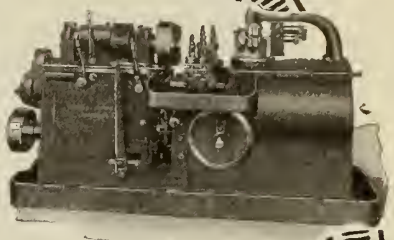

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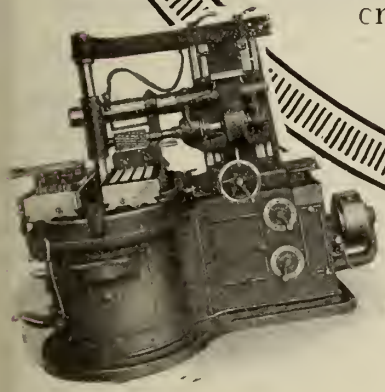

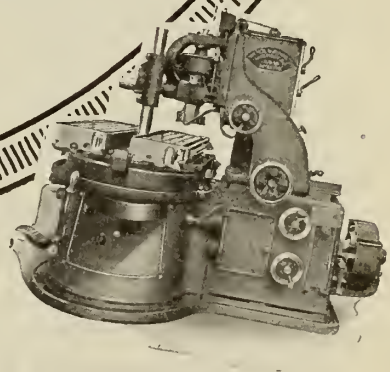

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90 H.P.—built by the Blackstone Company who are the recognized leading manufacturers of Crude Oil Engines. All in splendid condition and can be inspected set up. Complete with 60 KW. 550 Volt Generator, if so desired. This is an opportunity to get an economical power installation at attractive price to immediate purchaser.

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20 doz.—	11/64 Morrow H.S. Jobbers.
8 doz.—	No. 4 Morrow H.S. Wire Gauge.
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3 doz.—	Letter B High Speed.
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BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 738. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

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13" x 5' 6" New Carroll-Jamieson Quick-Change Lathe
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15" x 6' New Sidney D.B.G. Quick-Change Lathe, swing 17"
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110-125 Volts

H.P.	MAKE—	Speed	H.P.	MAKE—	Speed
1½	CROCKER-WHEELER	810	10	CAN. GEN. ELEC.	1700
2	ALLIS-CHALMERS	1175	20	CAN. GEN. ELEC.	1100
2	ROBBINS & MEYER	1100	25	WESTINGHOUSE	1300
7½	GENERAL ELECTRIC	1000	40	GENERAL ELECTRIC	1075
7½	WESTINGHOUSE	1150	44	BRITISH WEST.	1200
7½	WESTINGHOUSE	1560	50	GENERAL ELECTRIC	720
7½	GENERAL ELECTRIC	515	75	WESTINGHOUSE	550
10	WESTINGHOUSE	1200	100	CROCKER-WHEELER	300
10	UNION	1270	200	CROCKER-WHEELER	300

220-250 Volts

H.P.	MAKE—	Speed	H.P.	MAKE—	Speed
½	WESTINGHOUSE	1000	15	GENERAL ELECTRIC	625
¾	DILG ACME	2500	15	WESTINGHOUSE	1625
1	PEERLESS	1650	20	GENERAL ELECTRIC	925
2	TRIUMPH	1760	20	GENERAL ELECTRIC	600
2	FAIRBANKS-MORSE	1800	20	CAN. GEN. ELEC.	1100
5	WESTINGHOUSE	1500	25	(3) CROCKER-WHEELER	775
7½	WESTINGHOUSE	600	25	(2) CROCKER-WHEELER	750-900
7½	(2) WESTINGHOUSE	850	25	BULLOCK	600
7½	CAN. GEN. ELEC.	785	25	WESTINGHOUSE	450
8	CAN. GEN. ELEC.	1700	30	(2) BULLOCK	600
10	NORTHERN ELEC. CO	7[illegible]	35	CROCKER-WHEELER	900
10	VENINE BROS.	5[illegible]	35	GENERAL ELECTRIC	540-1000
10	PEERLESS MFG. CO.	59	40	WESTINGHOUSE	935
10	CAN. GEN. ELEC.	[illegible]	40	GREGORY ELEC. CO.	700
12	AMERICAN ENGINE CO.	1170	40	SPRAGUE	800
15	SPRAGUE	1500	55	ALLIS-CHALMERS	560
15	NATIONAL ELEC. CO.	750	60	BULLOCK	725
15	(4) CROCKER-WHEELER	800	75	WESTINGHOUSE	800
15	GENERAL ELECTRIC	1200	80	GENERAL ELECTRIC	750
15	STURTEVANT	800	90	FORT WAYNE	660
15	SPRAGUE	700	150	SPRAGUE	1050
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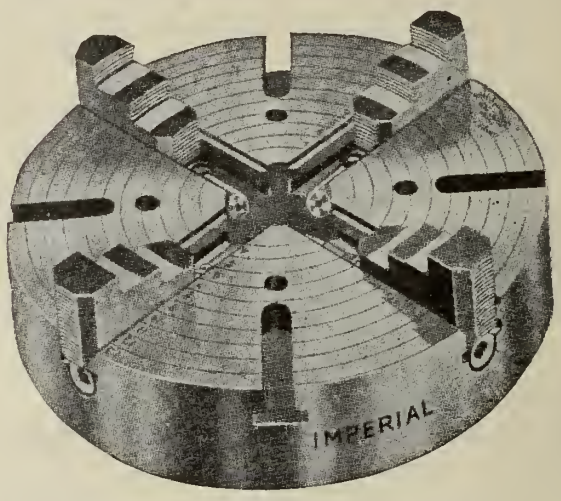

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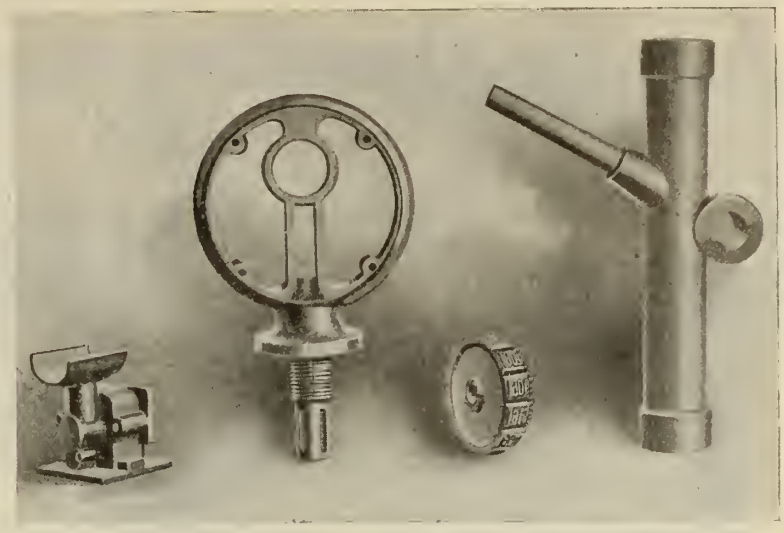
DIE-CAST PARTS

They Cut the Costs



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Die Casting Chat No. 3

Having found out what a die-casting is, and how they are made, let us see what they are used for. They are used for practically every known line of manufacture.

Following are a few familiar lines. Automobile accessories, phonograph parts, electrical instruments, adding and billing machines, milking machines, aeroplanes, cream separators, motor boat parts, photographic supplies, etc.

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Time and again skilled machinists have remarked on the strength of construction and compact design of our Tool Chests. Have us give you full particulars.

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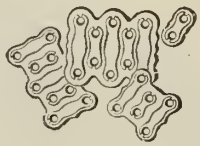
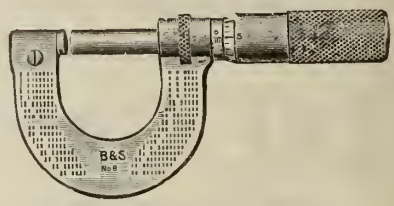
Clinch beneath the surface of the belt on the pulley side — no part in contact with the pulley. They maintain uniform grip the entire width of belt and never weaken from wear.



Micrometer and other fine tools



Select from such wholly dependable makes as Starrett, or Brown & Sharpe, or from other makes you have proven in your own shop to be most durable and efficient. Our stocks are complete.

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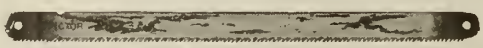

Durable, fast-cutting blades that you can rely upon to cut true through toughest metals. Users have found that these blades increase every day's output and serve much longer than ordinary blades.

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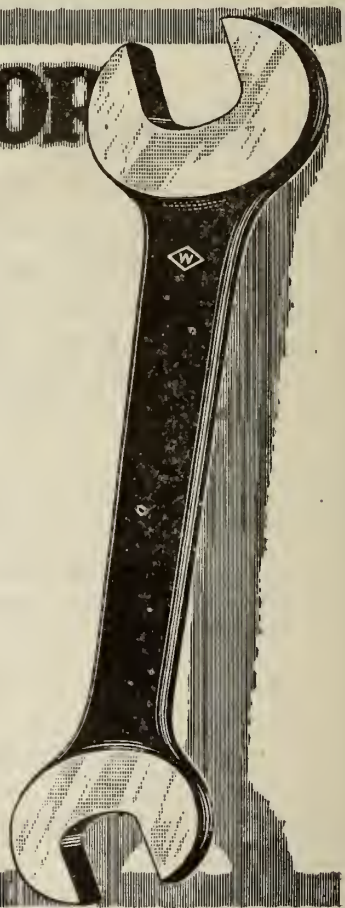

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And you can't buy a better wrench
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J. H. Williams & Co.

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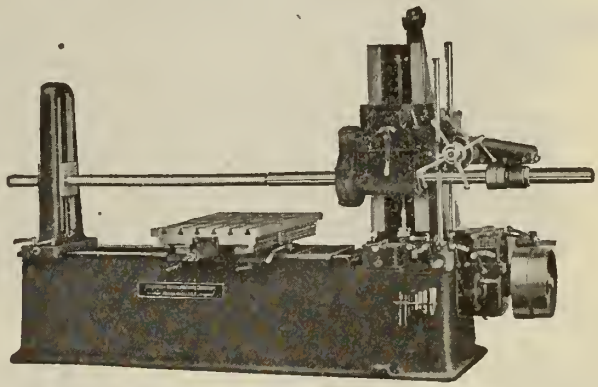
This service means that the Petrie staff take a minute interest in the requirements of every customer; it means that the customer gets what he orders—further, Petrie service includes advice on the selection of proper equipment and advice on the solving of all machinery problems that frequently come up in machine and woodworking shops.

The Universal Horizontal Boring Machine



This machine is designed for Boring, Milling and Facing. It helps, and frequently takes the place of, the Lathe, Planer, Drill and Milling Machine. The nine feeds are entirely independent of the sixteen feeds.

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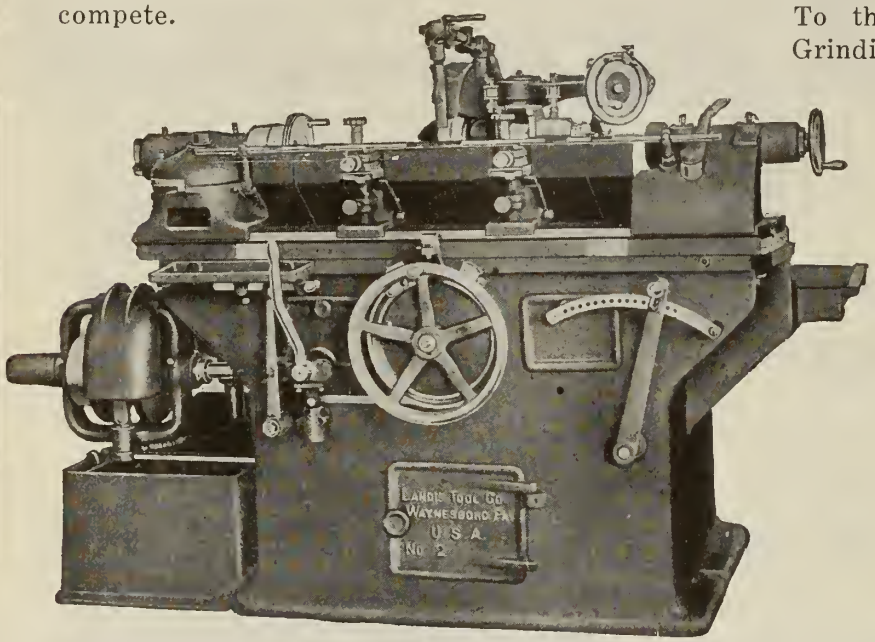
Unless your Tool Room is equipped for "High Pressure" work, your capacity is lowered; and unless you have the machines to handle the varied and difficult jobs, your Tool Room cannot compete.



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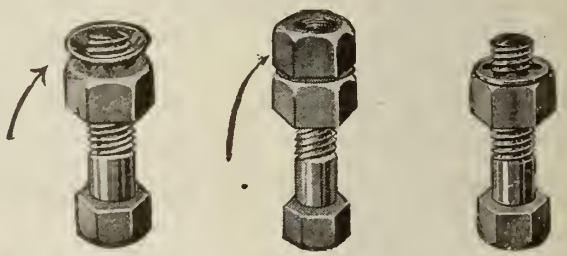

Knowing the size Bolt—use same size Nut Lock. Place over Bolt—as shown above.

Screw another Nut onto Nut Lock and Depress it — as shown above.

Remove Second Nut and Nut Lock will Look — as shown above.

The Hold Tite Nut Lock cannot come loose when it is compressed into the thread of the Bolt. Compressing will not destroy the thread.

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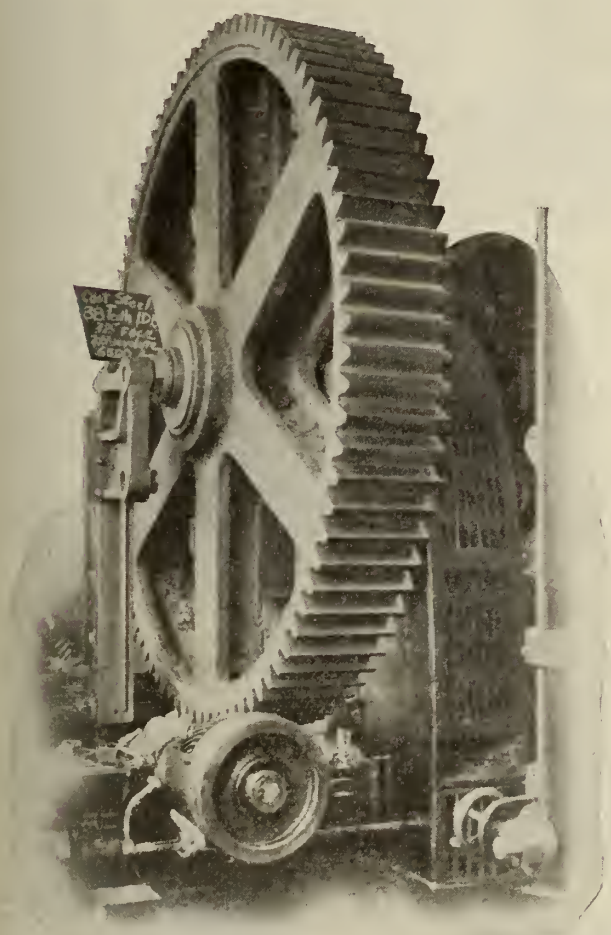

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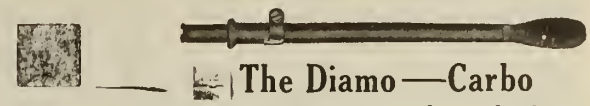

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Do not warp, grow, crack or scale under repeated heating and cooling.

Conduct the heat readily and uniformly because of unchanging thin walls.

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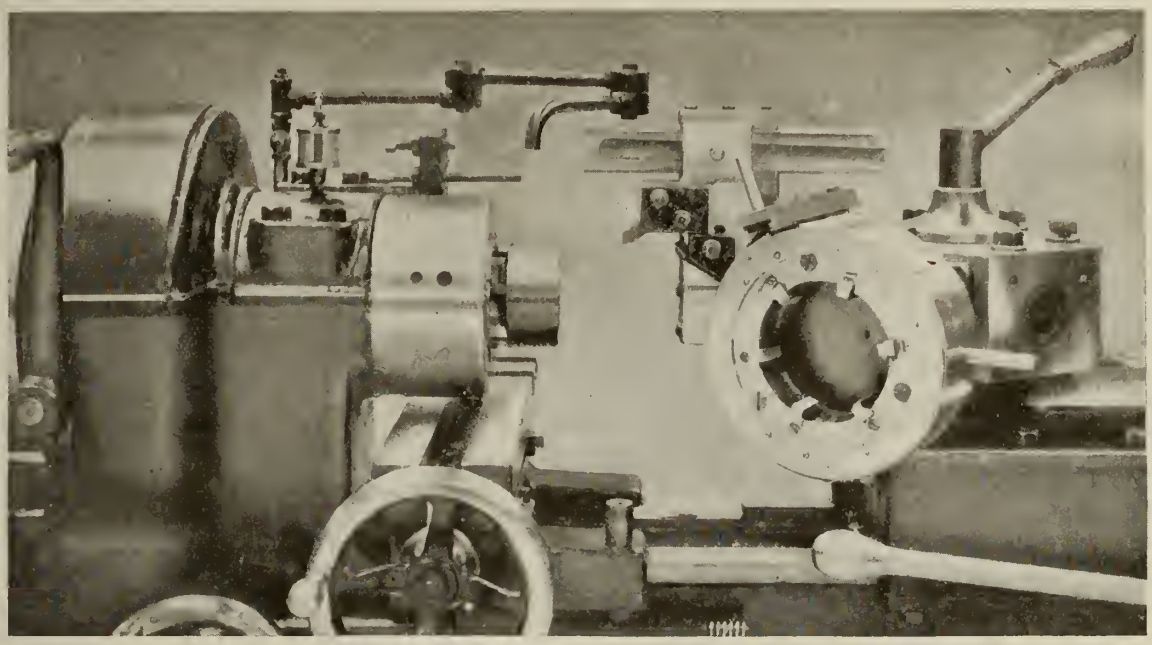
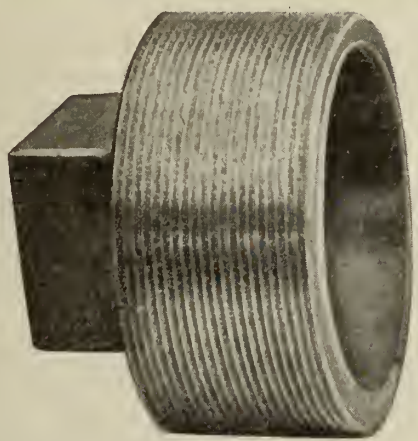
W & S Turret Lathe exceeds expectations





You know that satisfied feeling when the machine you have just bought exceeds your expectations! The W & S No. 6 Turret Lathe turns and threads this Monel metal taper plug in 3½ minutes flat instead of 6 minutes, the estimated time that landed the order.

The plug is used in steam boiler construction. It is 4 7-16″ in diameter—has a thread 3¼″ long, 10 pitch, and a taper of ¼″ to the foot. First it is taper turned and then taper threaded. All in 3½ minutes! And Monel metal is a tough machining proposition.

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Bar Capacity—⅝" x 4" to 4½" x 44". Maximum Swing—21½".

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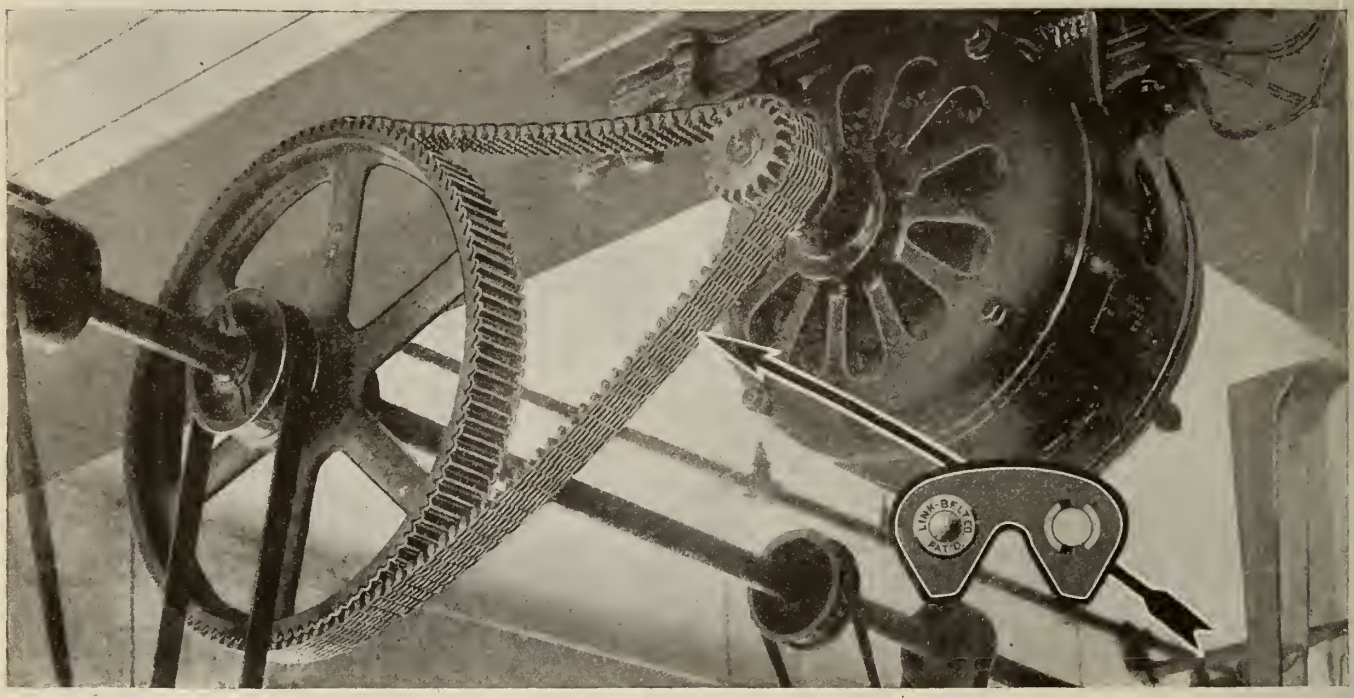

HERE is the EFFICIENT drive for lineshafts and machinery of every character—in every line of industry.

It is 98.2% efficient (on actual test). It is flexible as a belt—positive as a gear—more efficient than either. Made in various sizes to transmit power from ¼ H. P. to 1,000 H. P. and over. Thousands of successful installations testify to its unrivaled success.

Link-Belt Silent Chain is practically a flexible gear. It cannot slip. Tension is on the pulling side of the chain only; hence journal friction is much less than with belt drives. No power is lost due to bearing friction; 98.2% of the energy of the motor is transmitted to your shaft or machine to perform useful work. This means increased production.

The drive is not affected by atmospheric conditions, operating equally well in hot, cold or damp places; it permits economy of space because you are able to arrange for centers to suit the convenient location of your driving unit. It combines in one drive the best points of leather belts and cut gears, minus their disadvantages. You should use Link-Belt Silent Chain on all important drives in your plant.

Look at the illustration, think over these statements and then send for one of our experienced Power Transmission Engineers to study your conditions. He will explain the results of various tests which have proved the superiority of the Link-Belt Silent Chain Drive. This service we render without obligation.

Link-Belt Silent Chain is the EFFICIENT means of transmitting power, and we welcome the opportunity of proving it to you in your own plant, under your individual conditions. We sell each drive complete and guarantee its successful operation.

Send for 128-page Link-Belt Silent Chain Price List Data Book No. 125. It completely illustrates and describes the drive.

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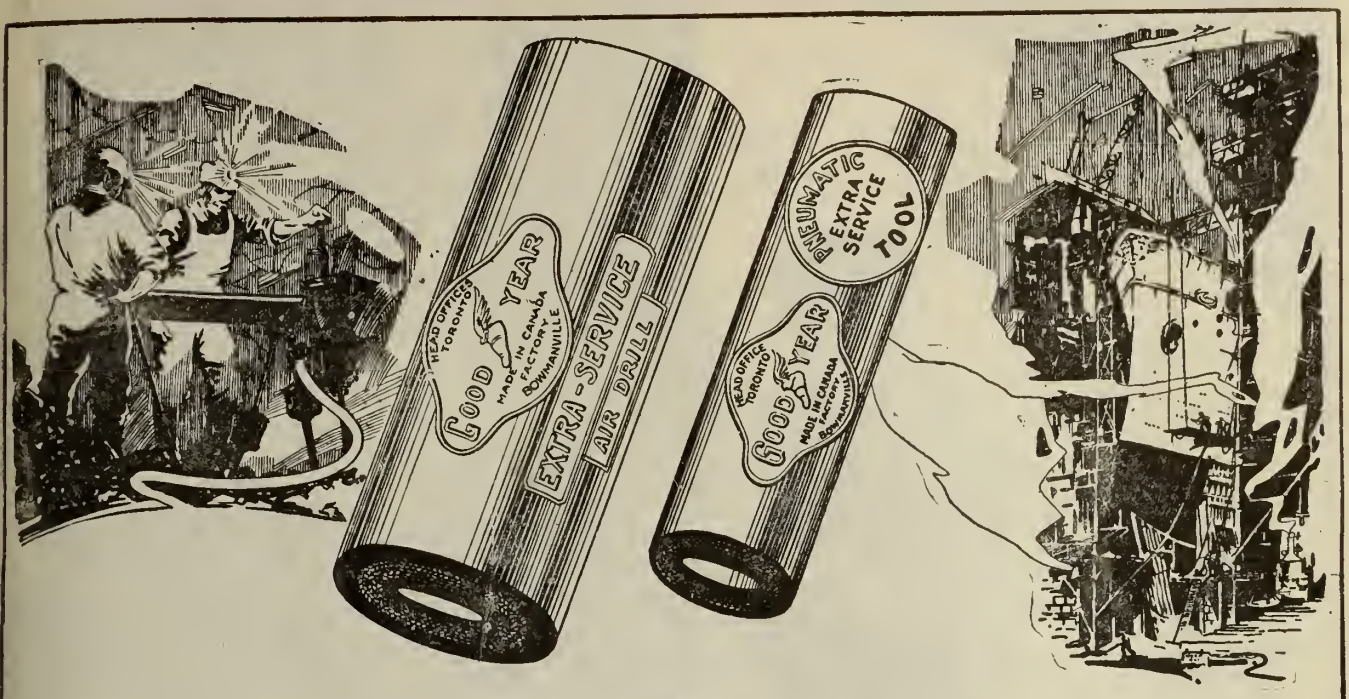
WELLINGTON AND PETER STS.
TORONTO

LINK-BELT
SILENT CHAIN DRIVES



Tough as a Tire Tread—
This Hose Cover

IN mines, quarries, tunnel work, shipyards and structural steel work, the tough cover on Goodyear Air Drill Hose and Goodyear Pneumatic Tool Hose has resulted in more work and a lowering of hose cost.

The life of hose in this work depends about 75% on the cover. Dragged over rock and ore and steel girders, tramped on and run over, it takes a tough and well-designed hose to give any length of service.

We have records of Goodyear Air Drill Hose in constant service for 18 months to 2 years.

The cover of white rubber is as tough as a tire tread. It is extra thick. It wears long, even under rough handling.

To balance such a good cover is a specially developed, oil-resisting inner tube; and fabric of extra strength.

So good are Goodyear Pneumatic Tool Hose and Goodyear Air Drill Hose that five-ply is found as satisfactory as six or seven-ply of old-style hose.

The thoroughness with which Goodyear Air Drill and Pneumatic Tool Hose has been designed and built, is paralleled in every kind of Goodyear Industrial Hose. The problems of each industry have been studied carefully. The solution to those problems has been worked out in the Goodyear laboratories. The Goodyear Industrial Hose man has a mighty interesting story to tell to industrial executives. No obligation on your part if you have him call. Just phone, wire or write the nearest branch.

The Goodyear Tire & Rubber Co. of Canada, Limited

Branches—Halifax, St. John, Quebec, Montreal, Ottawa, Toronto, Hamilton, London, Winnipeg, Regina, Saskatoon, Calgary Edmonton, Vancouver. Service Station Stocks in other Cities

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MADE IN CANADA
INDUSTRIAL HOSE

If interested tear out this page and place with letters to be answered.

"Good workmen know the difference."

This trade-mark is a little thing to look for but a big thing to find.

Fast but Sure!

"'Slow, but sure'—that's our motto, Mason," said Misik. "Our finish is all hand work."

Misik is foreman of the finishing division of the Drawing Instrument department in the Keuffel & Esser Company's factory at Hoboken, N. J., where the world famous K. & E. drawing instruments are made.

Mason, who is a Speed-grits salesman, watched the workmen putting the finish on the fine nickel-silver compasses by hand with strips of emery cloth. Yes, it was slow—and tedious and costly.

"What's wrong with your machines?" he asked finally, pointing to the row of belt-grinders that stood idle along the wall. "Nothing—with the machines," replied Misik. "It's the belts. The 'jump' from the belt-joints in an abrasive belt spoils the finish on our instruments. I've tried a lot of belts but I stick to hand work."

The first thing Mason did when he got back to his office that afternoon (August of last year) was to send Misik several samples of the new Speed-grits Uniflow Belt. Then several days later, he went back to the K. & E. factory. The first thing that greeted his ears as he came up the stairs was the hum of busily whirring belt-grinders.

Misik came forward to meet him. "You win, Mason," he said. "That joint in your new Speed-grits Uniflow Belt does the trick. We are getting our fine finish by machine now, fast—but sure."

"The jump has gone from the belts and the kick has gone from the workmen."

Write today for "The Difference Book." *Address*

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DURITE COMBINATION
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DURUNDUM CLOTH

Manning
Speed-grits
Reg. U.S. Pat. Off.

Don't say Sandpaper —say Speed-grits

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have the same qualities of value and satisfaction that have made the reputation of Starrett Tools among the Nation's machinists.

Used according to the recommendations of the Starrett Hack Saw Chart, they reduce "cutting costs" and troubles to the minimum.

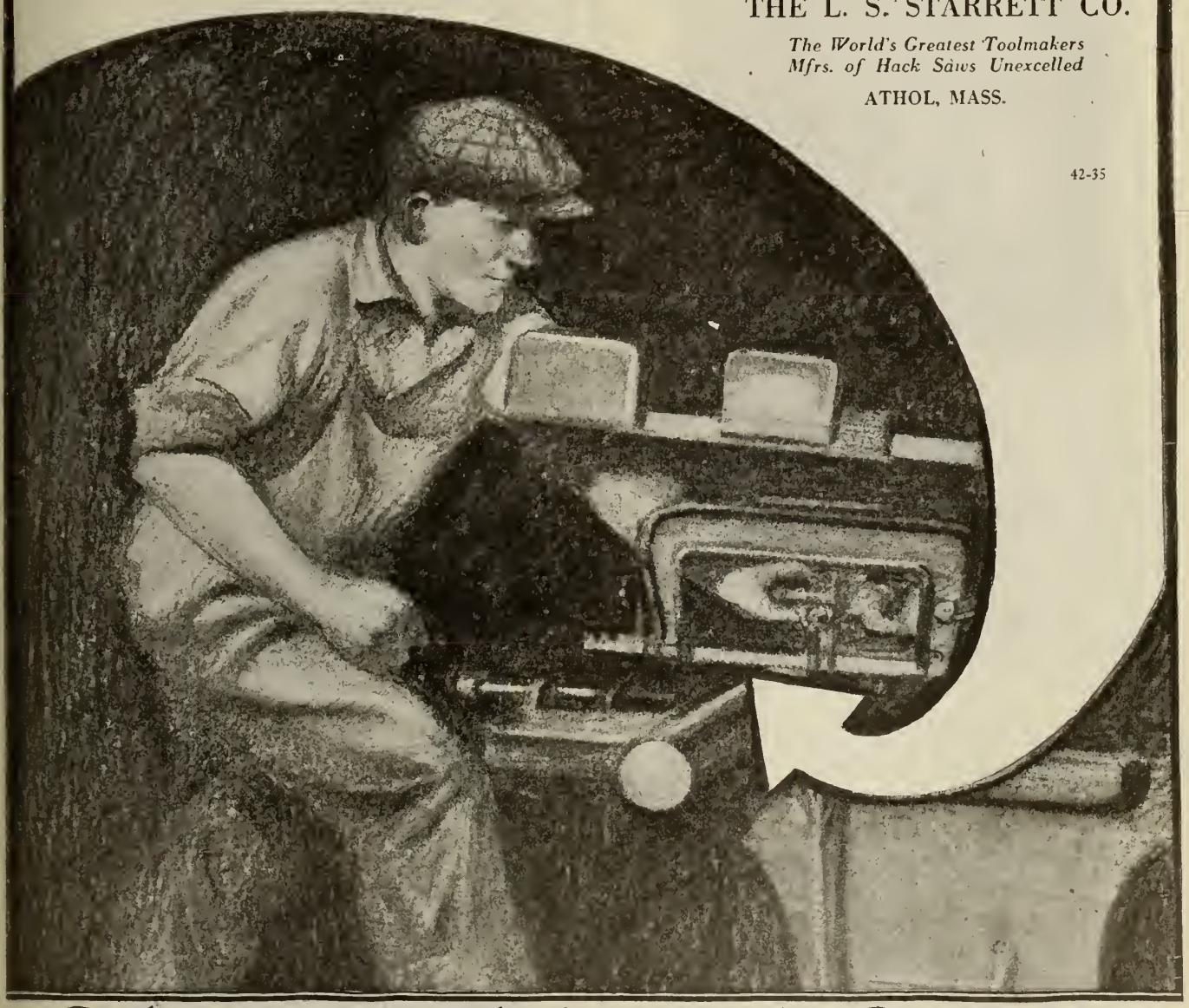
Write for copy of the Chart and Catalog No. 21 "3", sent free anywhere on request.

THE L. S. STARRETT CO.

The World's Greatest Toolmakers
Mfrs. of Hack Saws Unexcelled

ATHOL, MASS.

42-35



Starrett Hack Saws

STARRETT HACK SAWS CUT QUICKER LAST LONGER

STARRETT TOOLS

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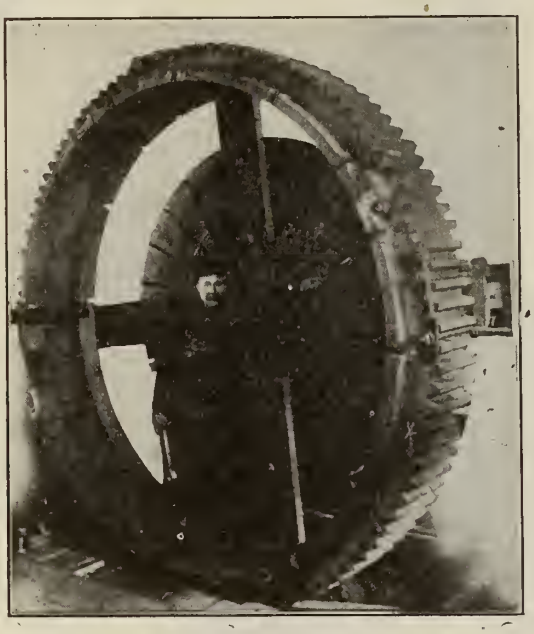
HULL, QUEBEC



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"HISCO" machine-moulded gears, while requiring no pattern, insure accuracy, dependability, quality, and the price is minus the cost of patterns—which in these days of high prices of lumber and labor is something to be considered.

Made in all Standard Shapes and Sizes

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Firebrick of Quality

Tell us your needs and We'll tell you the Brand

We have made a careful study of the different conditions affecting firebrick and are prepared to investigate your troubles and advise you the brand of Elk products particularly suitable to your purpose. Each brand differs from the others either in grind, mixture of clays, or in method of manufacture, or possibly in chemical composition, which fits it to give better results in certain places than other brands we produce.

When you are in the market for a reliable firebrick that is best suited to your needs consult us. We carry large stocks of all standard sizes and shapes in our warehouse at Hamilton and can make prompt shipments on all orders. Why not give us a trial?

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Made in Canada

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Many new creations have been placed on the market, but if you have ever used a Trahern, you will agree with us that nothing yet has been found which will surpass the Rotary Geared Type for unceasing delivery of coolant to your cutting tools.
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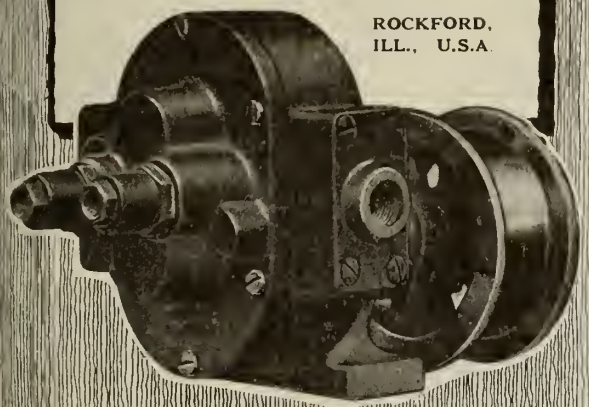
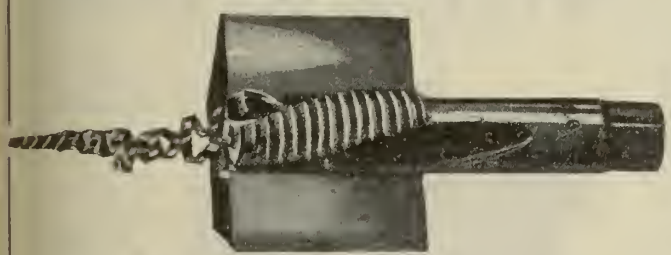


THE "SEMPLE" TAP



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The Most MODERN,
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Send for a "SEMPLE" Sample Tap. Made in any thread
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Made by Chisholm-Moore Mfg. Co., Cleveland, Ohio

For Catalogue and Prices write the
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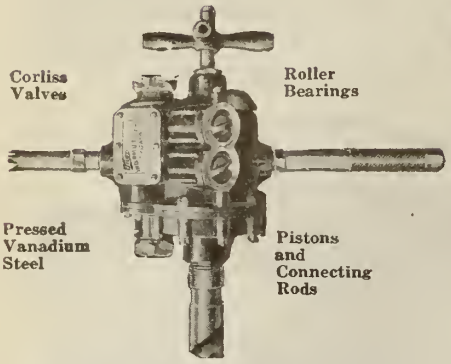
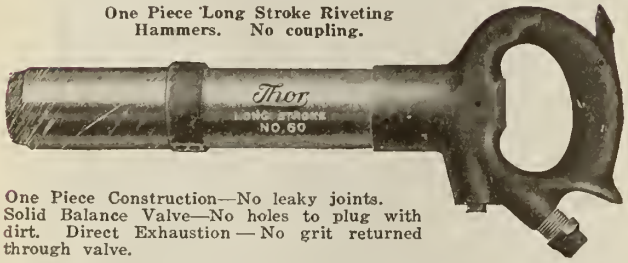
Thor Air Drills



Four cylinder type, two on each side, Semi-Corliss valve close to each pair of cylinders gives greater efficiency and power, saves clearance losses and allows air to enter cylinder at full pressure of the pipe line.

One Piece Long Stroke Riveting Hammers. No coupling.



One Piece Construction—No leaky joints. Solid Balance Valve—No holes to plug with dirt. Direct Exhaustion — No grit returned through valve.

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The Tools that Reduce High Cost of Labor

Manual labor was never so costly as it is to-day. You are running into needless expense if you continue work with hand tools when ONE man with one **Thor** pneumatic tool will do FIVE TIMES the work.
The demand for **Thor** pneumatic drills, hammers, grinders, rammers, electric drills and grinders increases daily. Their economy, efficiency and superiority in practical service is widely recognized. You should adopt them without delay.

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There is unusual strength, accuracy, speed, convenience and range in

AURORA
Drilling Machines

You can use them to great advantage on any work in your shop that's suitable for a machine tool of this kind. The operating is easy and the labor cost comparatively low.

Drop a line for full particulars and specifications.
Stationary Head Sizes 20"—21"
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ACCURACY

Prompt shipments of all Standard Sizes in
Cap Screws, V or U.S.S.
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The Hammer With The Human Stroke

HEADS RIVETS COLD

Heads 'em tight or loose, flush, countersunk, or finishes heads any shape desired, and at the rate of:—

A rivet a second, sizes up to 3/16".
A rivet in two seconds, size ¼" to ⅜".
A rivet in three seconds, size 7/16" to ⅝".

And on special order we build machines to handle rivets up to 1½" with proportionate rapidity.

Built in eight sizes.

Besides riveting, the High Speed Riveting Hammer does all kinds of peining, swaging, upsetting, etc.

Send us sample assembly parts with rivets or sketch of your work,

and

Let us shoulder your riveting problems.
Send for the High Speed Hammer Book.

THE HIGH SPEED HAMMER COMPANY, INC.
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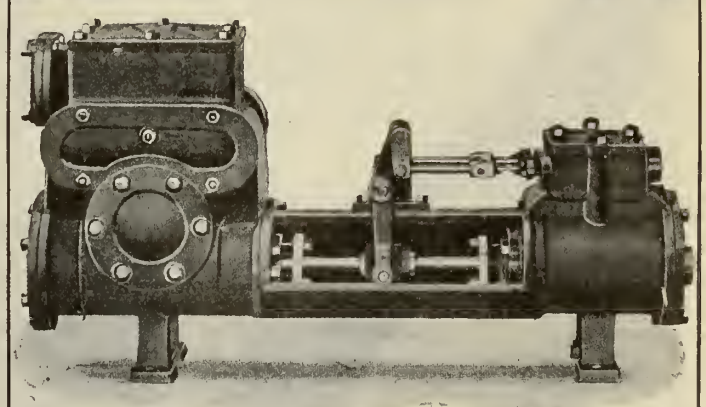
HEPBURN



We are now exclusive manufacturers of the well-known Martin and also the Tod Pumps, and are now ready to quote on any of your pump requirements. We have a complete line of Simplex and Standard duplex pumps for boiler feed, air circulation, fire, mine and general service; low and high pressure pumps for hydraulic presses; lifts, accumulators, etc.

Prices quoted on request

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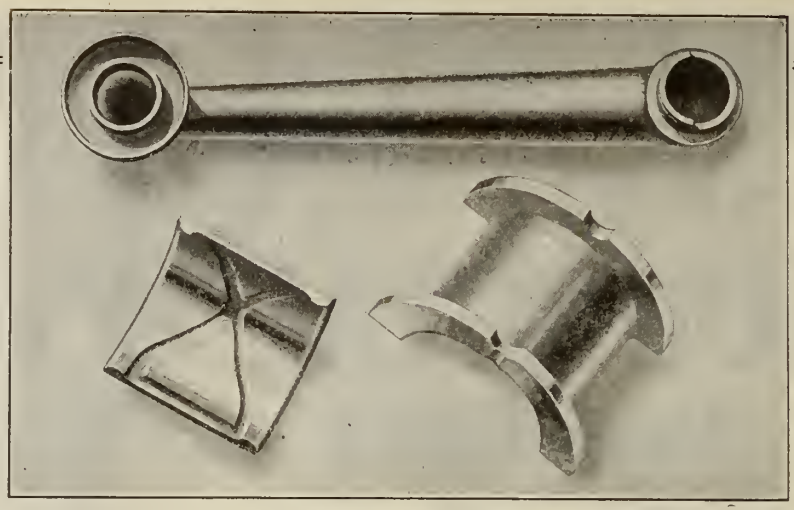
Doehler Service



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We have purchased the Canadian Rights for the Doehler Die Casting Process and are now manufacturing castings in our factory at Hamilton.

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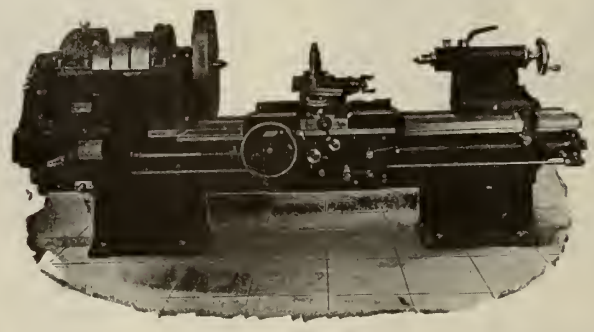
Sidney-for-Service Lathes are noted for their power and rigidity. Take deep cuts through toughest metal without pause or chatter.



Specifications include 3 step cone, double brake gear, semi-quick change gear lathe, built on 10 ft bed. This lathe also furnished with quick-change gears. Bed lengths available: 10, 12, 14, 16, 18 and 20 ft.

The Sydney Line comprises 15-inch, 17-inch, 19 inch, 25-inch, 27-inch, 30 inch and 36-inch lathes which are adaptable to the finest tool room work or the heaviest duty ship yard or factory rapid production work.

Heavy Duty Engine Lathes

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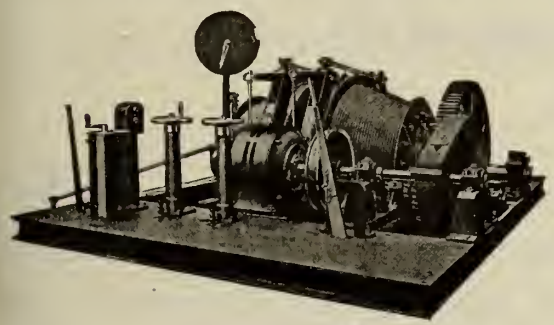

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UNIFORM HEATING AND COOLING

One is at the start and the other at the finish of the heat-treatment operation. *Both are essential* to a uniformly heat-treated product.

Automatic Furnaces, by heating and cooling each piece to the same temperature, for the same length of time and in the same manner, *insure uniformity of finished product.*

Increase in production and *decrease in fuel and labor* are among the other advantages of Automatic Furnaces.

We have a variety in type and size of Automatic Furnaces, for different heat-treating requirements.

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You have to pay demurrage on standing freight cars. So you unload them quickly.

Well, you pay demurrage on unloaded inter-department trucks.

You pay for the time men and machines waste, while waiting for loads of stuff to be moved to or from them.

You pay for the friction and bickering incident to arguments between mechanics and truckmen.

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The only cure for it, at one time, was to buy a lot of trucks.

That's no longer necessary. One or two Tranco Trucks and a battery of platforms (platforms costing two or three dollars each) will take care of an endless volume of inter-department trucking.

The Tranco Truck solves the problem of inter-department hauling. Saves endless friction between skilled workmen and truckmen, and earns its keep in a few months.

The sheer common-sense of its operating principle cannot fail to appeal to you. That is why we want you to write for the booklet that describes it fully.

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Double Ball Bearing Co.
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You Are Entitled To Good Filing

And you can get it when you specify Famous Five Files.

Made of specially fabricated steel, accurately cut and thoroughly hardened, they do all that can possibly be expected of a file.

Long, efficient service, cleanly done jobs, contented workmen time and money saved — this is what Famous Five Files mean to you.

They are:

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The Mecca of Manufacturers

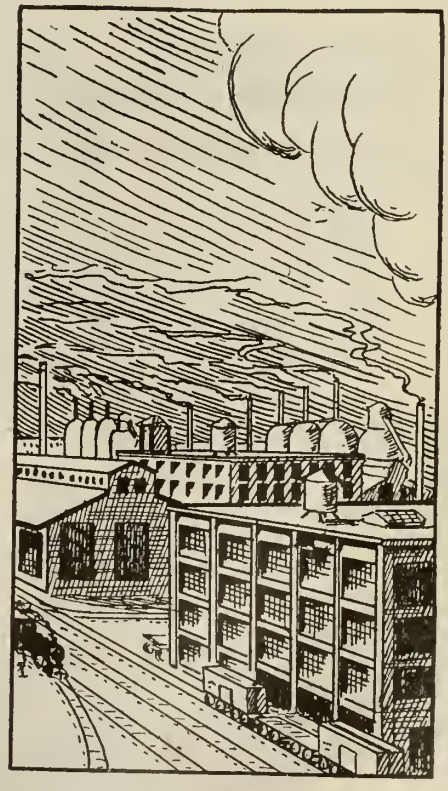
ST. JOHNS QUEBEC

Consider Its Advantages!

ST. JOHNS possesses such unusual advantages of great economic importance, such as its commanding geographical location, unequalled transportation facilities, adequate fuel, power and labour supply, that it should always be included in investigations before definitely deciding on the location of a new industry. Situated on the Richelieu River, in the most densely populated section of Quebec, **and being the nerve centre for a network of seven important railways,** St. Johns obtains lower freight rates and cheaper fuel and labor than any other centrally-located manufacturing city on the North American Continent.

St. Johns is directly connected by rail with the Montreal docks, 27 miles distant, affording first-class facilities for foreign trade. Excellent canals connect with St. Lawrence and also with New York and the Eastern States.

Electric power is cheap and plentiful and the excellent railway connections assure a satisfactory coal supply. In addition to the natural advantages of St. Johns as an industrial site the city also offers extraordinary inducements, such as: Tax exemptions; street extensions; bonus of five per cent. on your payroll for five years, making it an unusual industrial opportunity.



For Specific Information
Write to

The Secretary of the City Council
ST. JOHNS, QUE.

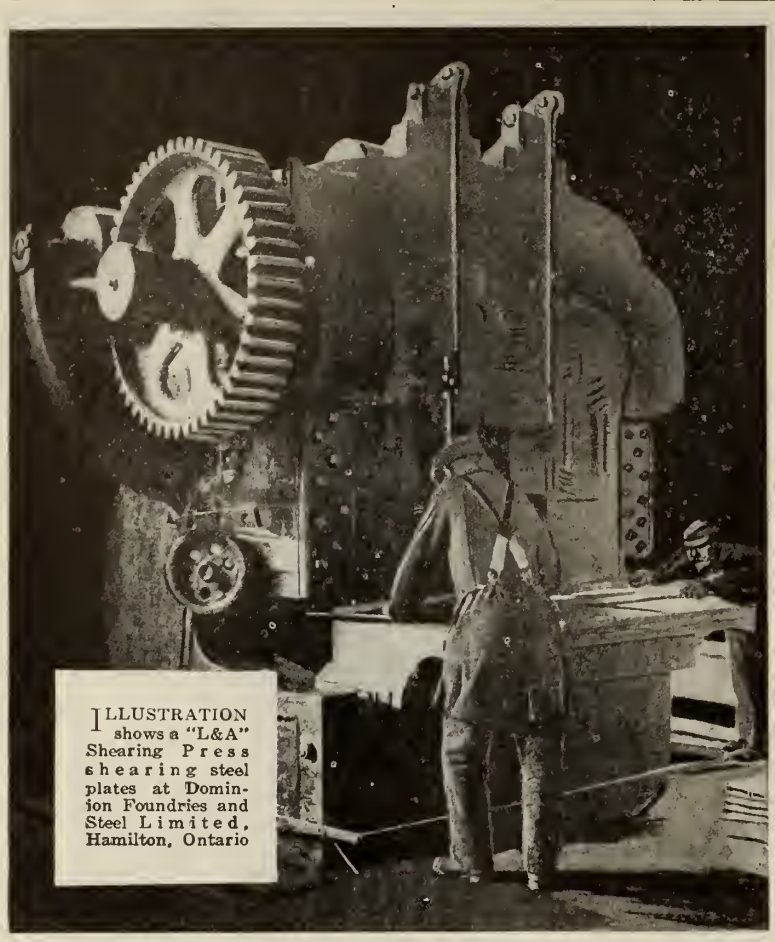


ILLUSTRATION shows a "L&A" Shearing Press shearing steel plates at Dominion Foundries and Steel Limited, Hamilton, Ontario

"The Quality Line"

PUNCHING and SHEARING MACHINERY

We manufacture "The Quality Line" machinery equipment for Rolling Mills, Bridge and Structural Works, Steel Car Plants and Shipyards. All machines are built of the same high grade workmanship and material that have given the "L & A" product a recognized standard of quality of over 50 years.

Send for our big catalogue.

The Long & Allstatter Co.
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RUDEL-BELNAP MACHINERY CO., LIMITED
Toronto, Montreal.

We wanted something original— this is what we got

"BOTH of these operations and half another — I'll show you later—completed in the time our old taps took to do one; that, I guess, is why we continue to use your Victor Collapsible Taps."

It was the often-heard story of time saved, of costs lowered, of all threads clean and smooth. And it was pleasant to hear.

Victor Tool Company
Waynesboro, Pa.
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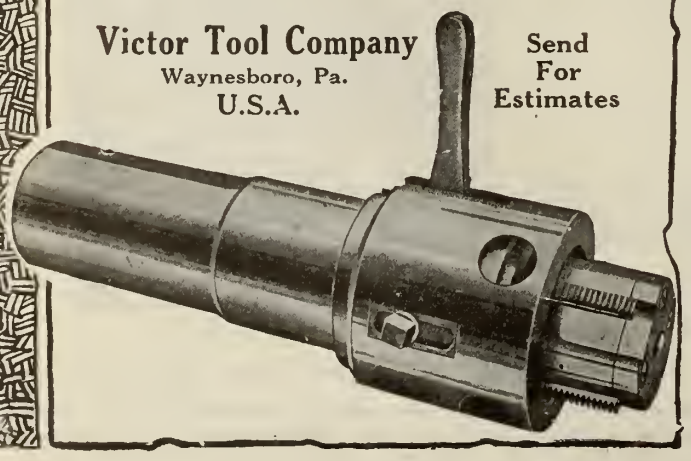
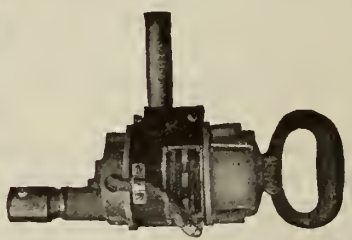
Send For Estimates



U. S. Electric Drills and Grinders

Save Time, Labor and Money



They can be attached to any lamp socket.

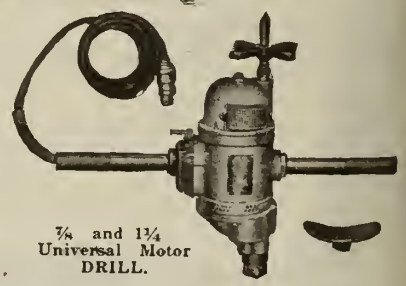
For drilling in metal they are superior to any other kind of portable drill. Cost 50% less to run than air drills.

3 SIZES
3-16 in., W.G.T., 6 lbs.
¼ in., W.G.T. 9 lbs.
⅜ in., W.G.T. 12 lbs.

All motors wound for 110 or 220 volts.

Direct or alternating current.

Try a few of our Electric Drills and Grinders and you'll send us an order for more. Our guarantee protects you.



⅜ and 1¼ Universal Motor DRILL.

For Sale By
The Canadian Fairbanks-Morse Co., Limited
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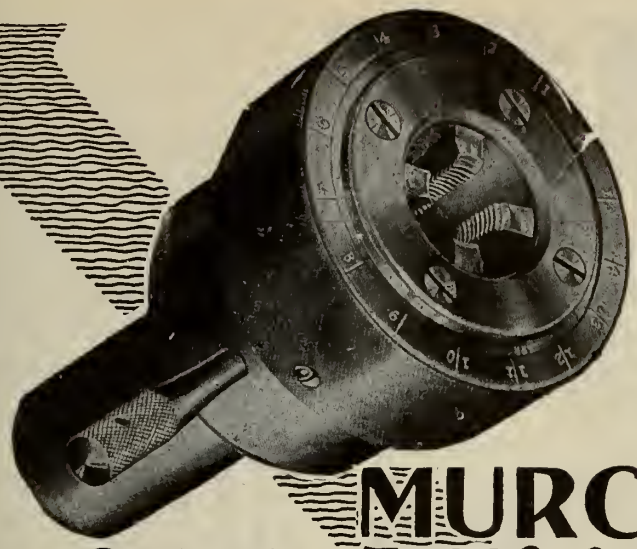

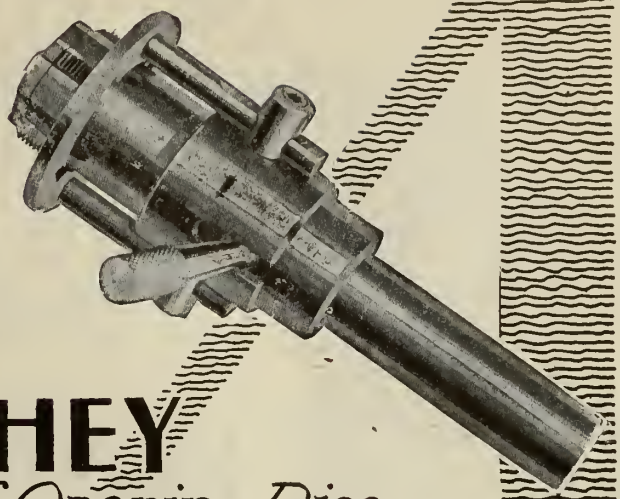

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Collapsing Taps & Self-Opening Dies

can do the work in half the time. No reversing, no stripping. No damaging threads by hacking.

Murchey Taps and Dies can be used everywhere that solid tools are used on drill presses, tapping machines, automatics, boring mills, turret lathes, etc.

You want increased production at decreased costs, Murchey tools are at your service.

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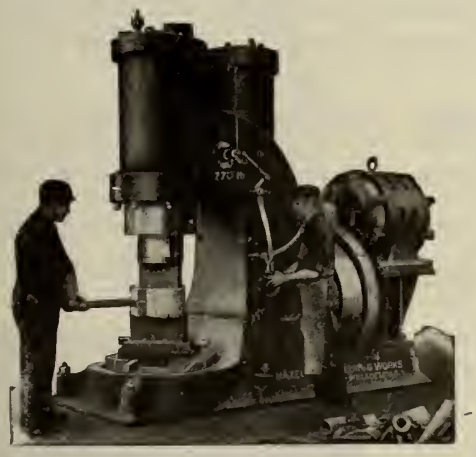
The Nazel Air Hammer

(A Self-Contained Unit)

Noted for Its Blow and Control



The Most Modern Reliable Power Driven Substitute for the Steam Hammer.

Built in 3 types, 6 sizes, arranged for belt or direct motor drive, with capacities up to 7" square for all manner of jobbing, manufacturing and certain classes of die forging. Write for catalogue.

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Hand Made

Matthews' Letters and Figures are hand made from carefully selected tool steel. The characters are neatly formed, producing stamps that make easily read and durable marks on all classes of products. They reduce considerably the cost of high grade marking.

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Our engineers are specialists in the design of industrial furnaces. They study your furnace problems and build a furnace that will give the most economical results on that particular class of work. We control basic patents covering the conversion of oil into gas and burning it as a superheated natural gas in your furnace and by the application of this process we can cut your furnace operating costs in two. Consult us now. It will save you money.

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Heat treating to-day is an exact science and requires furnaces that are absolutely accurate and can be depended upon at every stage of the game.

Stewart Furnaces met war problems successfully, and have been equally successful in industrial requirements. Manufacturers and heat treating plants using them have found their product uniformly high grade, with economy in time and material.

Stewarts are giving entire satisfaction in well-known plants all over Canada and the United States. The fact that they give dependable results in these plants with high grade dies, gears and machine parts is good evidence that they will solve your production problems.

There's a Stewart for every heat treating requirement.

STEWART NO. 28 OVEN FURNACE

Indirect heat, with U-shaped bottom slab.

For hardening high-speed or carbon steel, or for annealing and case hardening.

Specifications

Opening, 4″x 8″.
Depth, 12″.
Floor space, 24″x 24″.
Gas and air connections, 1¼″.
Shipping weight, 750 lbs.
For gas burners only.

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Distributors in Canada:

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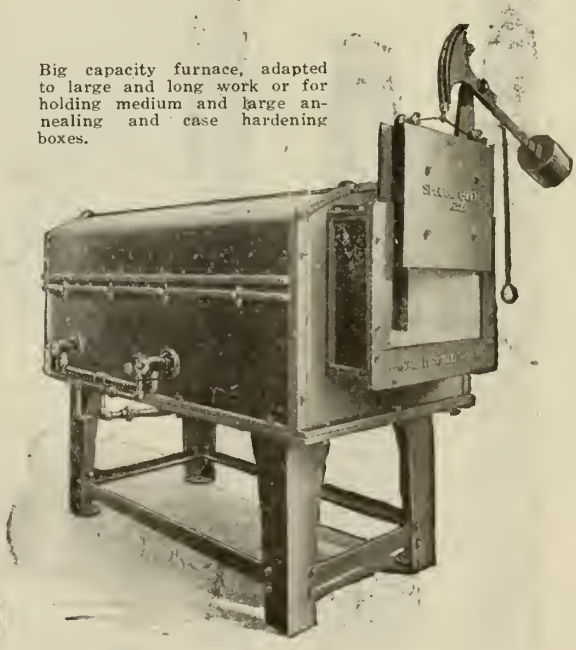
Indirect heat, with flat bottom slab.

For case hardening, heat treating and annealing.

Specifications:

Opening, 14″x 22″.
Depth, 60″.
Floor space, 50″x 74″.
Gas and air connections, 1½″.
Shipping weight, 7,000 lbs.
For gas or oil burners.

Big capacity furnace, adapted to large and long work or for holding medium and large annealing and case hardening boxes.



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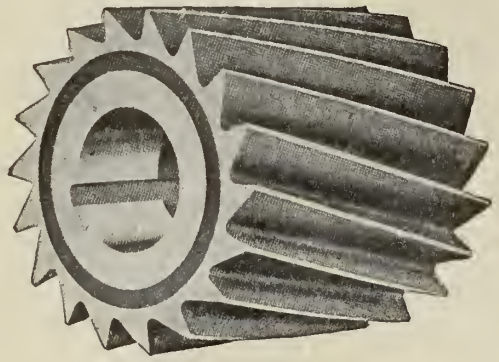
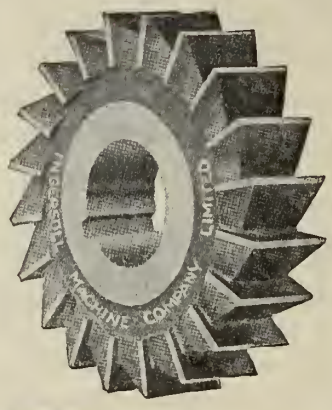
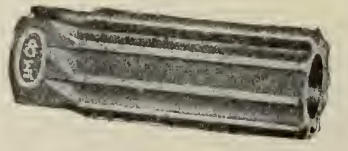
"IMCO" Tools







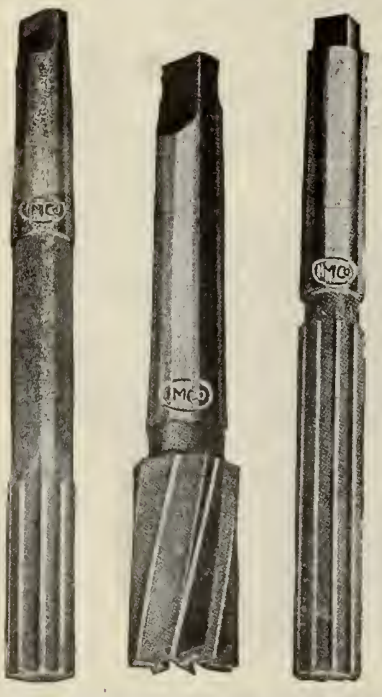
Service —*is proof of merit*

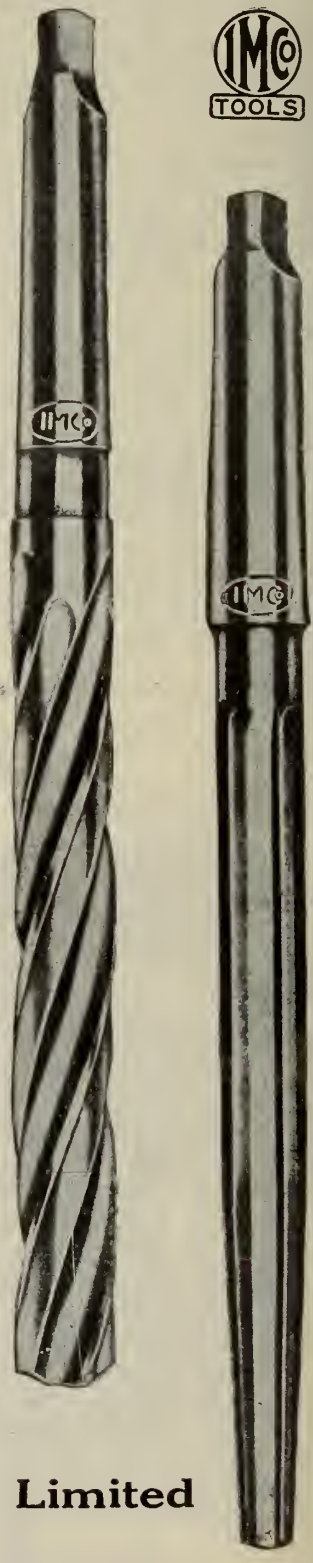
Not careful workmanship alone, nor perfect finish, nor even a great many years' manufacturing experience. Service is the *only* proof—the acid test of the small tool.

In service, as in any other particular, Imco tools may be favorably compared with any on the market.

Imco tools have rapidly established a splendid reputation for endurance, for reliability, for the faculty of cutting keenly and accurately after hard use — in short, for economy.

For the real economy that is measured in dollars and cents by the reduction in factory costs.





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And in tightest corners just as fast. Every head just as smooth. Not a bent shank; not a tool mark on either rivet head or casting.

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handle any rivet up to ¼-in. shank.
If Grant-made, every hard steel rivet is finished as smooth and as true as every rivet of soft brass.
The Grant Book called "Perfect Riveting" tells how to give an extra appearance of quality to your product. For your copy Write to-day.

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We have solved the problem by making our own abrasives, and we are now prepared to guarantee that DOMINION WHEELS will give equal service to the best imported wheels.

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WORKS WELLAND ONT.

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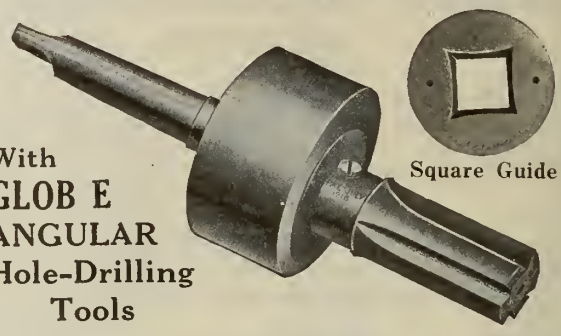

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With GLOB E ANGULAR Hole-Drilling Tools

A GREAT TIME-SAVER

A large number of Canadian manufacturers are profiting by reduced production cost — a direct result of Globe Angular Hole Drilling Tools.

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Globe Engineering Co., Limited
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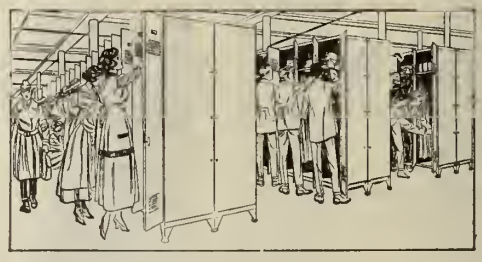
Healthy, Efficient, Contented Employees are an Asset



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Built of high-grade furniture steel, smoothly finished and given successive coats of baked-on enamel in Olive Green (standard), French Grey, Khaki, Corona Green or any other color desired. The name

DENNISTEEL

has come to represent Canada's best in steel lockers, shelving, cabinets, bins, etc.
We have pioneered in this industry and maintain our leadership by uniform excellence of product. Let our Engineering Dept. assist you with plans, detail drawings, estimates, etc. Write for illustrated folders to-day.

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—for a large variety of grinding

if your variety of grinding is large invest in a Manhattan Universal Grinder. It is capable of handling cylindrical or internal grinding with the utmost in speed and accuracy.

Write for details.

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Manhattan All-Around UNIVERSAL TOOL GRINDER

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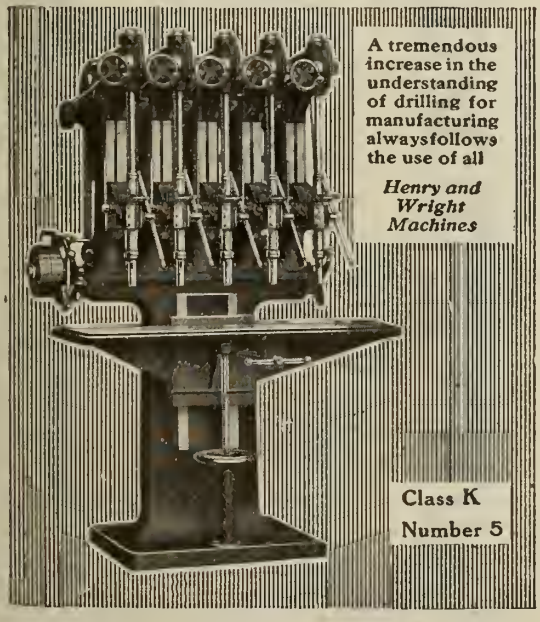
2

HENRY & WRIGHT
Drilling Machines



A tremendous increase in the understanding of drilling for manufacturing always follows the use of all *Henry and Wright Machines*

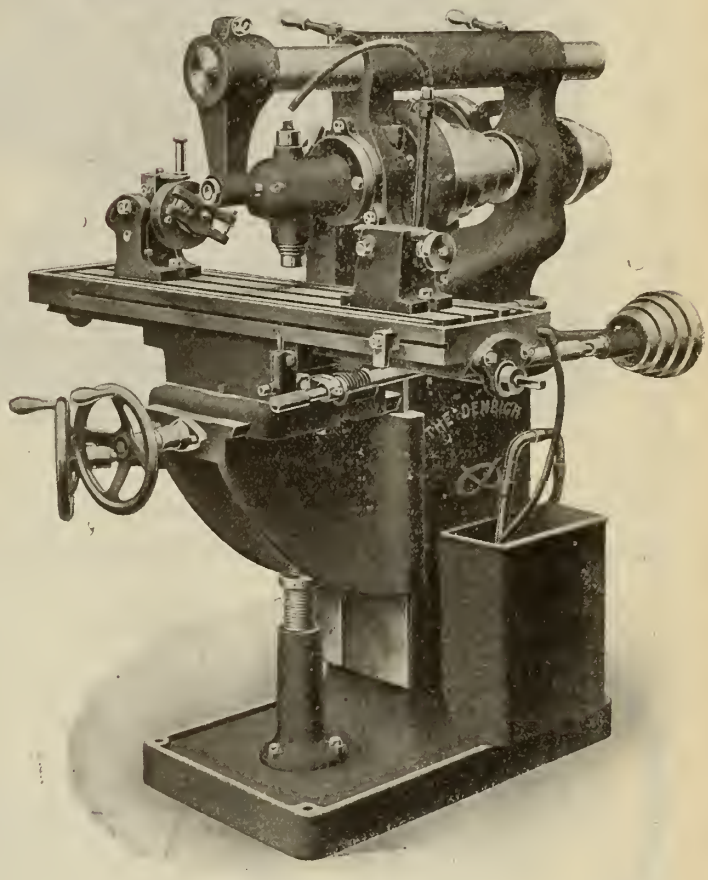
Class K
Number 5

The Henry & Wright Mfg. Co.

Hartford, Conn.

Canadian Fairbanks-Morse Co., Montreal, Toronto, Winnipeg; A. R. Williams Machinery Co., Toronto, St. John, N.B.; H. W. Petrie, Ltd., Toronto; Williams & Wilson, Montreal; Rudel-Belnap Machinery Co., Montreal; Canada Machinery Corp., Galt, Ont.; Geo. F. Foss Machinery & Supply Co., Montreal; General Supply Co., Montreal.

The DENBIGH Famous MANUFACTURING MILLERS



Enormous war demands enabled us to lay down a large and highly co-ordinated organization for the quantity production of Denbigh Manufacturing Millers.

This extensive experience has resulted in machines perfect in design and construction. We are now in a position to place them on the market at a very low price.

Nine types and sizes—to suit any miller requirement—**and the delivery is right.**

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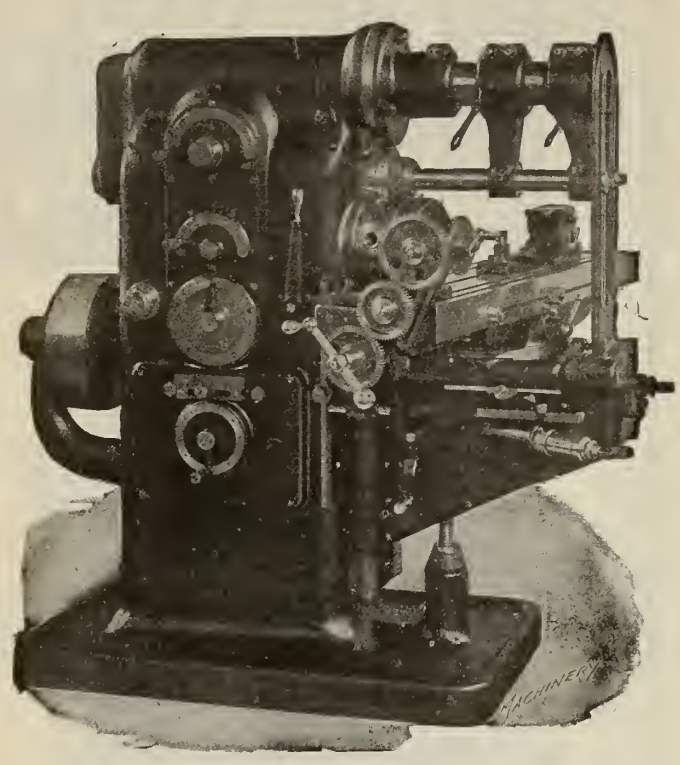
Cables: Athenian, Cannon, London.

For work requiring the utmost accuracy—



ROCKFORD MILLERS

have established an enviable reputation among prominent manufacturers for accuracy, simplicity in construction and ease of operation. That they have been able to do this is credited to the great care exercised in their design, and the high-grade workmanship used in their construction.

All feeds on the Rockford are controlled by one lever — the main spindle is instantly adjustable by a single nut, and the operator can complete a job without leaving the front of his machine. These are a few of the points that have made the Rockford a favorite with the men as well as their employers. We would like to tell you more about these machines. Write us for full information.

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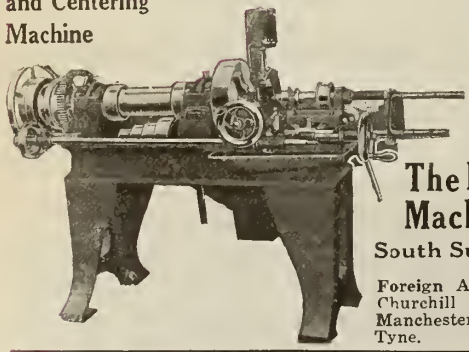
One Cuts Up
Another Cuts Down
and
They Both Cut
At Once

Hurlbut,
Rogers
Cutting-off
and Centering
Machine



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This patented Hurlbut, Rogers Cutting-Off and Centering Machine embodies two cutting-off tools—one cutting up and the other cutting down, each holding the work against the other. What is the result?—**the production is doubled and the cost is cut in half.** Further, the centering operation goes on at the same time. Doesn't this appeal to you as real economy in production? When you are assured of such good-paying results why hesitate to adopt this machine? Soon pays for itself.

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CELOGLAS-LENSES

A Prominent Safety Engineer Says;

"It is not as heavy as the majority of samples submitted. This is in its favor because it is possible to get lenses so heavy that the goggles become burdensome, second I am inclined to think that your lenses come near to the condition of plain glass in that it apparently does not cut down the vision as much as the average non-shatterable lenses."

Every once in a while our offer of a sample Stoco Safety Goggle "on receipt of request on letterhead" results in a letter like the one from which the above is quoted. (The original letter is on file at our office). In fact, if we were not sure that an inspection and trial of the Stoco Safety Goggle would result in unqualified approval, could we afford to make such an offer?

Stoco Safety Goggles
Price per Hundred
(f.o.b. Geneva, N.Y.)

With Celoglas Shatter-Proof lenses $115.00
With extra heavy optical glass lenses 90.00

Discounts for quantity orders.

Black elastic headbands or easy cable temples at same price.

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Eye Safe

Eye Still Safe

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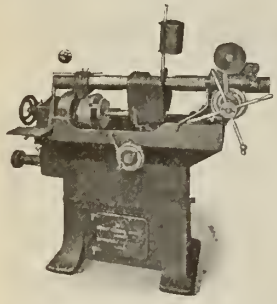

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Precise Accuracy

How often do you obtain these features simultaneously in a machine? The totally different design of the

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allows speedy production day in and day out, to limits as close as .0005 inch. The "2-to-1 accuracy" of the suspended swinging wheelhead and the ganging speed of the semi-autimatic machine make this

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MAXIMUM EFFICIENCY IN BELT LACING

A broken belt won't hold up production long if you repair it with

Patent Steel BRISTOL'S Belt Lacing

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No special tool is required. Simply a hammer and a soft block of wood to drive the sharp, staggered steel prongs through the belt in double rows and to clinch the points. The belt is gripped firmly without danger of cutting or weakening.

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Catalog No. 6.

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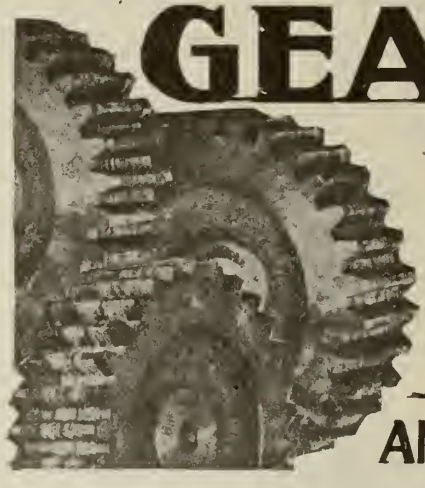

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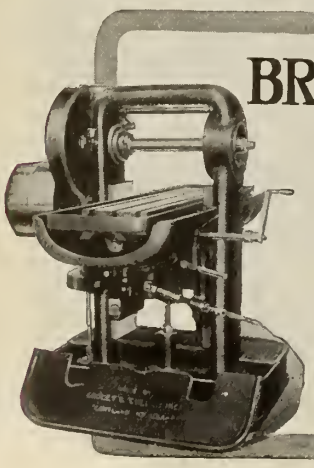

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We should like to show how "Briggs" adaptability and convenience can better output and lower costs for you. Get in touch with us.

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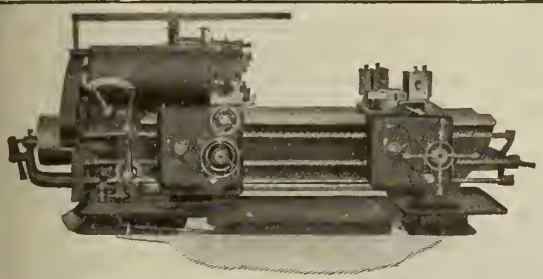

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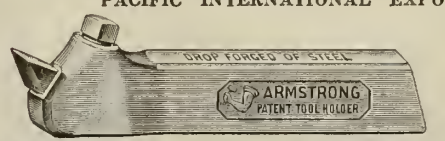

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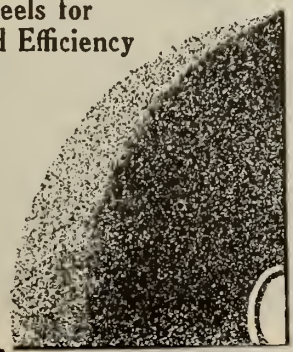

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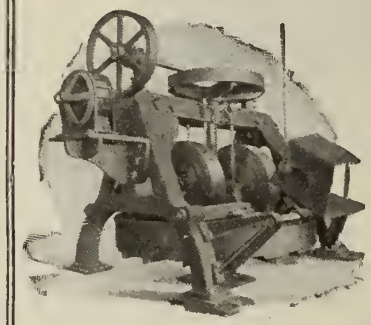

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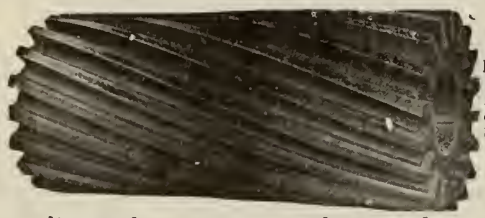

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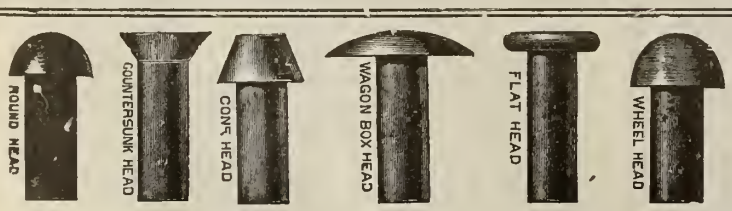

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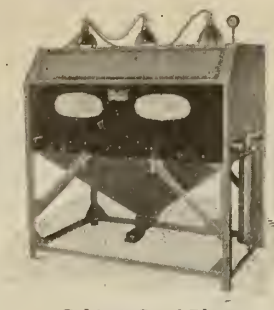

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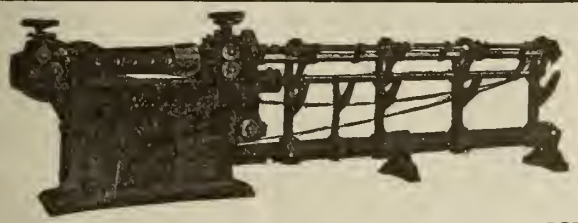

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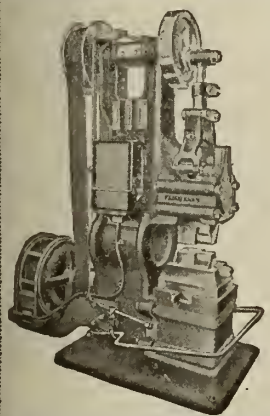

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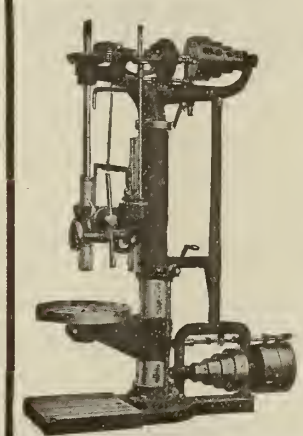

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Aikenhead Hardware Co, Toronto, Ont.
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Morrow Screw & Nut Co., John, Ingersoll.
Peckovers, Ltd., Toronto, Ont.
Rice, Lewis & Son, Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton, Ont.
Williams & Co.,, J. H. Brooklyn, N.Y.

BOLTS, COUPLING
Gast Machine Screw Co., Ltd., Galt, Ont.

BOLTS, STAY
Morrow Screw & Nut Co., John, Ingersoll.

BOLTS, SPRING SHAKLE
Can. Winkley Co., Ltd., Windsor, Ont.
Morrow Screw & Nut Co., John, Ingersoll

BOLTS, PATCH
Morrow Screw & Nut Co., John, Ingersoll.

BOLT AND NUT MACHINERY
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Gardner & Son, Robt., Montreal.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Universal Mach, Co., Bowling Green, O.
Williams Machinery Co., A. R., Toronto

BOLT THREADING MACHINERY
Jardine & Co., Ltd., , B., Hespeler.
Landis Machine Co., W aynesboro, Pa.
National Acme Co., Cleveland, Ohio.
Victor Tool Co., Waynesboro, Pa.

BONDING MACHINES (Electric Railway)
The Lincoln Electric Co., Toronto, Ont.

BORING MACHINES, PNEUMATIC CYLINDER
Cleveland Pneumatic Tool Co., Toronto.
Canadian Fairbanks-Morse Co., Montreal
Can. Ingersoll-Rand Co., Sherbrooke Que
Garlock-Walker Mach. Co., Toronto.

BORING MACHINES, UPRIGHT AND HORIZONTAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto
Oliver Mach'y Co., Grand Rapids, Mich.
Gisholt Machine Co., Madison, Wis.
Hoefer Mfg., Co., Freeport, Ill.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Rockford Drilling Mche. Co, Rockford, Ill

BORING AND TURNING MILLS
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Foss Mch. & S'ply Co., Geo. F., Montreal
Knight Metal Products, Toronto.
Oliver Mach. Co., Grand Rapids, Mich.
Niles-Bement-Pond Co., New York.

BOXES, CAST IRON
Brown & Sharpe Mfg. Co., Providence, R.I.

BOXES, STEEL SHOP AND TOTE
Cleveland Wire Spring Co., Cleveland.

BRAKES
Brown, Boggs & Co., Hamilton, Can.
Electric Steel & Metals, Ltd., Welland.

BRASS—SHEETS, ROLLS, PLATES, and RODS
Brown's Copper and Brass Rolling Mills, New Toronto.

BRASS ALLOYS
British Smelting & Refining Co., Ltd., Montreal, Que.

BRASS AND COPPER TUBING
Lyman Tube & Supply Co., Montreal, Que.

BRASS FOUNDERS
Canada Metal Co., Toronto.
St. Lawrence Welding Co., Montreal.
Tallman Brass & Metal Co., Hamilton.

BRASS GOODS
Crane, Ltd., Montreal, Que.

BRASS PIPE AND TUBE
Crane, Ltd., Montreal, Que.

BRASS WORKING MACHINERY
Barber Mchy. Co., Ltd., Toronto, Ont.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machinery Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Pressed-O-Lite Co., Inc., Toronto, Ont.
Wood Turret Machine Co., Brazil, Ind.
Williams Machy. Co., A. R., Toronto.
Brown's Copper and Brass Rolling Mills, New Toronto.

BRAZING EQUIPMENT
Chicago Flexible Shaft Co., Chicago, Ill.

BRICKS, FIRE
Elk Fire Brick Co., Can., Ltd., Hamilton, Ont.

BRIDGES, RLY. AND HIGHWAY
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.

BRINELL MACHINES
U. S. Ordnance, Toronto, Ont.

BRONZE—SHEETS, ROLLS, PLATES, and RODS
Brown's Copper and Brass Rolling Mills, New Toronto.

BRONZE, NAVAL
Canada Metal Co., Toronto.
Tallman Brass and Metal Co., Hamilton.

BRONZE COPPER
Canada Metal Co., Toronto.

BRUSHES, CARBON
Lyman Tube & Supply Co., Montreal, Que.

BUFFING AND POLISHING MACHINERY
Ford-Smith Mach. Co., Hamilton.
Foss Mchy. & S'ply Co., Geo. F. Montreal
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.

BUCKETS, DUMP
MacKinnon Steel Co., Sherbroooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
St Lawrence Welding Co, Ltd , Montreal

BUCKETS, ELEVATOR
Can. Link-Belt Co., Toronto, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co. Ltd., Montreal

BUCKETS, CLAM SHELL, CRAB, DUMP
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Ltd, Walkerville.
St Lawrence Welding Co, Ltd., Montreal

BULLDOZERS
Bertram & Sons Co., John, Dundas.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.
Williams, White & Co., Moline, Ill.

BURNERS, OIL AND NATURAL GAS
Northern Crane Works, Ltd., Walkerville.
W. S, Rockwell Co., New York, N.Y.

BURRS, IRON AND COPPER
Parmenter & Bulloch Co., Gananoque,.

BUSHINGS, BRONZE
Morrow Screw & Nut Co., John, Ingersoll.
St Lawrence Welding Co, Ltd., Montreal

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R.I.
Pangborn Corporation, Hagerstown, Md.

CABINETS, SAND BLAST
Pangborn Corporation, Hagerstown, Md.

CABLE, ELECTRIC
International Machinery & Supply Co., Ltd., Montreal, Que.

CABLES, TRANSMISSION AND TELEPHONES
Northern Electric Co., Ltd., Montreal.

CALKS, BOOT
Lufkin Rule Co., of Can., Windsor, Ont.

CANNERS' MACHINERY
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Can.

CANNERS' CONVEYORS
Can. Link-Belt Co., Toronto, Ont.

CARBIDE
Union Carbide Co., of Canada, Limited, Weland, nt.

CARBONIZING BOXES
Can. Driver-Harris Co., Ltd., Walkerville
Katie Foundry, Galt, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
Swedish Crucible Steel Co., Windsor.

CARRIERS, PNEUMATIC TUBE
Jones & Glassco, Montreal.

CARS, INDUSTRIAL
Can. Blower & Forge Co., Kitchener, Ont
Can. Fairbanks-Morse Co., Ltd, Montreal
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
St Lawrence Welding Co, Ltd., Montreal

CASES, FILING
Economy Drawing Table Co., Adrian, Mich.

CASTINGS, ALUMINUM, BRASS BRONZE, COPPER, AND GUN METAL
Algoma Steel Corp., Sault Ste. Marie.
Franklin Mfg. Co., Syracuse, N.Y.
Canada Metal Co., Ltd., Toronto, Ont.

CASTINGS, DIE CAST
Canada Metal Co., Ltd., Toronto, Ont.
Franklin Mfg. Co., Syracuse, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Tallman Brass & Metals Ltd., Hamilton, Ont.

CASTINGS. STEEL—ALL KINDS
Can. Elec. Steel Castings, Aurora, Ont.
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Electric Steel & Metals Co., Welland.
Mesta Machine Co., Pittsburgh, Pa.

CASTINGS, ELECTRIC AND ALLOY STEEL
Can. Elec. Castings Co. Ltd., Orillia, Ont
Dominion Foundries & Steel Ltd., Hamilton, Ont.

CARRIERS COUPLING BOLTS
John Morrow Screw & Nut Co., Ingersoll
Alexander Fleck Ltd., Ottawa.
Greenleafs Ltd., Bellaville, Ont.
St. Lawrence Welding Co., Montreal.
Tallman Brass & Metal Co., Hamilton.

CASTINGS, BENCH LEG.
Brown & Sharpe Mfg. Co., Providence, R.I.

CASTINGS, BRASS AND IRON
Algoma Steel Corp., Sault Ste. Marie.
International Machinery and Supply Co., Ltd., Montreal, Que.

CASTINGS, BUILDING
Katie Foundry, Galt. Ont.

CASTINGS, GRAY IRON
Bernard Industrial Co., A., Fortierville, Q.
Brown & Sharpe Mfg. Co., Providence, R.I.
Brown, Boggs Co., Ltd., Hamilton.
Can. Elec. Castings Co, Ltd., Orillia, Ont
Alexander Fleck, Ltd., Ottawa.
Gardner & Son, Robt., Montreal.
Hull Iron & Steel Foundries, Ltd., Hull
International Malleable Iron Co., Guelph
Kennedy & Sons, Ltd., Wm., Owen Sound.
Katie Foundry, Ltd., Galt, Ont.
Hamilton Co., Wm., Peterboro.

CASTINGS, PLUMBERS'
Katie Foundry, Galt, Ont.

CASTINGS, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville

CASTINGS, HARDWARE
Katie Foundry, Galt, Ont.

CASTINGS, STEEL CHROME AND MANGANESE STEEL
Thos. Davidson Mfg. Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hull Iron & Steel Foundries, Ltd., Hull.
Kennedy & Sons, Ltd, Owen Sound.

CASTINGS, MALLEABLE
International Malleable Iron Co., Guelph

CASTINGS, NICKEL STEEL
Hull Iron & Steel Foundries, Ltd., Hull.

CEMENT, ELASTIC, IRON AND FURNACE
Warminton Co., J. N., Montreal.

CEMENT MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gardner, Robt., & Son, Montreal.

CEMENT HANDLING MACHINERY
Can. Link-Belt Co., Toronto, Ont.

CEMENT TOOLS
Atkins & Co., E. C., Hamilton, Ont.

CENTERING MACHINES
Victoria Foundry Co., Ottawa, Ont.

CENTRE REAMERS
Bertram & Sons Co., John, Dundas.
Butterfield & Co., Inc., Rock Island, Que.
Gardner, Robt. & Son, Montreal.
Hurlburt, Rogers Mch. Co., South Sudbury, Mass.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co., of Canada, Galt, Ont.

CHAIN, WELDED COIL
Morris Crane & Hoist Co., Herbert, Niagara Falls. Ont.

CHAIN BLOCKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford Chain Block & Mfg. Co., Phila., Pa.
Garlock-Walker Machy. Co., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & HoistCo., Herbert, Niagara Falls, Ont.
Oliver Engineering Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Jones & Glassco, Montreal, Que.

CHAINS, AGRICULTURAL
Morse Chain Co., Ithaca, New York.

CHAINS, AUTOMOBILE ENGINE
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.

CHAINS, BICYCLE, DRIVE AND BLOCK
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAINS, FOR ELEVATORS AND CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAIN, MALLEABLE, DETACHABLE AND RIVETED
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAINS, POWER TRANSMISSION
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, New York.
Glasgow, N.S.

CHAINS, SPROCKET WHEEL
Can. Link-Belt Co., Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAIN DRIVES
Can. Link-Belt Co., Toronto, Ont.
Coventry Chain Co., Coventry, England.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHASERS
National Acme Co., Cleveland, Ohio.
Taylor, J. A. M., 313 Stair Bldg., Toronto, Ont.

CHEMISTS
Toronto Testing Lab'tory, Ltd., Toronto

CHUCKS, AERO, AUTOMATIC
Garvin Machine Co., New York.

CHUCKS, CENTERING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKS, COLLET, AIR
Elliott & Whitehall Mach. & Tool Co. Galt, Ont.
Smalley-General Co., Inc., Bay City, Mich.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, LATHE AND UNIVERSAL
Aikenhead Hardware Co., Toronto, Ont.
Almond Mfg. Co., Ashburnham, Mass.
Bertram & Sons Co., John, Dundas.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt., & Son, Montreal.
Garlock-Walker Mach'y Co., Toronto.
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Chicago, Ill.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Jacobs Mfg. Co., Hartford, Conn.
Ker & Goodwin Machine Co., Ltd.
Knight Metal Products, Toronto.
Modern Tool Co., Erie, Pa.
Rice Lewis & Son, Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, AUTOMATIC AND KEYLESS
Aikenhead Hardware Co., Toronto, Ont
Can. Blower & Forge Co., Kitchener.

CHUCKS, FRICTION AND TAP
Victor Tool Co., Waynesboro, Pa.

CHUCKS, MACHINE MILLING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKS, MAGNETIC
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

CHUCKS, RING WHEEL
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.

CHUCKS, WHEEL, CAR
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKING MACHINES
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Windsor, Vt.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Wood Turret Mach. Co., Brazil, Ind.
Williams Mchy Co., A. R., Toronto, Ont.

CIRCULATING SYSTEMS FOR LUBRICATING OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

CLAMPS, BELT
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CLAY FIRE
Elk Fire Brick Co., Can., Ltd., Hamilton, Ont.

CLEANERS, METER, WASTE, GENERAL
Oakley Chemical Co., New York, N.Y.

CLEANING COMPOUND
Oakley Chemical Co., New York.

CLOCK SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

CLOCKS, WATCHMAN, PORTABLE
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Inc., Chicago, Ill.

CLOSETS
Crane, Ltd., Montreal, Que.

CLUTCHES, CHAIN
Wright Mfg. Co., Lisbon, Ohio.

CLUTCHES, FRICTION AND PULLEY
Bernard Industrial Co., A., Fortierville, Q.
Can. Link-Belt Co., Toronto, Ont.
Carlyle Johnson Mach. Co., Manchester, Conn.
Positive Clutch & Pulley Wks., Aurora, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.

COAL CRUSHERS
Canadian Mead-Morrison Co., Limited, Montreal, Que.

COAL HANDLING MACHINERY
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Nova Scotia Steel & Coal Co., New

Appearance
High finish and clean cut graduations are the factors that have made
Brown & Sharpe
Machinists Tools
the choice of three generations.

Brown & Sharpe Mfg. Co.
Providence R.I.U.S.A.

If interested tear out this page and place with letters to be answered

COLD ROLLED STRIP, ALL METAL
Can. Driver-Harris Co., Ltd., Walkerville.
Williams & Co., J. H., Brooklyn, N.Y.

COLLARS, SHAFTING
Can. Blower & Forge Co., Kitchener.
Sturtevant Co., B. F., Galt, Ont.

COLLETS
Becker Milling Machine Co., Boston.
Hardinge Bros., Inc., Chicago, Ill.

COLLECTORS, PNEUMATIC
Can. Blower & Forge Co., Kitchener.
Sturtevant Co., B. F., Galt, Ont.

COMPOSITION INGOT
Canada Metal Co., Toronto, Ont.

COMPOUNDS, CUTTING AND GRINDING, DRAWING, STAMPING
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR
Atkins & Co., E. C., Hamilton, Ont.
Can. Ingersoll-Rand Co., Sherbrooke.
Cleveland Pneumatic Tool Co., Toronto.
Curtis Pneumatic Machy. Co., St. Louis.
Elliott & Whitehall, Galt, Ont.
Garlock-Walker Machy. Co., Toronto.
MacGovern & Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Superior Machinery Co., London, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

CONDENSERS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
MacGovern & Co., Montreal, Que.
Smalley-General Co., Inc., Bay City, Mich.

CONDUITS
Northern Electric Co., Ltd., Montreal Que

CONNECTING RODS
Canada Found's & Forgings, Ltd., Welland, Ont.

CONTRACTORS' HOISTS
Canadian Mead-Morrison Co., Limited, Montreal, Que.

CONTRACT WORK
Brown Engineering Corp., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.
Globe Engineering Co., Hamilton, Ont.
Homer & Wilson, Hamilton, Ont.
Katie Foundry, Ltd., Galt, Ont.
St. Lawrence Welding Co., Montreal.
Victoria Foundry Co., Ottawa.

CONTROLLERS, MAGNETIC BRAKES, ELEC. WINCHES, MONO RAIL HOISTS
Volta Mfg. Co., Welland, Ont.

CONTROLLERS AND STARTERS
Williams Mach'y Co., A. R., Toronto.

CONTROLLING INSTRUMENTS
Taylor Instrument Co., Rochester, N.Y.

CONVERTERS, ROTARY
MacGovern & Co., Montreal, Que.
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.

CONVEYORS—McCASLIN GRAVITY BUCKET
Canadian Mead-Morrison Co., Limited, Montreal, Que.

COOLERS, WITH DRINKING FOUNTAINS
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

COPING MACHINES
Bertram & Sons Co., John, Dundas, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Can. Blower & Forge Co., Kitchener.

COPPER, BUS BAR, SHEET, PATES, RODS
British Smelting & Refining Co., Ltd., Montreal, Que.
Brown's Copper and Brass Rolling Mills, New Toronto.
Brown's Copper and Brass Rolling Mills, New Toronto.

CORE OIL
Swan & Finch, Inc., 165 Broadway.

COUNTERBORES AND COUNTERSINKS
Aikenhead Hardware Co., Toronto, Ont.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.

COUNTERSHAFTS
Almond Mfg. Co., Ashburnham, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Gray Ball Bearing Co., Ltd., Toronto.
Baird Machine Co., Bridgeport, Conn.
Ford-Smith Machine Co., Hamilton, Ont.
Foster Machine Co., Elkhart, Ind.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams Mchy Co., A. R., Toronto, Ont.

COUPLINGS, FRICTION
Bernard Industrial Co., The A., Fortierville, Que.
Can. Link-Belt Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

COUPLINGS, RAPID HOSE
Int. Machinery & Supply Co., Ltd., Montreal, Que.

COILING MACHINERY, WIRE AND SPRING
Garlock-Walker Machinery Co., Toronto.

COKE AND COAL
Hanna & Co., M. A., Cleveland, O.

COUPLINGS PLAIN, FLEXIBLE AND CUT OFF
Cleveland Pneumatic Tool Co., of Canada, Toronto.
Gardner, Robt. & Son, Montreal.
Independent Pneumatic Tool Co., Chicago

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.
Northern Crane Works, Walkerville.

CRANES, OVERHEAD, HAND AND ELECTRIC
Volta Manufacturing Co., Welland, Ont.

CUPS, OIL
Can. Winkley Co., Ltd., Windsor, Ont.

COVERS, OIL HOLE
Can. Winkley Co., Ltd., Windsor, Ont.

CRANES, GANTRY
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.

CRANE RUNWAYS
MacKinnon Steel Co., Sherbrooke, Que.

CRANES, JIB
Brown Hoisting Machinery Co., Cleveland, Ohio.

CRANES, LOCOMOTIVE
Brown Hoisting Machinery Co., Cleveland, Ohio.

CRANES, GOLIATH, PNEUMATIC AND PORTABLE
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Morris Crane and Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Petrie, Ltd., H. W., Toronto.

CRANES, PILLAR
Brown Hoisting Machinery Co., Cleveland, Ohio.

CRANES, TRAVELLING, ELECTRIC AND HAND POWER
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Machy. Co., St. Louis.
Dominion Bridge Co., Montreal.
Hepburn, John T., Ltd., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Niles-Bement-Pond Co., New York.
Northern Crane Works, Walkerville.
Oliver Engineering Co., Montreal.

CRANK SHAFTS
Canada Found's & Forgings Ltd., Welland
Williams & Co., J. H., Brooklyn, N.Y.

CRANES, PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CRIMPS, LEATHER
Graton & Knight Mfg. Co., Worcester, Mass.

CRUSHERS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Elec. Steel & Metals, Welland, Ont.

CUPOLAS
Can. Blower & Forge Co., Kitchener.
Northern Crane Works, Walkerville.

CURB PUMPS FOR OIL, GASOLINE
Bowser Co., Ltd., S. F., Toronto, Ont.

CURRENT TRANSFORMERS
Volta Manufacturing Co., Welland, Ont.

CUT-OFF COUPLINGS, FRICTION
Petrie, Ltd., H. W., Toronto.

CUTTERS, BOLT
See Bolt Cutters.

CUTTERS, GEARS
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Fellows Gear Shaper Co., Springfield, Vt.

CUTTERS, FLUE
Cleveland Pneumatic Tool Co., Toronto.

CUTTER HEADS
Oliver Machinery Co. Grand Rapids, Mich

CUTTERS, PIPE (See Pipe Cutters)

CUTTERS, MILLING
Becker Milling Mach. Co., Boston, Mass.
Boker & Co., Inc., H., Montreal, Que.
Butterfield & Co., Rock Island, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cleveland Twist Drill Co., Cleveland.
Davidson Tool Mfg. Co., New York, N.Y.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Illinois Tool Works, Chicago, Ill.
Ingersoll Machc. Co., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Whitney Mfg. Co., Hartford, Conn.
Wilt Twist Drill Co., Walkerville, Ont.

CUTTER RELIEVING MACHINES
Cleveland Milling Machine Co., Cleveland.

CUTTING-OFF MACHINES
Armstrong Bros., Tool Co., Chicago.
Atkins & Co., E. C., Hamilton, Ont.
Bertram & Sons Co., John, Dundas.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Foss Mchy & S'ply Co., Geo. F., Montreal
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield, Mass
Hurlburt, Rogers Machy. Co., South Sudbury, Mass.
Hall & Sons, John H., Brantford, Ont.
Kennedy & Sons, Wm., Owen Sound.
Lyman Tube & Supply Co., Montreal, Que.
Niles-Bement-Pond Co., New York, N.Y.
Prest-O-Lite Co., Inc., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Tabor Mfg. Co., Philadelphia, Pa.
Wells Bros. of Can., Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

CUTTING COMPOUND AND CUTTING OIL
Cataract Refining Co., Ltd., Toronto.
Swan & Finch, Inc., New York.

CUTTING OIL, RECLAIMING SYSTEM
Bowser Co., Ltd., S. F., Toronto, Ont.

CUTTING AND WELDING PLANTS
Davis-Bournonville Co., Jersey City, N.J.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

CYANIDE AND LEAD BATH POTS
Swedish Crucible Steel Co., Windsor.

CYLINDERS, AIR
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Smalley General Co., Inc., Bay City, Mich

CYLINDERS, AUTOMATIC REBORING JIGS AND REAMERS
Kelley Reamer Co., Cleveland, O.

DEHUMIDIFYING
B. F. Sturtevant Co, Galt, Ont.

DERRICKS
Aikenhead Hardware Co., Toronto, Ont.
Dominion Bridge Co., Montreal.
Hepburn Co., Ltd., J. T., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

DERRICK HOISTS
Canadian Mead-Morrison Co., Limited, Montreal, Que.

DIAMOND (BORTZ)
Furniss, Clarke & Co., Montreal, Que.

DIAMOND TOOLS
Ford-Smith Machine Co., Hamilton, Ont.
Furniss, Clarke & Co., Montreal, Que.
Joyce-Koebel Co., Inc., New York City.
Wheel Trueing Tool Co., Detroit.
Petrie, Ltd., H. W., Toronto.

DIAMONDS, CARBON AND BORTZ
Wheel Trueing Tool Co., Detroit.

DIAMONDS, BLACK AND ROUGH
Joyce, Koebel & Co., Inc., New York.
Wheel Trueing Tool Co. Windsor, Ont.

DIE CASTINGS
Fisher Motor Co., Ltd., Orillia, Ont.
Tallman Brass & Metals Ltd., Hamilton, Ont.

DIES, CUTTING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

DIE HEADS, AUTOMATIC
Greenfield Tap & Die Corp., Greenfield Mass.
Wells Bros. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.

DIES, BRASS PRINTING, EMBOSSING AND LETTERING
Matthews, Jas. H., & Co., Pittsburgh, Pa

DIES FOR BIT BRACE USE
Butterfield & Co., Rock Island, Que.
Crescent Mche. Co., Ltd., Montreal, P.Q.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Wells Brothers Co., of Canada, Galt.

DIES AND DIE STOCKS
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Rock Island, Que.
Brown, Boggs Co., Hamilton, Ont.
Crescent Mche. Co., Ltd., Montreal, P.Q.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt. & Son, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Jones & Lamson, Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.
Marshall, Son & Bunney, Toronto.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Rickert-Shafer Co., Erie, Pa.
Stoll Co., Inc., D. H., Buffalo, N.Y.
U. S. Ordnance, Toronto, Ont.
Wells Brothers of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DIES, HAMMERED
Kimber & Hillier Mfg., Co., St. Catharines, Ont.

DIES, DROP FORGE.
Kimber & Hillier Mfg., Co., St. Catharines, Ont.

DIES, METAL STAMPING
Crescent Mche. Co., Ltd., Montreal, P.Q.
Elliott & Whitehall, Galt, Ont.

DIES, PIPE THREADING
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Crescent Mche. Co., Ltd., Montreal, P.Q.
Landis Machine Co., Waynesboro, Pa.

DIES, THREADING
Butterfield & Co., Inc., Rock Island, Que.
Crescent Machine Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

DIE SINKERS
Becker Milling Machine Co., Boston
Garvin Machine Co., New York.
Jackson Machine Tool Co, Jackson, Mich.
Kimber & Hillier Mfg., Co., St. Catharines, Ont.
Pratt & Whitney Co., Dundas, Ont.
Walcott Lathe Co., Jackson, Mich

DIES FOR MACHINES
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Rock Island, Que.
Firth & Sons, Thos., Montreal, Que.
Landis Machine Co., Waynesboro, Pa.
Wells Brothers Co. of Canada, Galt.

DIE HEADS
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Canada, Galt, Ont.

DIES, SELF-OPENING
Geometric Tool Co., New Haven.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Wells Brothers Co. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.

DIE FILING MACHINES
Oliver Mach. Co., Grand Rapids, Mich.

DIE STEEL, HOT AND COLD WORK
Armstrong-Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.
Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.

DIES FOR SCREW PLATES
Butterfield & Co., Inc., Rock Island, Que.
Wells Bros. Co. of Can., Galt, Ont.

DIES, SHEET METAL WORKING
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada
Globe Engineering Co., Hamilton, Ont.
Stoll Co., D. H., Buffalo, N.Y.

DIES, SCREW AND THREAD
Butterfield & Co., Rock Island, Que.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
National-Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros., Co., of Can., Galt, Ont

DISCS, LEATHER, STEEL
Graton & Knight Mfg. Co., Worcester, Mass.
Swedish Steel & Importing Co., Montreal.

DIRECT CONNECTED UNITS
MacGovern & Co., Montreal, Que.

DRAFT, MECHANICAL
Butterfield & Co., Rock Island, Que.
Can. Blower & Forge Co., Kitchener.
A. B. Jardine & Co., Hespeler, Ont.
Pratt & Whitney Co., Dundas, Ont.
Sturtevant Co., B. F., Galt, Ont.

DRAINAGE FITTINGS
Crane, Ltd., Montreal, Que.

DRAWING INSTRUMENTS
Hughes, Owens Co., Ltd., Montreal, Que.

DRAWING OFFICE SUPPLIES
Hughes, Owens Co., Ltd., Montreal, Que.

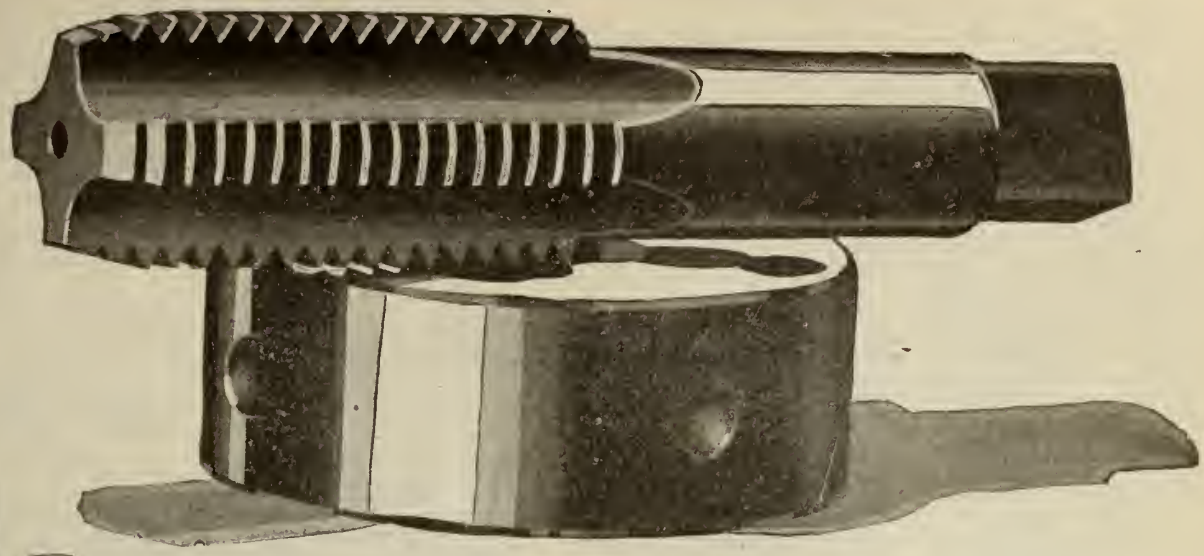
DRESSERS, GRINDING AND EMERY WHEEL
Atkins & Co., E. C., Hamilton, Ont.
Can. Desmond-Stephan Mfg. Co., Hamilton
Dominion Abrasive Co., Ltd., Mimico, Ont.
Petrie, Ltd., H. W., Toronto.
Wheel Trueing Tool Co., Windsor, Ont.

DRILL PRESSES
Aurora Tool Works, Aurora, Ind.
Barber Mchy. Co., Ltd., Toronto, Ont.
W. F. & John Barnes Co., Rockford.
Can. Blower & Forge Co., Kitchener.
Canada Machinery Corp., Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
U. S. Mach. Tool Co., Cincinnati, Ohio.
A. R. Williams Machinery Co., Toronto.

DRILL RODS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Kayser-Ellison & Co., Ltd., Montreal.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
Marshall, Son & Bunney, Toronto.
Swedish Steel & Importing Co., Ltd., Montreal.

DRILLING MACHINES, GANG
Barnes, W. F. & John, Co., Rockford, Ill.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bilton Mach. Tool Co., Bridgeport, Conn
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Silver Mfg. Co., Salem, Ohio.

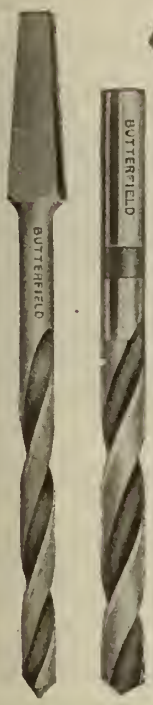
DRILLING MACHINES, LOCOMOTIVE AND MULTIPLE SPINDLE
Barber Mchy. Co., Ltd., Toronto, Ont.
John Bertram & Sons Co., Dundas.
Bilton Mach. Tool Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal
Garlock-Walker Mach. Co., Toronto.
Garvin Machine Co., New York.
Hoefer Mfg., Co., Freeport, Ill.
Henry & Wright Mfg. Co., Hartford, Conn
A. B. Jardine & Co., Hespeler, Ont.
Landis Tool Co., Waynesboro, Pa.
Nat. Automatic Tool Co., Richmond, Ind.
Niles-Bement-Pond Co., New York.
Rockford Drilling Mach Co., Rockford, Ill.



Quality Tools

The BUTTERFIELD Line of

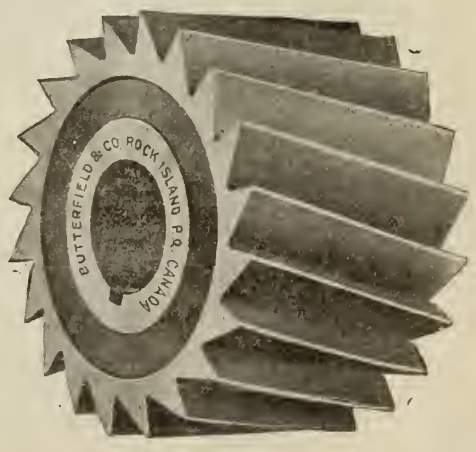
TAPS, DIES, DRILLS, REAMERS AND MILLING CUTTERS



enjoys a reputation for unexcelled quality. A reputation built up by the unusual durability and long life at the highest efficiency.

BUTTERFIELD & CO., Inc.

Rock Island, Quebec



If interested tear out this page and place with letters to be answered

DRILLING MACHINES, RADIAL AND TURRET
Barber Mchy. Co., Ltd., Toronto, Ont.
John Bertram & Sons Co., Dundas.
Canadian Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Henry & Wright Mfg. Co., Hartford.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLING MACHINES, SENSITIVE
Barber Mchy. Co., Ltd., Toronto, Ont.
Bilton Mach. Tool Co., Bridgeport, Conn.
W. F. & John Barnes Co., Rockford, Ill.
Canadian Fairbanks-Morse Co., Montreal.
Canadian Machinery Corp., Galt, Ont.
Geo. F. Foss Mch. & S'ply Co., Montreal
Garlock-Walker Mach. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
United States Mach. Tool Co., Cincinnati
Williams Mchy Co., A. R., Toronto, Ont.

DRILLING MACHINES, UPRIGHT AND HORIZONTAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Aurora Tool Works, Aurora, Ind.
John Bertram & Sons Co., Dundas.
Garlock-Walker Mach. Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener.
Canada Mach. Corp., Galt, Ont.
Garvin Machine Co., New York.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mach. Co., Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
A. B. Jardine & Co., Hespeler, Ont.
Knight Metal Products, Toronto.
Landis Tool Co., Waynesboro, Pa.
R. McDougall Co., Galt.
Nat. Automatic Tool Co., Richmond, Ind.
Rockford Drilling Mach. Co., Rockford, Ill.
Niles-Bement-Pond Co., New York.
Silver Mfg. Co., Salem, Ohio.
U. S. Ordnance, Toronto, Ont.
A. R. Williams Machinery Co., Toronto.

DRILLING MACHINES, SPECIAL
Hoefer Mfg. Co., Freeport, Ill.

DRILLING POSTS
Aikenhead Hardware Co., Toronto, Ont.
Keystone Mfg. Co., Buffalo, N.Y.
Rice Lewis & Son, Toronto, Ont.
Silver Mfg. Co., Salem, Ohio.

DRILLS, BENCH
Aikenhead Hardware Co., Toronto.
W. F. & John Barnes Co., Rockford, Ill.
Can. Blower & Forge Co., Kitchener.
Can. Fairbanks-Morse Co., Montreal.
Geo. F. Foss Mch. & S'ply Co., Montreal
Garlock-Walker Machinery Co., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

DRILLS, CENTRE
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto.
Rice Lewis & Son, Toronto, Ont.
Wilt Twist Drill Co., of Can., Walkerville

DRILLS, BLACKSMITH AND BIT STOCK
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Can. Blower & Forge Co., Kitchener.
Cleveland Twist Drill Co., Cleveland.
Geo. F. Foss Mch. & S'ply Co., Montreal
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.
Whitman & Barnes Mfg. Co., Akron, O.
Wilkinson & Kompass, Hamilton, Ont.
Wilt Twist Drill Co. of Can., Walkerville

DRILLS, CARBON
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Marshall, Son & Bunney, Toronto.
John Morrow Screw & Nut Co., Ingersoll

DRILLS, ELECTRIC, PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener.
Cincinnati Electrical Tool Co., Cincinnati
Geo. F. Foss Mch. & S'ply Co., Montreal
Haskins Co., R. C., Chicago, Ill.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Pilot Steel & Tool Co., Montreal, Que.
Prest-O-Lite Co., Inc., Toronto, Ont.
U. S. Electrical Tool Co., Cincinnati, O.
A. R. Williams Mach. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLS, HAMMER
Samuel Osborne, Ltd., Montreal, P.Q.

DRILLS, EMERY
Garlock-Walker Mach. Co., Toronto, Ont.

DRILLS, HIGH SPEED TWIST
Aikenhead Hardware Co., Toronto, Ont.
Armstrong-Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Canadian Fairbanks-Morse Co., Montreal
H. A. Drury Co., Montreal.
Geo. F. Foss Mch. & S'ply Co. Montreal
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
W. F. & John Barnes Co., Rockford, Ill
Osborne, Samuel, Montreal, P.Q.
Plewes, Ltd., Winnipeg, Man.
Pratt & Whitney Co., Dundas, Ont.
Petrie, H. W. Toronto.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Taylor J. A. M., Stair Bldg., Toronto.
Wilt Twist Drill Co. of Can., Walkerville
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLS, OIL TUBE
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

DRILLS, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Williams Mchy Co, Ltd., A. R., Montreal
Greenfield Tap & Die Corp., Greenfield, Mass.

DRILLS, PNEUMATIC CORNER
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.

DRILLS, RATCHET AND HAND
Aikenhead Hardware Co., Toronto, Ont.
Armstrong Bros. Tool Co., Chicago, Ill.
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cincinnati Electrical Tool Co., Cincinnati.
Cleveland Twist Drill Co., Cleveland.
Garlock-Walker Mchy. Co., Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilt Twist Drill Co. of Can., Walkerville.

DRILLS, ROCK
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
The Foss Mchy. & Supply Co., Montreal.
Samuel Osborne Ltd., Montreal, P.Q.
A. R. Williams Machy. Co., Toronto.

DRILLS, SQUARE & HEXAGON
Globe Engineering Co.

DRILLS, TRACK
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
The Foss Mchy. & Supply Co., Montreal.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Wilt Twist Drill Co. of Can., Walkerville.

DRINKING FOUNTAINS, SANITARY
Crane, Ltd., Montreal, Que.
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

DRIVES, CHAIN
See Belting, Chain.

DRIVING TOOLS
The Thos. Pink Co., Ltd., Pembroke, Ont.

DRY CLEANING SYSTEM
Bowser Co., Ltd., S. F., Toronto, Ont.

DRYERS, SAND
Lyman Tube & Supply Co., Montreal, Que.
Pangborn Corporation, Hagerstown, Md.

DRYING APPLIANCES
Baird Machine Co., Bridgeport, Conn.
Sturtevant Co., B. F., Galt, Ont.
W. S. Rockwell Co., New York, N.Y.

DRUM CONTROLS
Volta Manufacturing Co., Welland, Ont.

DUMP CARS
Canadian Fairbanks-Morse Co., Montreal
MacKinnon Steel Co., Sherbrooke, Que.
St Lawrence Welding Co, Ltd., Montreal

DUST EXHAUSTER. ARRESTER SYSTEM
Pangborn Corporation, Hagerstown, Md.

DUST HANDLING EQUIPMENT
Pangborn Corporation, Hagerstown, Md.
Sturtevant Co., B. F., Galt, Ont.

DUST SEPARATORS
Can. Blower & Forge Co., Kitchener, Ont.
Sturtevant Co., B. F., Galt, Ont.

DYNAMOS AND ELECTRICAL SUPPLIES
Canadian Fairbanks-Morse Co., Montreal.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
MacGovern & Co., Montreal, Que.
A. R. Williams Machy. Co., Toronto.

ELECTRICAL SUPPLIES
Can. General Electric Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Northern Electric Co., Ltd., Montreal Que

ELECTRIC FURNACES
Electric Furnace Construction Co., Philadelphia, Pa.
Hamilton & Hansell, Inc., New York City
Volta Manufacturing Co., Welland, Ont.

EECTRIC FURNACE REGULATORS, WINCHES, ROOF COOLERS AND ELECTRODE HOLDERS
Volta Manufacturing Co., Welland, Ont.

ELECTRICAL RESISTANCE MATERIALS, NICHROME, KROMORE, CHROMAX, CLIMAX, NICKEL, SILVER, ADVANCE.
Can. Driver-Harris Co., Walkerville, Ont.

ELECTRIC HOISTS, STATIONARY AND MONO RAIL
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Volta Manufacturing Co., Welland, Ont.

ELECTRIC MOTORS
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
Sturtevant Co., B. F., Galt, Ont.
Volta Mannfacturing Co., Welland, Ont.

ELECTRIC TRUCKS
Cowan Truck Co., Holyoke, Mass.
Goad Engineering Co., Toronto, Ont.

ELEVATOR, ENCLOSURES
Volta Mfg. Co., Welland, Ont.
Canada Wire & Iron Goods Co., Hamilton

ELEVATOR WEIGHTS
Katie Foundry, Galt, Ont.

ELEVATORS AND BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Machy. Co., St. Louis.

ELEVATING AND CONVEYING MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Petrie, Ltd., H. W., Toronto.

EMBOSSING PRESSES
Dom. Steel Products Co., Ltd., Brantford.
Oliver Machinery Co., Grand Rapids, Mich

EMERY GRINDERS (PNEUMATIC)
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.

EMERY CLOTH
Atkins & Co., E. C., Hamilton, Ont.
Atkins & Co., E. C., Hamilton, Ont.
H. H. Barton & Son Co, Philadelphia, Pa
Wausite Abrasives Co., Chicago, Ill.

EMERY PAPER
Atkins & Co., E. C., Hamilton, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Wausan Abrasives Co., Cbicago, Ill.

EMERY AND EMERY WHEELS
Atkins & Co., E. C., Hamilton, Ont.
Brantford Emery Wheel Co., Brantford, Canada.
The Foss Mchy. & Supply Co., Montreal.
Garvin Machine Co., New York.
Canadian Fairbanks-Morse Co., Montreal.
Canada Emery Wheels Co., Hamilton.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Wilkinson & Kompass, Hamilton, Ont.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.

ENAMELWARE
Crane, Ltd., Montreal, Que.

EMERY WHEEL DRESSINGS
Dominion Abrasive Co., Ltd., Mimico, Ont.
Wheel Trueing Tool Co., Windsor Ont.

END MILLS
John Morrow Screw & Nut Co., Ingersoll

ENGINEERS—INDUSTRIAL CLEANING (Free Consultation)
Oakley Chemical Co., New York, N.Y.

ENGINEERS
Samuel Osborne (Canada) Ltd., Montreal.

ENGINES—HOISTING, PILE DRIVING, BRIDGE ERECTING, MINING
Canadian Mead-Morrison Co., Limited, Montreal, Que.

ENGINES, STEAM, GAS, GASOLINE
Furniss, Clarke & Co., Montreal, Que.
Canadian Fairbanks-Morse Co., Montreal.
Johnson Mach. Co., Carlyle, Manchester, Conn.
MacGovern & Co., Montreal, Que.
Sturtevant Co., B. F., Galt, Ont.

ENGINES, HORIZONTAL AND VERTICAL
Johnson Mach. Co., Carlyle, Manchester, Conn.
A. R. Williams Machy. Co., Toronto.
Petrie, Ltd., H. W., Toronto.

ENGINES, OIL
Ker & Goodwin Machine Co., Ltd., Brantford, Ont.

ENGINES, HEAVY OIL, DIESEL TYPE
Dom. Steel Products Co., Ltd., Brantford

ENGINES, MARINE
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Sturtevant Co., B. F., Galt, Ont.

ESCUTCHEON PINS
Parmenter & Bulloch, Gananoque, Ont.

EXHAUST HEADS AND HOODS
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Sturtevant Co., B. F., Galt, Ont.

EXHAUSTERS
Can. Blower & Forge Co., Kitchener, Ont.
Pangborn Corporation, Hagerstown, Md.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
St Lawrence Welding Co, Ltd., Montreal

EXTRACTORS, TAP
Walton Co., The, Hartford, Conn.

EYE BOLTS AND NUTS
Can. Foundries & Forgings, Ltd., Welland, Ont.

EYE PROTECTORS
Standard Optical Co., Geneva, N.Y.
Strong, Kennard & Nutt Co., Cleveland.
Willson & Co., Inc., T. A., Reading, Pa.

FACTORY GATES
Page Steel & Wire Co., Adrian, Mich.

FACTORY LOCATIONS
City of St. Johns, Quebec.

FACTORY SITES
City of St. Johns, Quebec.

FANS
Baird Machine Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont.
Sturtevant Co., B. F., Galt, Ont.
Sheldons, Ltd., Galt, Ont.

FENCING, WIRE
Page Steel & Wire Co., New York, N.Y.

FENCE, IRON AND FACTORY
Can. Wire & Iron Goods, Hamilton, Ont.
Page Steel & Wire Co., Adrian, Mich.

FERRO-TUNGSTEN
Vanadium-Alloys Steel Co., Pittsburgh, Pa

FILES
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., Wm., Sheffield, Eng.
Ingersoll File Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Marshall, Son & Bunney, Toronto, Ont.
Nicholson File Co., Port Hope, Ont.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
Whitman & Barnes Mfg. Co., Akron, O.
Wilkinson & Kompass, Hamilton, Ont.

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Lyman Tube & Supply Co., Montreal, Que.

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Barry Mfg. Co., Chicago, Ill.

FILTERING AND CIRCULATING SYSTEMS FOR LUBRICATING OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. Wire & Iron Goods, Hamilton, Ont.

FIRE BRICK
Elk Fire Brick Co., Hamilton, Ont.
General Combustion Co., Ltd., Montreal, Que.

FIRE CLAY
Elk Fire Brick Co., Can., Ltd., Hamil.
General Combustion Co., Ltd., Montreal, Que.

FINISHING MACHINES
Brown & Sharpe Mfg. Co., Providence, R.I.

FIRST AID CABINETS
Strong, Kennard & Nutt Co., Cleveland.

FIRE EXTINGUISHERS
Strong, Kennard & Nutt Co., Cleveland, O.

FITTINGS, CAST IRON, SCREWED, FLANGED
Crane, Ltd., Montreal, Que.

FIXTURES
Brown Engineering Corp., Toronto, Ont.
Crescent Mche. Co., Ltd., Montreal, Que.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Toronto Tool Co., Toronto, Ont.

FLAT SPRINGS
The Dunbar Brothers Co., Bristol, Conn

FLEXIBLE SHAFT EQUIPMENT
R. C. Haskins Co., Chicago, Ill.

FLOODLIGHTS, ELECTRIC
Northern Electric Co., Ltd., Montreal Que

FLOTATION MACHINERY
Elec. Steel & Metals, Welland, Ont.

FLUMES
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
William Hamilton Co., Peterboro, Ont.

FORGES, HAND PORTABLE
Hardware Co., Toronto, Ont
Can. Blower & Forge Co., Kitchener.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Sturtevant Co., B. F., Galt, Ont.
U. S. Ordnance, Toronto, Ont.

FORGE TOOLS
Kimber & Hillier Mfg., Co., St. Catharines, Ont.

FORGES, OIL
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

FORGINGS
Mesta Machine Co., Pittsburgh, Pa.
Can. Found. & Forgings, Ltd., Welland
Nova Scotia Steel & Coal Co., New Glasgow, N.S.

FORGINGS, DROP, AUTOMOBILE AND LOCOMOTIVE FORGING AND WELDING
Dominion Bridge Co., Montreal, Que.
Dom. Forge & Stamping Co., Walkerville
Steel Co. of Canada, Ltd., St. Catharines
Victoria Foundry Co., Ottawa.
Williams & Co., J. H., Brooklyn, N.Y.

FORGING MACHINERY
John Bertram & Sons Co., Dundas, Ont
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Bogge Co., Ltd., Hamilton, Ont
Canada Machinery Corp., Galt, Ont.
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Chicago Flexible Shaft Co., Chicago, Ill.

HARTNESS

Completes Your Machine for Production

Hartness Dies are compact, simple and efficient. They were the first successful automatic dies placed on the market, and are to-day standard equipment for many of the high production machines.
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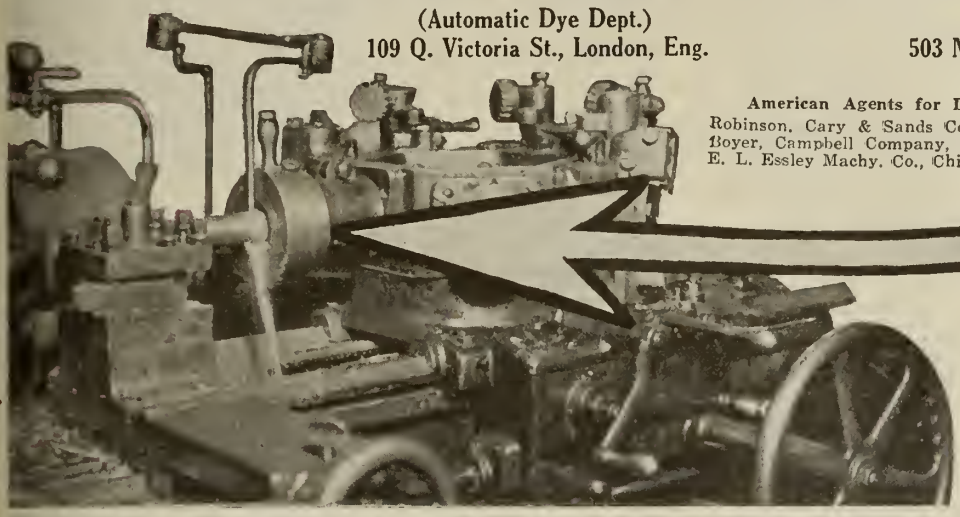

American Agents for Dies and Chasers:
Robinson, Cary & Sands Co., St. Paul and Duluth.
Boyer, Campbell Company, Detroit.
E. L. Essley Machy. Co., Chicago, Milwaukee and Moline.

Foreign Agents:
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Holland — Spliethoff, Beewukes & Company, Rotterdam, Holland.
Australia — McPherson's Pty., Ltd., Melbourne, Australia.
Japan, Manchuria, Korea, Formosa—Mitsui Bussan Kaisha, Ltd., Tokyo, Japan.
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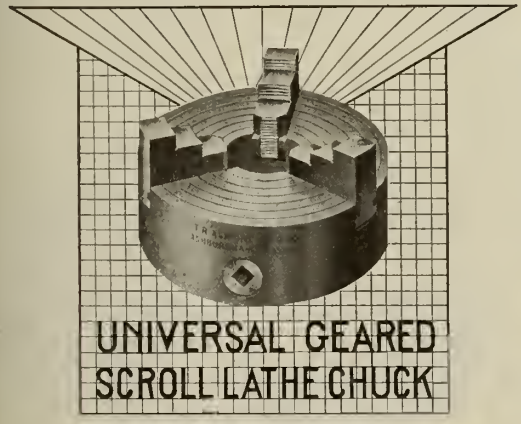
ALMOND



The body is a one-piece casting which eliminates parts and chattering when under heavy cutting pressure. The jaws are made of special alloy steel and hardened through, making them stronger than the usual case-hardened jaws. Two styles jaws—No. 1 Common Jaws, No. 2 Reverse Jaws.

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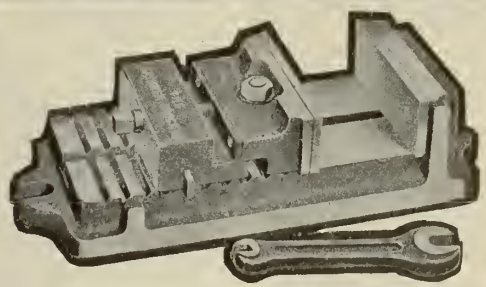

Designed for holding either straight or taper work this vise is portable, convenient and durable.

It is truly **THE HANDY TOOL.**

It may be bolted to a drill, planer, miller or shaper by the ears at both ends, clamped as desired by the flange or used at right angles.

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Williams & Co., J. H., Brooklyn, N.Y.

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St Lawrence Welding Co, Ltd., Montreal

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W. S. Rockwell Co., New York, N.Y.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.

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W. S. Rockwell Co., New York, N.Y.
Toronto Iron Works, Ltd., Toronto.

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General Combustion Co., Ltd., Montreal.

FURNACES — CRUCIBLE
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GALVANIZING FLUX
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Armstrong Bros. Tool Co., Chicago.

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Mesta Machine Co., Pittsburgh, Pa.

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St. Lawrence Welding Co., Montreal, Que

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GAUGES, MERCURY COLUMN, DRAFT
Taylor Instrument Co., Rochester, N.Y.

GAUGES, HYDRAULIC
Taylor Instrument Co., Rochester, N.Y.

GAUGES, MANUFACTURERS, LIMIT, THREAD
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Wells Bros. of Can., Galt, Ont
Wilton Tool & Mfg. Co., Boston 20, Mass.

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Wilton Tool & Mfg. Co., Boston 20, Mass.

GAUGES, THREAD
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Taylor Instrument Co., Rochester, N.Y.

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Canadian Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Crescent Mche. Co., Ltd., Montreal, Que.
Garvin Machine Co., New York.
C. E. Johanson, Inc., Toronto, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Hartford, Conn
Taylor, J. A. M., 318 Stair Bldg., Toronto
Toronto Tool Works, Toronto, Ont.
Wells Brothers Co. of Canada, Galt, Ont.
Wilton Tool & Mfg. Co., Boston 20, Mass.

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Dom. Found. & Steel, Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Williams & Co., J. H., Brooklyn, N.Y.

GEAR BLANKS, CAST
Katie Foundry, Galt, Ont.

GEAR BLANKS, RAWHIDE
Lyman Tube & Supply Co., Montreal, Que.

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Fellows Gear & Shaper Co., Springfield, V.
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Petrie, Ltd., H. W., Toronto.
A. R. Williams Machy. Co., Toronto.

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Gisholt Machine Co., Madison, Wis.

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Morse Chain Co., Ithaca, New York.
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, COMPENSATING
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Can. Link-Belt Co., Ltd., Toronto, Ont.

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Dominion Bridge Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Elliott & Whitehall, Galt, Ont.
Gardner, Robt., & Son, Montreal.
Hamilton Gear & Machine Co., Toronto.
Hull Iron & Steel Found., Ltd., Hull, Q.
Jones & Glassco, Montreal.
Wm. Kennedy & Sons, Ltd., Owen Sound, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia.
Victoria Foundry Co., Ottawa.

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Grant Gear Works, Boston, Mass.
Hamilton Gear & Machine Co., Toronto.
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia.
A. R. Williams Machy. Co., Toronto.

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Fellows Gear & Shaper Co., Springfield, V

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GEARS, SPRING
Morse Chain Co., Ithaca, New York.

GEARS, SPUN, BENCH, SPIRAL
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St Lawrence Welding Co, Ltd., Montreal

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GENERATORS, MOTOR
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Northern Elec. Co., Ltd., Montreal, P.Q.
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Oliver Machinery Co., Grand Rapids, Mich

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Willson & Co., Inc., T. A., Reading, Pa.

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Rice Lewis & Son, Toronto.

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Standard Optical Co., Geneva, N.Y.
Strong, Kennard & Nutt Co., Cleveland.
Welding & Supplies Co., Montreal.

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Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

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Foss Mchry. & S'ply Co., G. F., Montreal
Garlock-Walker Machinery Co., Toronto.

GRINDERS, BENCH
Superior Machinery Co., London, Ont.

GRINDERS, CENTRE COLUMN, PEDESTAL AND BENCH
Can. Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Haskins & Co., R. C., Chicago, Ill.
Wisconsin Electric Co., Inc., Racine, Wis.
Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto.
Katie Foundry, Galt, Ont.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford.
Niles-Bement-Pond Co., New York, N.Y.
Perfect Machine Co., Galt, Ont.
United States Elec. Tool Co., Cincinnati.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Brown & Sharpe Mfg. Co., Providence, R.I
Cincinnati Milling Mach. Co., Cincinnati.
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Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield, M.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Norton Co., Worcester, Mass.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, DIE AND CHASER
Haskins & Co., R. C., Chicago, Ill.
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National-Acme Co., Cleveland, Ohio.

GRINDERS, DISK
Armstrong Bros. Tool Co., Chicago, Ill.
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Gardner Machine Co., Beloit, Wis.
Heald Machine Co., Worcester, Mass.

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Garvin Machine Co., New York.
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Petrie, Ltd., H. W., Toronto.
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Wells Bros. of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

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Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I
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Greenfield Machine Co., Greenfield, Mass.
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Ford-Smith Mach. Co., Hamilton, Ont.
Haskins & Co., R. C., Chicago, Ill.
Grant Mfg. & Mach. Co., Bridgeport, Conn
Garlock-Walker Machinery Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Independent Pneumatic Tool Co., Chicago
Petrie, Ltd., H. W., Toronto.
United States Elec. Tool Co., Cincinnati
Wisconsin Electric Co., Inc., Racine, Wis.
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Wilkinson & Kompass, Hamilton, Ont.

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Barber Mchy. Co., Ltd., Toronto, Ont.
Universal Grinding Mach. Co., Fitchburg, Mass.

GRINDERS, HOLE, HOLE AND AND DEEP HOLE
Barber Mchy. Co., Ltd., Toronto, Ont.
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Heald Machine Co., Worcester, Mass.

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Fitchburg Grinding Mach. Co., Fitchburg, Mass.

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Garlock-Walker Machinery Co., Toronto.
Heald Machine Co., Worcester, Mass.
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MacGovern & Co., Montreal, Que.

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Manhattan Machine & Tool Co., Grand Rapids, Mich.

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W. F. & John Barnes Co., Rockford, Ill.
Blount & Co., J. G., Everet, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I
Ford-Smith Machine Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield.
National-Acme Co., Cleveland, Ohio.
Tabor Mfg. Co., Philadelphia, Pa.
Wells Bros. of Canada, Galt, Ont.

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Modern Tool Co., Erie, Pa.
Norton Co., Worcester, Mass.
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Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Montreal.
Heald Machine Co., Worcester, Mass.
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Pratt & Whitney Co., Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Norton Co., Worcester, Mass.
Williams Mchy Co., A. R., Toronto, Ont.

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Garvin Machine Co., New York.
Garlock-Walker Machy. Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Haskins & Co., R. C., Chicago, Ill.
Hall & Sons, John H., Brantford, Ont.
Niles-Bement-Pond Co., New York, N.Y.
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Wisconsin Electric Co., Racine, Wis.
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Ford-Smith Machine Co., Hamilton, Ont.
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Dennis Wire & Iron Works, London, Ont.
B. Greening Wire Co., Hamilton, Ont.
Page Steel & Wire Co., Adrian, Mich.
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Strong, Kennard & Nutt Co., Cleveland

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Atkins & Co., E. C., Hamilton, Ont.
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Diamond Saw & Stamping Wks., Buffalo
Ford-Smith Machine Co., Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
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Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal
Plewes, Ltd., Winnipeg, Man.
Pilot Steel & Tool Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Racine Tool & Machine Co., Racine, Wis
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
L. S. Starrett Co., Athol, Mass.
Standard Machy. & Supplies, Montreal
Victor Saw Works, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.
Williams Mchy Co., A. R., Toronto, Ont.

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HACK SAW FRAMES
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Atkins & Co., E. C., Hamilton, Ont.
Can. Fairbanks-Morse Co., Montreal.
Ford-Smith Machine Co., Hamilton, Ont.
Garvin Machine Co., New York City.
Victor Saw Works, Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.

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Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Wks., Buffalo
Foss Mchy. & S'ply Co., G. F., Montreal
Ford-Smith Machine Co., Hamilton.
Perfect Machine Co., Galt, Ont.
Starrett Co., L. S., Athol, Mass.
Victor Saw Works, Hamilton, Ont.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

HAMMERS, FORGING
Nazel Eng. & Mach. Wks., Philadelphia

HAMMERS, ELECTRIC
Haskins & Co., R. C., Chicago, Ill.

The Convenient Chuck

Your workmen know that Jacobs Chucks with the key and toothed sleeve give greater convenience and save time in changing drills, and that their grip is sure and saves in broken drills.

The sooner you use them the quicker they will commence to save your money.

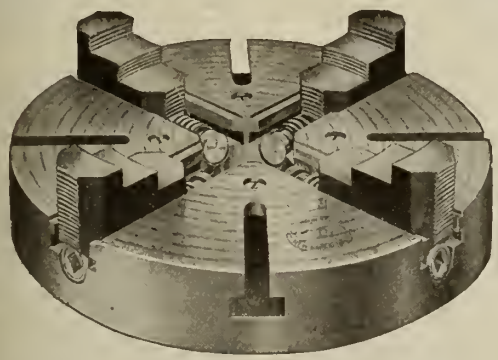
Dept. C.M.

THE JACOBS MFG. CO. HARTFORD, CONNECTICUT, U.S.A.

ALL STEEL

INDEPENDENT CHUCKS

are not an experiment—they have come to stay. They are a necessity with the modern machinery and high-speed steel cutting tools.



THE UNION STEEL BODY CHUCKS

are well designed and have all the elements of strength and durability for which they are designed. We make other types in steel also, including the Geared Scroll Chucks and the Geared Scroll Combination—all designed for heavy work and hard usage.

UNION MANUFACTURING COMPANY

New Britain, Conn.

New York Office: 26 Cortlandt Street

Makers of a complete line of chucks

Buried in the Work and Broke!

Next time a tap breaks below the surface of a large casting, don't let some makeshift method of removing it injure the thread and waste half an hour of valuable production time. Instead—

Walton it Out in a Jiffy

And save the casting.

Special analysis steel fingers of the Walton Extractor drop into the flutes of the broken tap—and grip. Then a few turns of a wrench applied to the squared end of the Extractor backs out the buried tap.

Sixty-day trial offer proves the Walton Extractor pays for itself.

Write.

The Walton Co.

Hartford, Conn.

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Beaudry & Co., Boston, Mass.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton.
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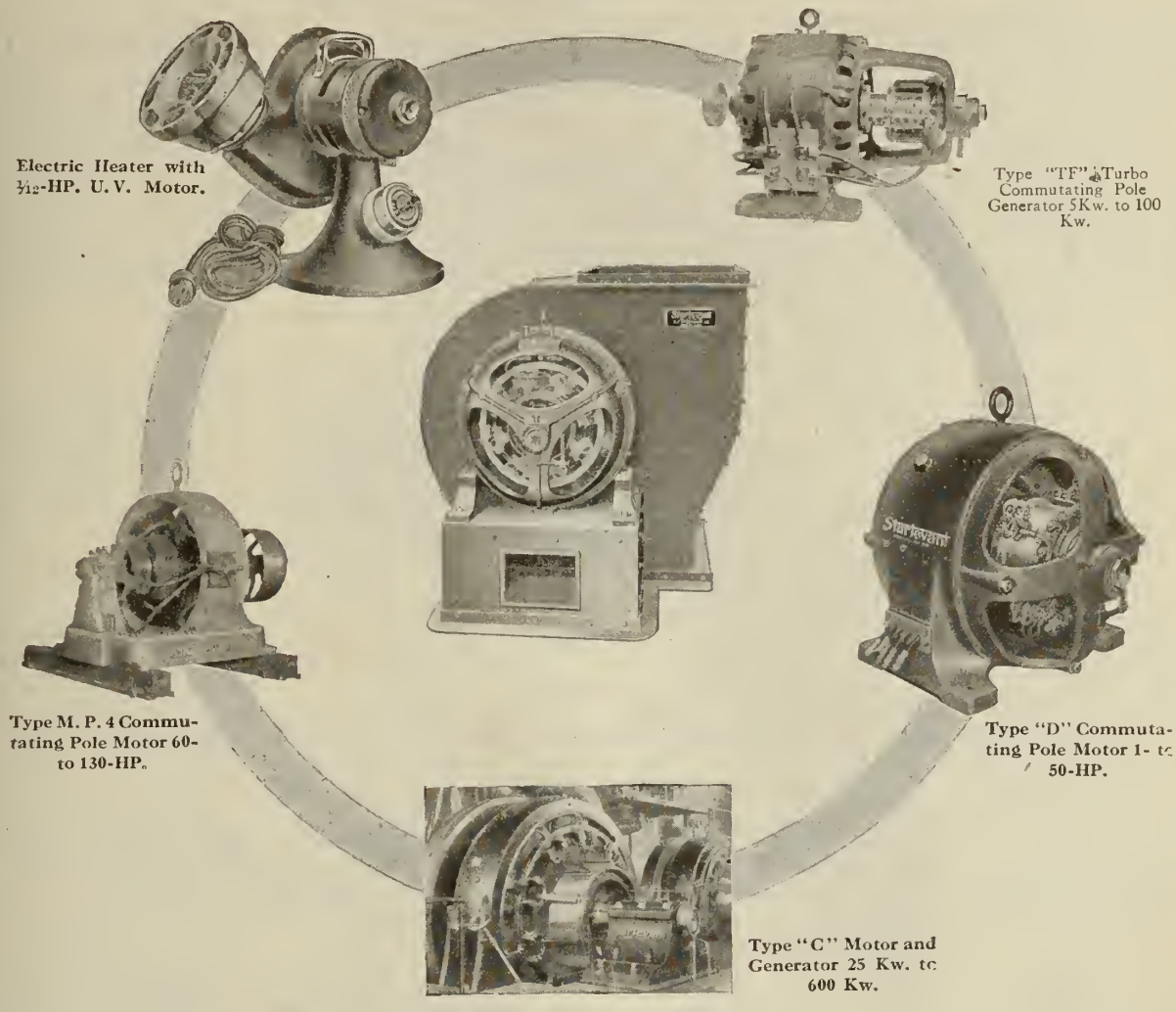

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Volume XXIII

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Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.
U.S. Ordnance, Toronto, Ont.

MILLING MACHINES, PROFILE
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

MILLING TOOLS
Aikenhead Hardware Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence.
Ford-Smith Mach. Co., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

MINE CARS
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dominion Bridge Co., Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.

MINING MACHINERY
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Elec. Steel & Metals, Welland, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

MIXERS, SAND
Frost Mfg. Co., Chicago, Ill.

MORTISING MACHINES
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
Gray Ball Bearing Co., Ltd., Toronto.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
MacGovern & Co., Montreal, Que.
Northern Elec. Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
U. S. Ordnance, Toronto, Ont.
Volta Mfg. Co., Welland, Ont.
Williams Mach'y Co., A. R., Toronto.

MOTOR SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

MOTORCYCLE FRAME AND FORK
The Dunbar Brothers Co., Bristol, Conn.

MOTORS, PNEUMATIC
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto.

MOULDS, RUBBER
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Hoggson & Pettis Mfg. Co., New Haven, Conn.

MULTIPLE INDEX CENTRES
Garvin Machine Co., New York.
Graton & Knight Mfg. Co., Worcester, M.

MULTI-DRILLING, MULTI-BORING, MULTI-TAPPING MACHINERY,
Nat. Automatic Tool Co., Richmond, Ind.

MUNICIPALITIES
City of St. John, Quebec.

NAIL SETS
Morrow Screw & Nut Co., J., Ingersoll, Ont

NAME PLATES, BRONZE, ETCHED AND STAMPED
Matthews & Co., Jas. H., Pittsburgh, Pa.
Turner Brass Works, Sycamore, Ill.

NICHROME CASTINGS
Can. Driver-Harris Co., Ltd., Walkerville.

NICKEL
Baker & Co., Inc., H., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.

NICKEL STEEL
See Steel.

NICKEL SILVER—SHEETS, ROLLS, PLATES and RODS
Brown's Copper and Brass Rolling Mills, New Toronto.

NIPPLE THREADING MACHINES
Hall & Sons, Ltd., John H., Brantford.
Landis Machine Co., Waynesboro, Pa.

NITROGEN
Carter Welding Co., Toronto, Ont.

NUTS, STEEL, CASTELLATED AND COLD PRESSED
Galt Machine Screw Co., Ltd., Galt, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Williams & Co., J. H., Brooklyn, N.Y.

NUTS, SEMI-FINISH AND FINISHED
Galt Machine Screw Co., Galt, Ont.
National-Acme Co., Cleveland, Ohio.
Wilkinson & Kompass, Hamilton.

NUT LOCKS
Edw. W. Robinson Co., Ltd., Montreal.

NUT BURRING AND NUT MACHINES (HOT)
National Machy. Co., Tiffin, Ohio.

NUT FACING AND BOLT SHAVING MACHINES
Garvin Machine Co., New York.
National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
Victor Tool Co., Waynesboro, Pa.

NUT TAPPERS
Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
Hall & Son, J. H., Brantford, Ont.
Jardine & Co., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.

OILERS
All-Way Oiler Mfg. Co., Toronto, Ont.

OIL SEPARATORS
Can. Fairbanks-Morse Co., Montreal.
St Lawrence Welding Co, Ltd., Montreal

OIL STONES
Aikenhead Hardware Co., Toronto, Ont.
Carborundum Co., Niagara Falls, N.Y.
Norton Co., Worcester, Mass.
Rice Lewis & Son, Toronto, Ont.

OIL STONE GRINDERS
Oliver Machy. Co., Grand Rapids, Mich.

OIL STORAGE SYSTEMS
Bowser Co., Ltd., S. F., Toronto, Ont.
St. Lawrence Welding Co., Ltd., Montreal.

OPENING DIE HEADS
Greenfield Tap & Die Corp, Greenfield.
Wells Bros. of Canada, Galt, Ont.

OPTICAL SUPPLIES
Consolidated Optical Co., Toronto, Ont.

ORE HANDLING EQUIPMENT
Brown Hoisting Machinery Co., Cleveland, Ohio.
Canadian Mead-Morrison Co., Limited, Montreal, Que.

OSCILLATING VALVE GRINDERS (PNEUMATIC)
Cleveland Pneumatic Tool Co. of Canada, Toronto.

OVENS FOR BAKING, BLUING, DRYING, ENAMELING, JAPANNING AND LACQUERING
Brantford Oven & Rack Co., Brantford.

OVEN TRUCKS, STEEL
Brantford Oven & Rack Co., Brantford.
MacKinnon Steel Co., Sherbrooke, Que.

OVENS FOR DRYING, TEMPER AND OXYGEN, ELECTROLYTIC CELLS UNDER TRUCKS
Welding & Supplies Co., Montreal, Que.
Brantford Oven & Rack Co., Brantford.

OXY-ACETYLENE WELDING AND CUTTING AND OUTFITS
Carter Welding Co., Toronto, Ont.
Prest-o-Lite Co., Inc. Toronto, Ont.
Davis-Bournonville Co., Toronto, Ont.
St. Lawrence Welding Co., Montreal, Que.
Welding & Supplies Co., Montreal, Que.

OXYGEN
Nat. Electro Products Ltd., Toronto, Ont.

OXYGEN PLANTS (ELECTROLYTIC)
Davis-Bournonville Co., Toronto, Ont.

PACKINGS, ASBESTOS
Cleveland Wire Spring Co., Cleveland.

PACKING, ROD AND SHEET
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.
Goodyear Tire & Rubber Co., Can., Ltd., Toronto.
Gutta Percha & Rubber, Ltd., Toronto.
International Mach. Spls., Ltd., Montreal
Petrie, Ltd., H. W., Toronto.
Quaker City Rubber Co., Philadelphia, Pa

PANS, WET AND DRY
Frost Mfg. Co., Chicago, Ill.

PAPER MILL CONVEYORS AND DRIVES
Bertrams, Ltd., Edinburgh, Scotland.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Gutta Percha & Rubber, Ltd., Toronto.
MacKinnon Steel Co., Sherbrooke, Que.

PARTITIONS, WIRE
See Guards

PAPER MILL MACHINERY
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Machinery Co., Toronto.
MacKinnon Steel Co., Sherbrooke, Que.

PATTERN SHOP EQUIPMENT
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Oliver Machy. Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto.

PATTERN MAKERS' LATHES
See Lathes.

PATENT SOLICITORS
Sudden, Hanbury A., Montreal.
Fetherstonhaugh & Co., Ottawa.
Marion & Marion, Montreal.
Ridout & Maybee, Toronto.

PECK CARRIERS FOR POWER PLANTS
Can. Link-Belt Co., Toronto, Ont.

PENSTOCKS
William Hamilton Co., Peterboro, Ont.

PERFORATED METALS AND ORNAMENTAL IRON GOODS
Canada Wire & Iron Goods Co., Hamilton

PHOSPHOR TIN, COPPER AND BRONZE
British Smelting & Refining Co., Ltd., Montreal, Que.

PHOTOSTATS
Commercial Camera Co., Providence, R.I.

PIG IRON
Hanna & Co., M. A., Cleveland, O.
Steel Co. of Canada, Ltd., Hamilton, Ont.

PINS, TAPER
Morrow Screw & Nut Co., J., Ingersoll, Ont

PINS, BELT-LACING
Clipper Belt Lacer Co., Grand Rapids.

PIPE, BLACK & GALVANIZED
Crane, Ltd., Montreal, Que.

PIPE FITTINGS, MALLEABLE AND CAST IRON
International Malleable Iron Co., Guelph.

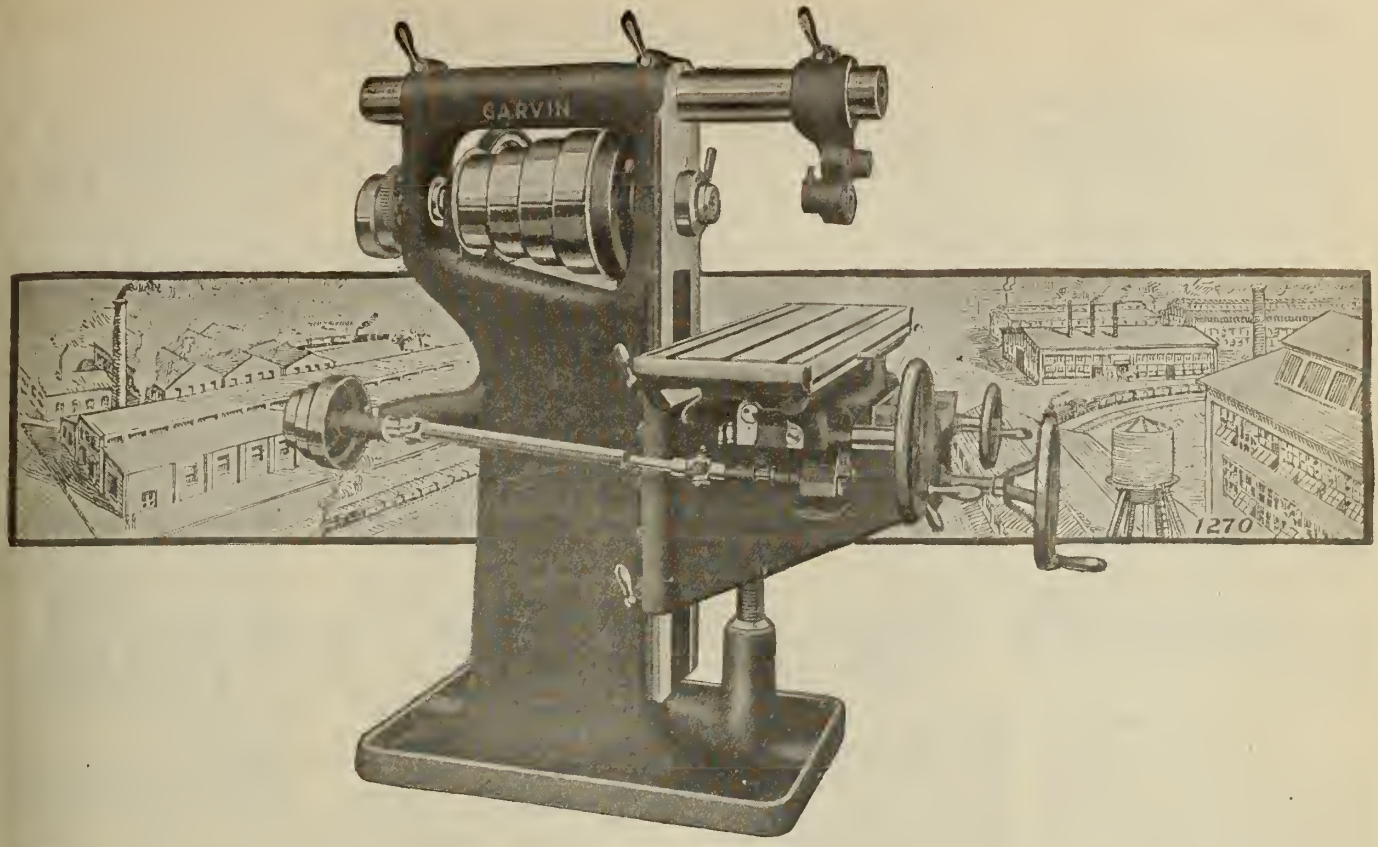
PIPE CUTTING AND THREADING MACHINES
Barber Mchy. Co., Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Curtis & Curtis Co., Bridgeport, Conn.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield.
Hall & Sons, John H., Brantford.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
McDougall Co., R., Galt.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt, Ont.
Williams Tool Co., Erie, Pa.
Williams Machy. Co., A. R., Toronto.

PIPE, JOINT COMPOUNDS
Crane, Ltd., Montreal, Que.

PIPE RIVETED STEEL
Toronto Iron Works, Ltd., Toronto.
Williams Hamilton Co., Peterboro, Ont.

PIERCING
Oliver Machy. Co., Grand Rapids, Mich.

PIPE CUTTERS, ROLLING
Curtis & Curtis Co., Bridgeport, Conn.
Greenfield Tap & Die Corp., Greenfield.
Hall & Sons, Ltd., John H., Brantford.
Wells Bros. Co. of Canada, Galt, Ont.



Garvin !

Everyone's Choice Among Milling Machines

The Machinist—who, living with them every day, knows them best. He likes them, likes to work with them and swears by them as models of all that a machine tool should be. He knows how much easier a Garvin is to operate, knows he can do more work and earn more with Garvin Millers.

When new or additional equipment is needed, the machinist is positive in backing Garvin as the proper choice.

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The Man Who Does the Buying is glad to stand with the machinist and the shop superintendent. He knows that another choice on their part might mean money in the first place and much more in subsequent upkeep.

Garvin Milling Machines have features of distinctive merit, among which are—

- A rigid knee of Garvin patented solid-top extended construction.
- A superior slide construction which gives better and permanent fit.
- An improved positive feed change gear box—simple, sturdy and positive.
- Telescoping feed screw with a ball-race thrust bearing.
- A conveniently placed trip box where the operator can manipulate it without moving.

These are but a few features of many. Let our 340 page Machine Tool Catalogue tell you the details. Ask your Dealer or Address :

The GARVIN MACHINE COMPANY, Spring & Varick Streets, New York, N.Y.

GARVIN

BUILDER OF BETTER MACHINE TOOLS

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If interested tear out this page and place with letters to be answered

PIPE TOOLS AND DIES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE CUTTERS AND REAMERS
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE STOCKS AND THREADERS
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE TAPS AND VISES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE WRENCHES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PISTON AND PISTON RING MACHINES
National Acme Co., Windsor, Vt.

PLANER BOLTS
Atkins & Co., E. C., Hamilton, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont

PLANER JACKS
Armstrong Bros. Tool Co., Chicago.

PLANERS, STANDARD AND ROTARY
Betts Machine Co., Rochester, N.Y.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Oliver Machy. Co., Grand Rapids, Mich.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner & Son, Robt., Montreal.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Morton Mfg. Co., Muskegon Heights, Mich
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.

PLANING AND SHAPING MACHINERY
Barber Mchy. Co., Ltd., Toronto, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Niles-Bement-Pond Co., New York.
Ohio Mach. Tool Co., Kenton, Ohio.
Perrin, Ltd., William, Toronto.
Williams Mchy Co. Ltd., A. R., Montreal

PLANER-SHAPER, COMBINED OPEN SIDE
Lyad-Farquhar Co., Boston.
Petrie, Ltd., H. W., Toronto.

POWER HAMMERS
Quickwork Co., St. Marys, Ohio.

PLANING MILL EXHAUSTERS
Can. Blower & Forge Co., Kitchener, Ont.
MacGovern & Co., Montreal, Que.
Niles-Bement-Pond Co., New York.
Sturtevant Co., B. F., Galt, Ont.

PLATES, Q.M., SHEARED AND CHEQUERED
Pedlovers, Ltd., Toronto, Ont.

PLATING, PLANTS & SUPPLIES
Can. Hanson Van Winkle Co., Ltd., Toronto, Ont.

PLIERS
Aikenhead Hardware Co., Toronto.
Can. Billings & Spencer, Ltd., Welland.
Peck, Stow & Wilcox Co., Southington, Ct.
Rice Lewis & Son, Toronto, Ont.

PNEUMATIC TOOLS
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland P'matic Tool Co., Can., Toronto.
Curtis Pneumatic Machy. Co., St. Louis.
Garlock-Walker Machy. Co., Toronto.
Int. Mach. & Supply Co., Ltd., Montreal.
Independent Pneumatic Tool Co., Chicago.

POWER CRANES, HAND
MacKinnon Steel Co., Sherbrooke, Que.

POLISHING MACHINES
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto.

POLISHING PLATES
Greenfield Tap & Die Corp., Greenfield.
Petrie, Ltd., H. W., Toronto.
Wells Bros. of Canada, Galt, Ont.

POLISHING PAPER
H. H. Barton & Son Co., Philadelphia.

POTS AND KETTLES, CAST STEEL
Elec. Steel & Metals, Welland, Ont.

POWER HOUSE CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
St Lawrence Welding Co, Ltd., Montreal

PORTABLE MACHINERY
Hastings & Co., R. C., Chicago, Ill.

POWER TRANSMISSION MCHY.
Petrie, Ltd., H. W., Toronto.

PRESSED STEEL PARTS
Gray Ball Bearing Co., Ltd., Toronto.

PRESSERS, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Metalwood Mfg. Co., Detroit, Mich.
Petrie, Ltd., H. W., Toronto.

PRESSES, BROACHING, FORGING AND FLANGING
Atlas Press Co., Kalamazoo, Mich.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Dom. Steel Products Co., Ltd., Brantford.
Metalwood Mfg. Co., Detroit, Mich.
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
Stoll Co., D. H., Buffalo, N.Y.
Williams Mchy Co., Ltd., A. R., Montreal

PRESSES, CAM, TOGGLE, EYELET
Baird Machine Co., Bridgeport, Conn.
Bliss Co., E. W., Brooklyn, N.Y.
Toledo Machine & Tool Co., Toledo.
Stoll Co., D. H., Buffalo, N.Y.

PRESSES, FILTER
Perrin, Ltd., William R., Toronto.
Smalley-General Co., Inc., Bay City, Mich.

PRESSES, PNEUMATIC
Barber Mchy. Co., Ltd., Toronto, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Metalwood Mfg. Co., Detroit, Mich.
Toledo Machine & Tool Co., Toledo.

PRESSES, DROP AND FORGING
Barber Mchy. Co., Ltd., Toronto, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton.
Can. Fairbanks-Morse Co., Montreal.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co, Toledo.
U. S. Ordnance, Toronto, Ont.

PRESSES, HYDRAULIC
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Dom. Steel Products Co., Ltd., Brantford.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
Stoll Co., Inc., D. H., Buffalo, N.Y.
U. S. Ordnance, Toronto, Ont.
West Tire Setter Co., Rochester, N.Y.
Williams Machy. Co., A. R., Toronto.

PRESSES, HYDRO-PNEUMATIC
Eastern Production Co., Detroit, Mich.

PRESSES, BALING
Perrin, Ltd., William R., Toronto.

PRESSES, POWER
Baird Machine Co., Bridgeport, Conn.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo.
U. S. Ordnance, Toronto, Ont.
Williams Machy. Co., A. R., Toronto.

PRESSES, SPRING FOOT
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Ont.
Toledo Machine & Tool Co., Toledo.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal

PRESSES, SCREW
Barnes & Co., W. F. & Jno., Rockford, Ill.
Bliss Co., E. W., Brooklyn, N.Y.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.

PRESSES, SEAL
Hoggson & Pettis Mfg. Co., New Haven, Conn.

PRESSES, TIRE
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,

PRESSES, TRIMMING
Bliss Co., E. W., Brooklyn, N.Y.
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.

PROJECTORS, FLOOD LIGHTING
Lyman Tube & Supply Co., Montreal, Que

PROPELLERS
Kennedy & Sons, Wm., Owen Sound.

PROTECTIVE COATINGS
H. H. Robertson, Ltd., Sarnia, Ont.

PSYCROMETERS, SLING
Taylor Instrument Co., Rochester, N.Y.

PULLEYS
Algoma Steel Corp., Sault Ste. Marie, Ont
American Pulley Co., Philadelphia.
Baird Machine Co., Bridgeport, Conn.
Bernard Industrial Co., Fortierville, Que.
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Ford-Smith Machine Co., Hamilton, Ont.
Kennedy & Sons, Ltd., W., Owen Sound.
Positive Clutch & Pulley Works Ltd., Toronto.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.

PULLEYS, STEEL SASH, STEEL BELT
American Pulley Co., Philadelphia, Pa.

PULLEYS, FRICTION, CLUTCH
American Pulley Co., Philadelphia, Pa.
Baird Machine Co., Bridgeport, Conn.
Bernard Industrial Co., A., Fortierville, Q.
Can. Link-Belt Co., Toronto, Ont.
Carlyle Johnson Mch. Co., Manchester, Ct.
Positive Clutch & Pulley Works, Toronto.
Jones & Glassco, Montreal.
Petrie, Ltd., H. W., Toronto.

PULP MILL MACHINERY
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
MacKinnon Steel Co., Sherbrooke, Que.

PUMPS, AIR LIFT
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,

PUMPS, BOILER FEED
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,

PUMPS, CENTRIFUGAL
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Ingersoll-Rand Co., Montreal, Que.
DarMog Bros., Ltd., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

PUMPS, FUEL OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Darling Bros., Ltd., Montreal, Que.
Trahern Pump Co., Rockford, Ill.

PUMPS, GEARED
Darling Bros., Ltd., Montreal, Que.
Globe Engineering Co., Hamilton, Ont.

PUMPS, HIGH PRESSURE
Perrin, Ltd., William R., Toronto.

PUMPS, HYDRAULIC
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Clarke & Co., Furniss, Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Darling Bros., Ltd., Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
Metalwood Mfg. Co., Detroit, Mich.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

PUMPS, LUBRICATING, OIL STORAGE
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, RETURN AIR
Can. Ingersoll-Rand Co. Ltd., Sherbrooke,

PUMPS, SPECIAL
Elec. Steel & Metals, Welland, Ont.

PUMPS, RUBBER CEMENT
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, KEROSENE, OIL, SELF-MEASURING
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, LUBRICANT, OIL, WATER
Darling Bros., Ltd., Montreal, Que.
Trahern Pump Co., Rockford, Ill.

PUMPS — ROTARY
General Combustion Co., Ltd., Montreal, Que.

PUMP LEATHERS
Graton & Knight Mfg. Co., Worcester.

PUNCHES AND DIES
Atkins & Co., Ltd., Wm., Sheffield, Eng.
E. W. Bliss Co, Brooklyn, N.Y.
Baker & Co., Inc., H., Montreal, Que.
Brown, Boggs Co., Ltd., Hamilton, Can.
Can. Blower & Forge Co., Kitchener, Ont.
Crescent Mach. Co., Ltd., Montreal, P.Q.
Can. Fairbanks-Morse Co., Montreal.
Elliott & Whitehall Machine and Tool Co., Galt, Ont.
Gardner & Son, Robert, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Marshall, Son & Blunney, Toronto.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Williams Mchy Co., A. R., Toronto, Ont.

PUNCHES, POWER
John Bertram & Sons Co., Dundas, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd, Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
A. B. Jardine & Co., Hespeler, Ont.
Long & Allstatter, Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
D. H. Stoll Co., Buffalo, N.Y.
Williams Mchy Co., A. R., Toronto, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertrams, Ltd., Edinburgh, Scotland.
Bertrams & Sons, John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton, Ont.
Garlock-Walker Mach'y. Co., Toronto.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

PYROMETERS
Bristol Co., Waterbury, Conn.
Shore Instrument & Mfg. Co., New York.
Taylor Instrument Co., Rochester, N.Y.
U.S. Ordnance, Toronto, Ont.

QUARTERING MACHINES
Bertram & Sons, John, Dundas, Ont.
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Niles-Bement-Pond Co., New York.

QUARRY HOISTS
Canadian Mead-Morrison Co., Limited, Montreal, Que.

RAIL BENDERS
Algoma Steel Corp., Sault Ste. Marie, Ont.

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Lyman Tube & Supply Co., Montreal, Que
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Wilt Twist Drill Co., Walkerville, Ont.

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Wilt Twist Drill Co., Walkerville, Ont.

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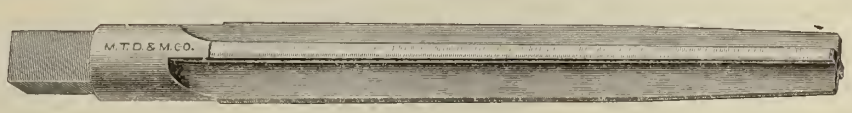

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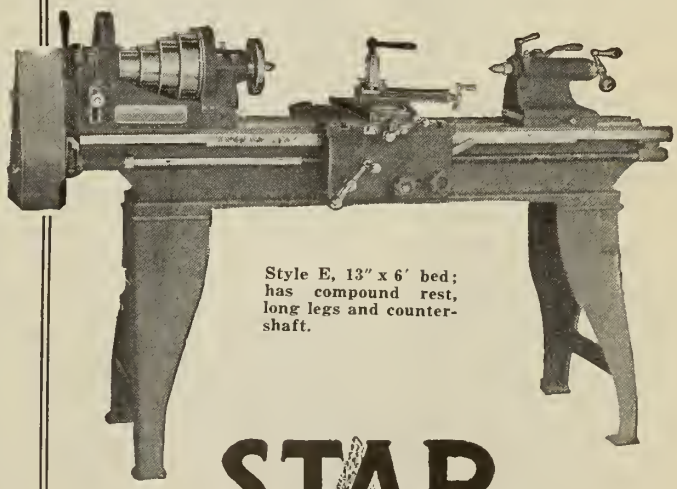

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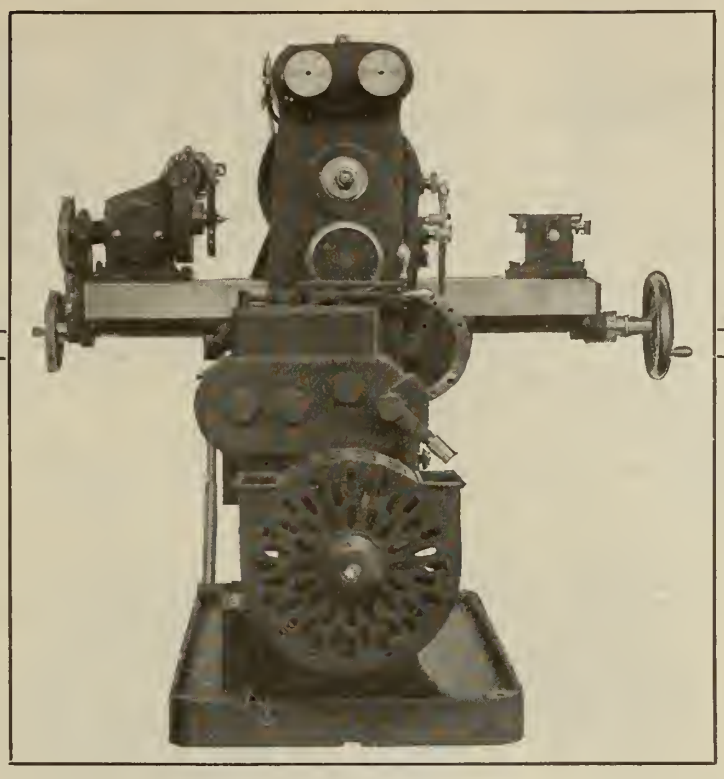

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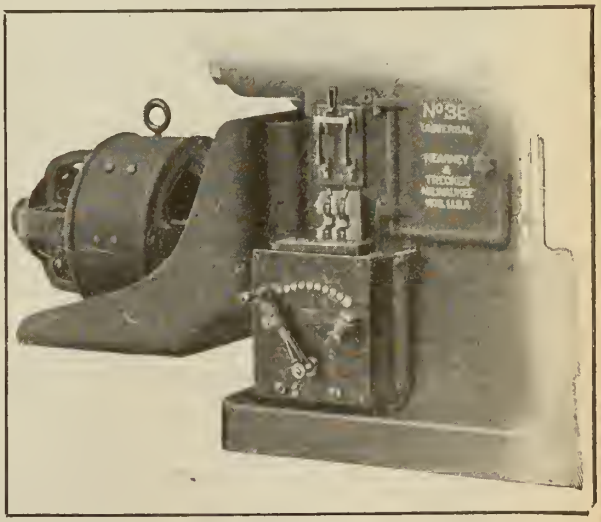

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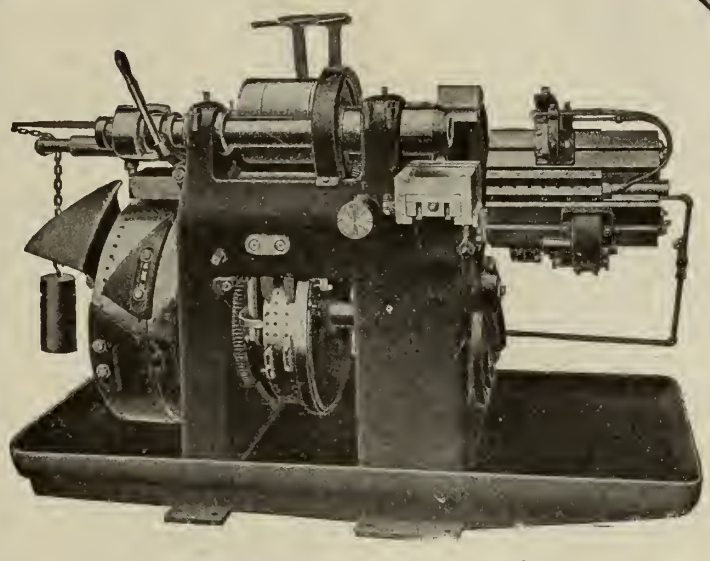

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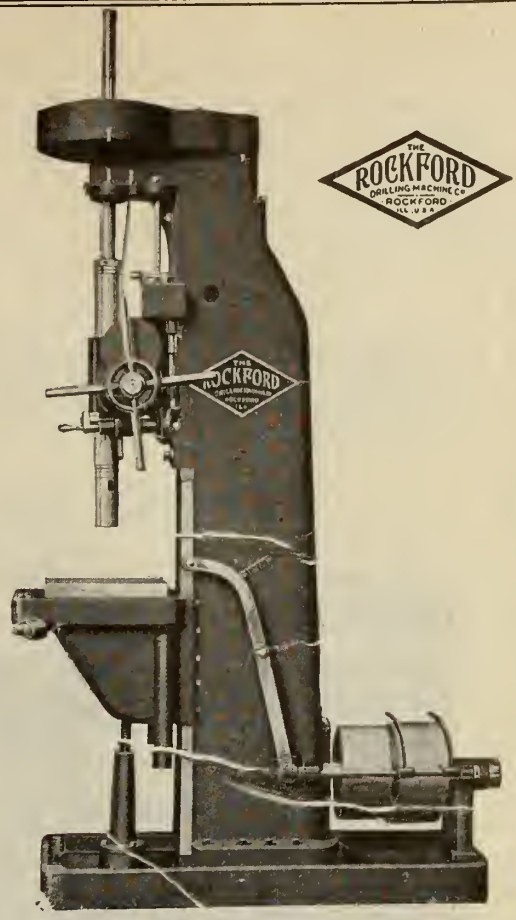

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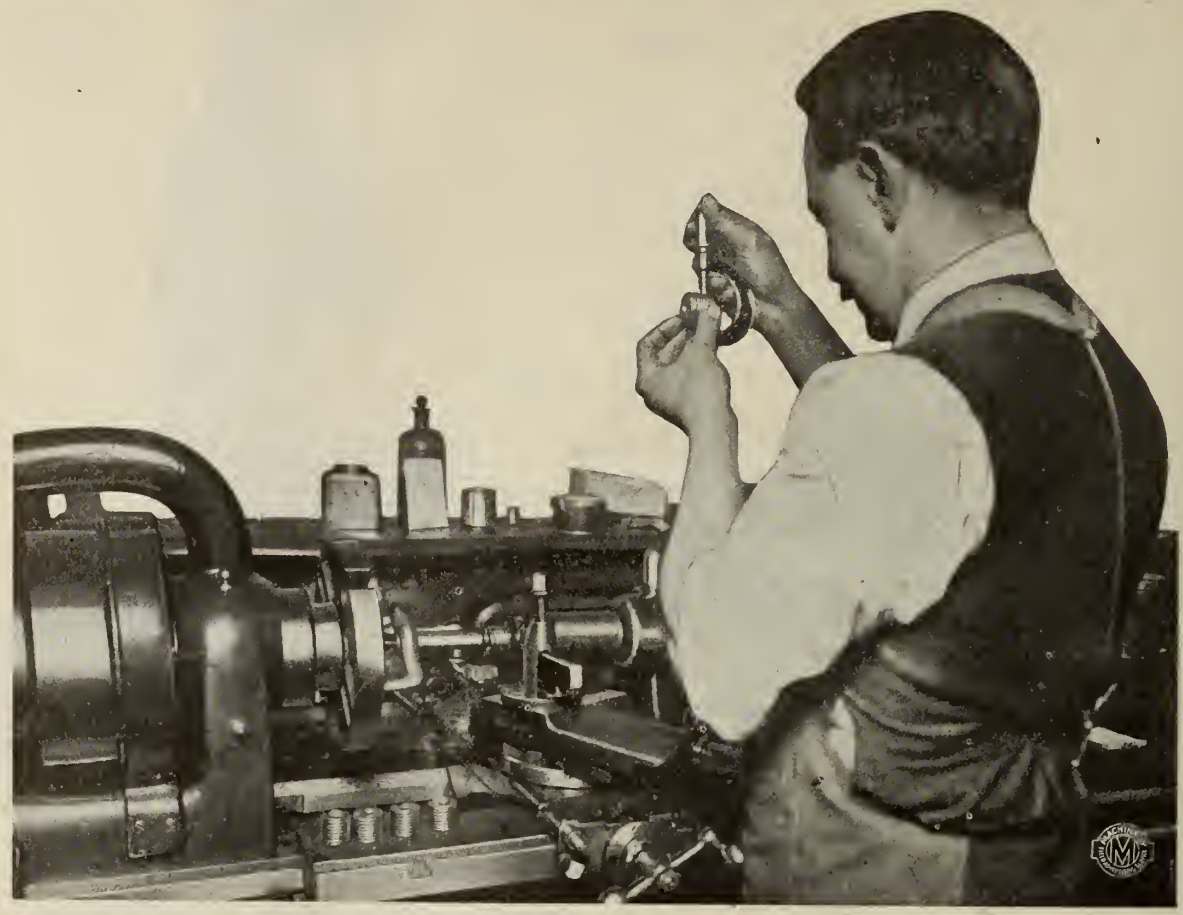

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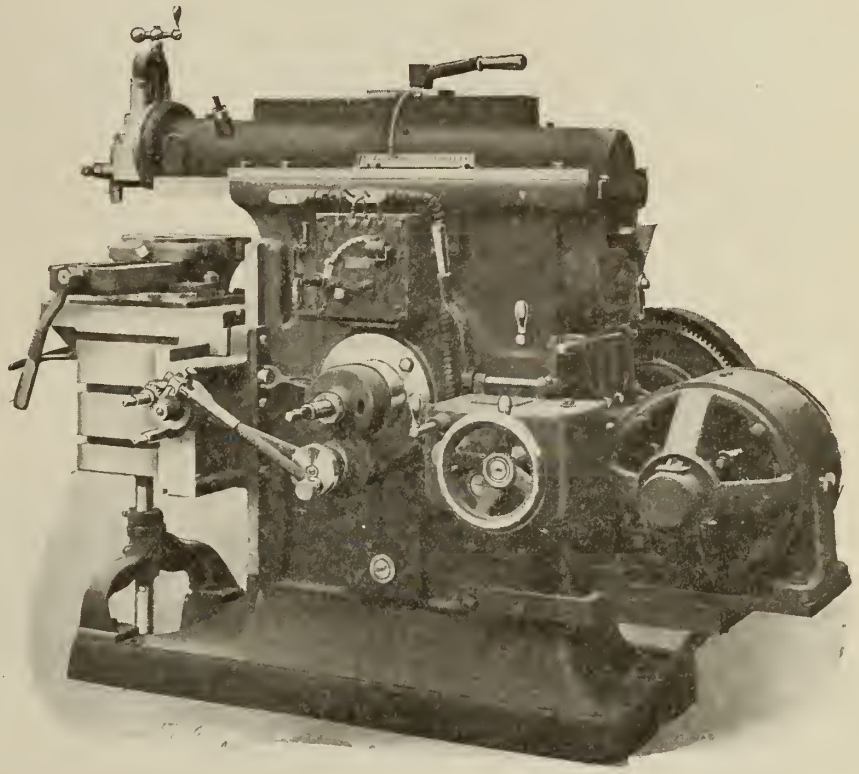

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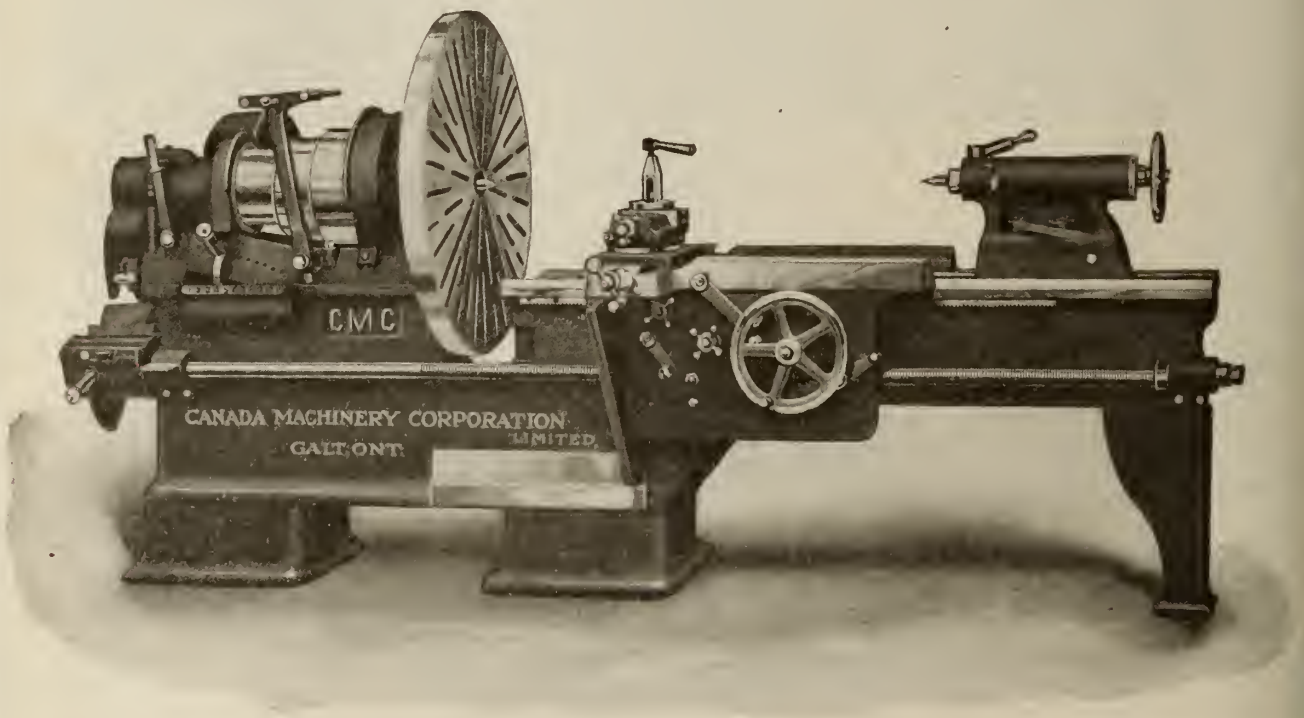

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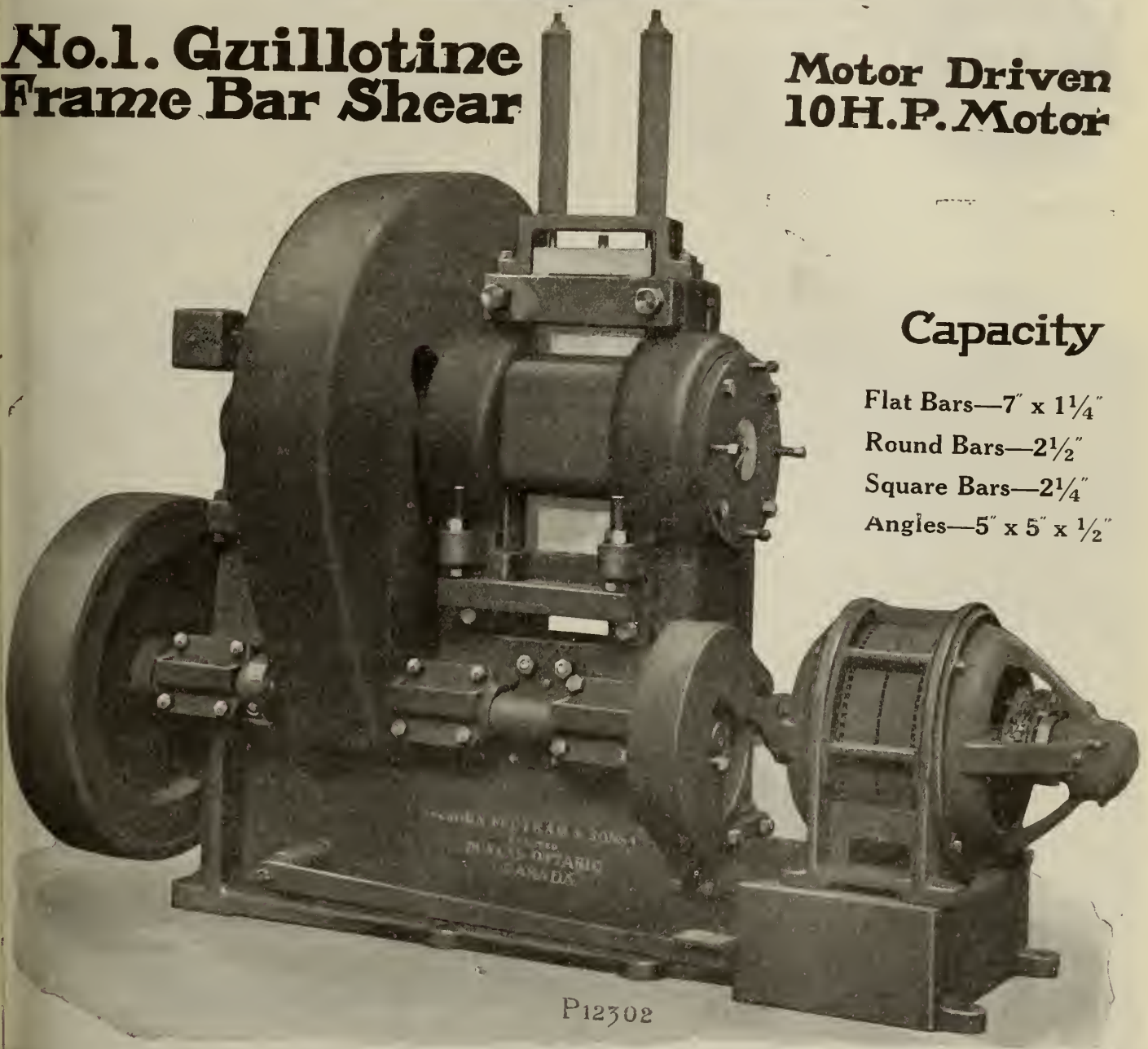

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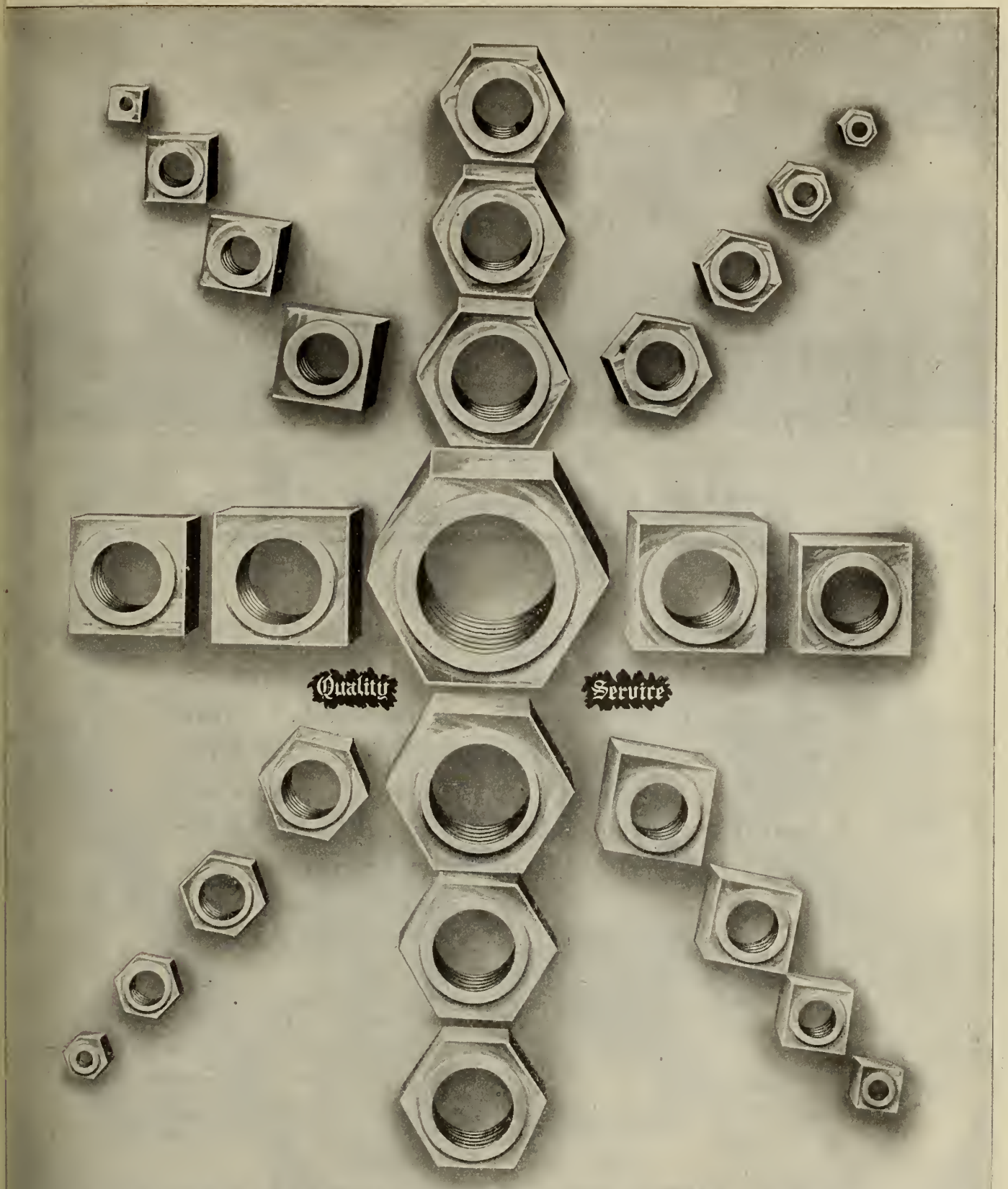

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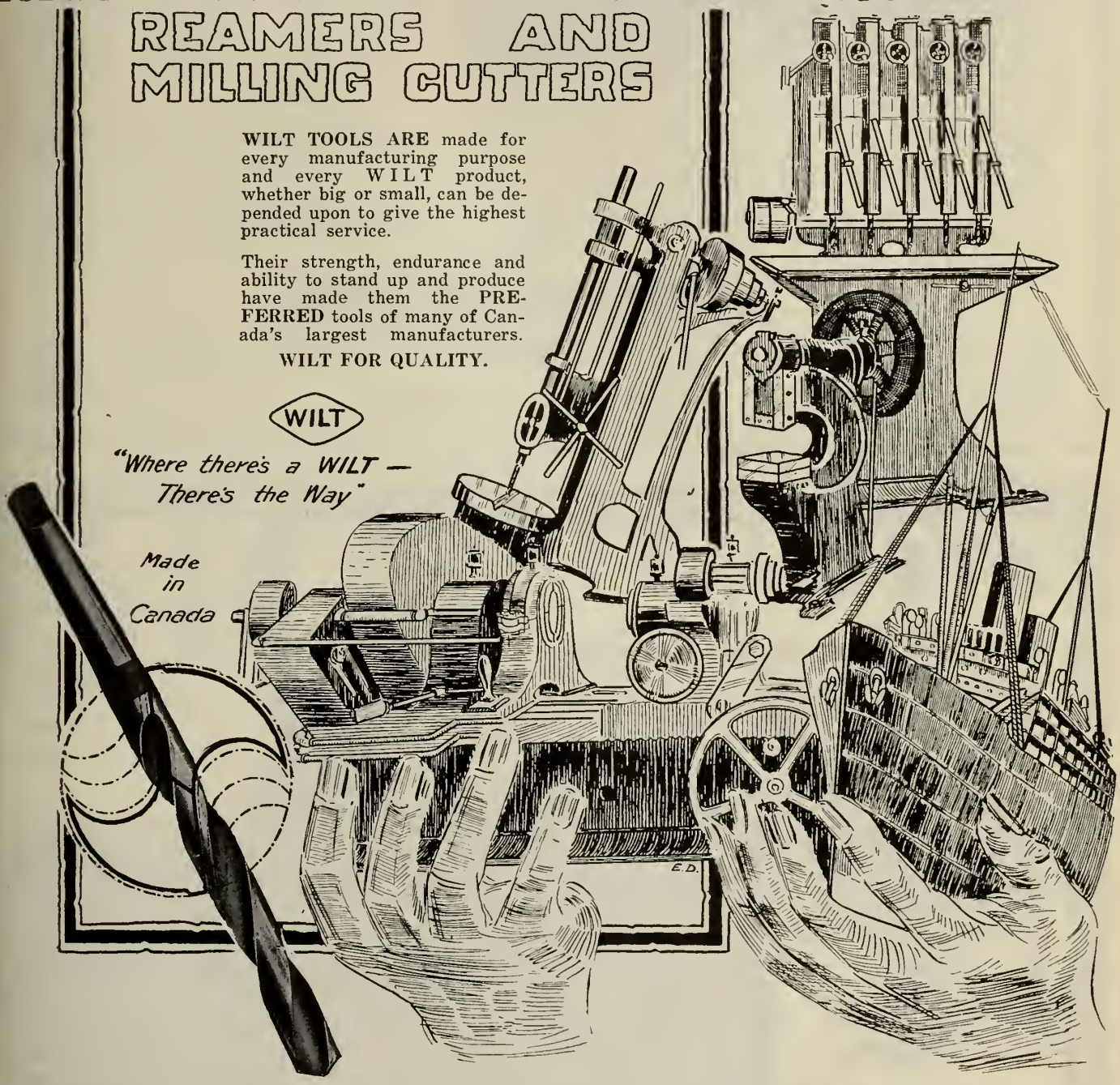

WILT TWIST DRILL CO OF CANADA LIMITED

Walkerville Ontario

London Office: Wilt Twist Drill Agency, Moorgate Hall, Finsbury Pavement, London E. C. 2, England

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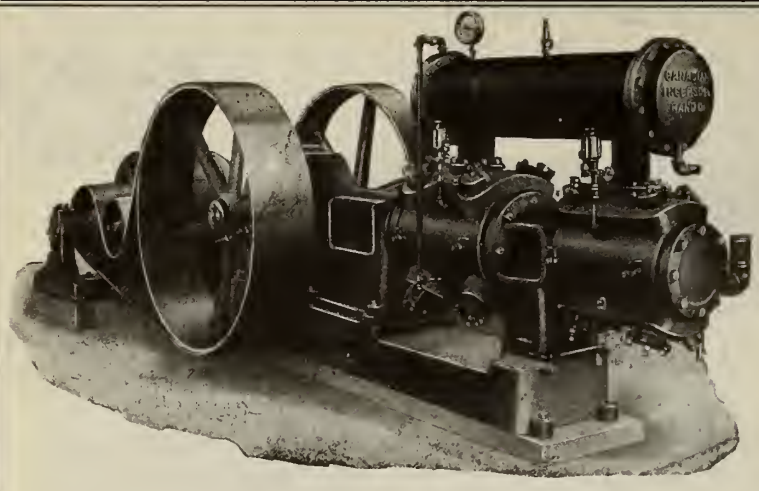

Class "EL-2" Compressor with short belt drive

SMALL COMPRESSORS FOR HIGH DUTY SERVICE

Class EL-2 Compressors are of enclosed dust-proof construction, having automatic flood lubrication and silent trouble-proof leaf valves. They possess the high compression efficiency obtained by two-stage compression, together with the simplicity and compactness of the straight line arrangement of cylinders.

Where space is scant and EL-2 Compressors with a Short Belt Drive Attachment makes a simple and compact unit comparable only to the direct connected type in economy of floor space and mechanical efficiency and at the same time is more elastic.

Bulletins describing these machines in detail will be sent by our nearest branch on request.

Canadian Ingersoll-Rand Company Limited

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Every Commercial Purpose

We are the only company in Canada producing steel ingots by the "HARMET" Liquid Process, a process that makes these ingots vastly superior to the ordinary kind, improving the physical properties and reducing the waste of ingot.

We can supply forgings of all shapes and sizes made of ordinary or "HARMET" Fluid Compressed Open-Hearth Steel on the Shortest Notice.

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Steel Ingots
by the
HARMET
Liquid Process

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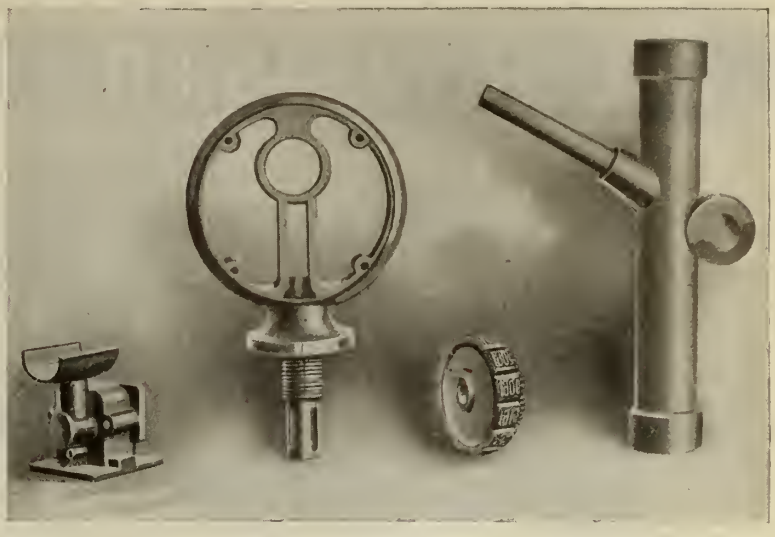
Die-Cast Parts

Mean Low Cost

Your small Metal Parts can be Die-Cast at a greatly reduced cost. The largest manufacturers are taking advantage of this modern method of production. Whether you are a large or small manufacturer you can save money by having your quantity parts Die-Cast by us. Our Die-Castings require no machining—they are smooth and accurate; no burrs, no rough spots. **Send blue print or sample of work and we will be glad to quote prices.**



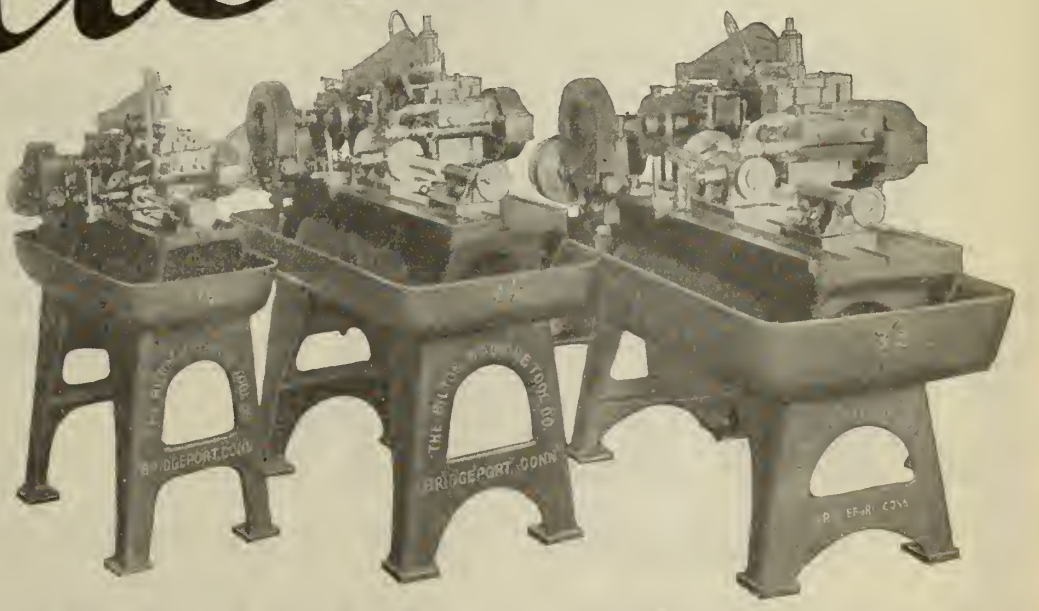
Die-Casting Chat No. 4

You might ask, "Can I use Die-Castings in my particular business?" Allow us to answer that question. Let us know your requirements. We will then let you know if you can use Die-Castings successfully. Above all, remember that the Die-Castings Method is a proven expense saver, not a novelty.

Largest Manufacturers of Die Castings in Canada

THE FISHER MOTOR CO., LIMITED
ORILLIA, ONTARIO

Bilton GEAR MILLERS



Fully Automatic

Their adaptability is almost unlimited on small work—such as cutting spur, bevel, miter, angle gears, saws, ratchets, sprockets, cutters, knurls, taps, cylinders, form cutting, manufacturing, milling, etc.

A big time saver, as indexing takes place during return stroke of cutter — which is removing metal 90% of the time.

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Over 500 leading manufacturers now use the Bilton for high production on accurate work

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Foreign Agents: Alfred Herbert, Ltd. Chas. Churchill & Co., Ltd.

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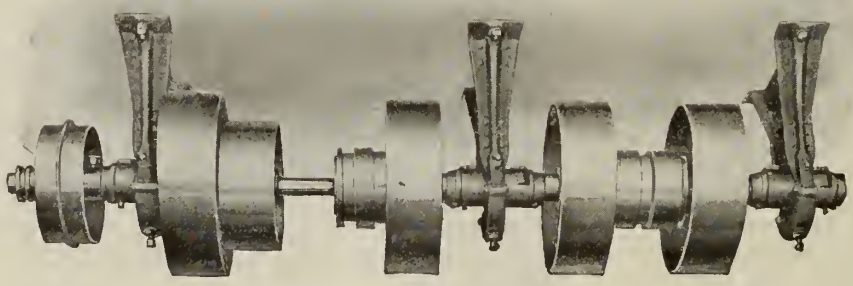
THE JOHNSON FRICTION CLUTCH



Put Johnson Clutches on Your Countershafts

Here's a countershaft equipped with three Johnson Clutches — two of the single type and one of the double — providing two speeds. a reverse, and a light auxiliary drive. An exceptionally neat and compact construction is obtained, light in weight and smooth-running.

Wherever really high-grade equipment is desired, Johnson Clutches are the selection. For general transmission purposes there is no clutch more reliable, and none so adaptable to all conditions. Johnson Clutches in special types have also been incorporated successfully in machinery of all kinds. Their exceptional fitness for this line of work is described in our booklet, "Clutches as Applied to Machine Building."

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THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN.

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"The only distinct advance in furnace practice since Siemens' time."

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SPEEDICUT High Speed Steel
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Superior steels of the highest quality, each a leader in its class.

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High Grade STEEL Castings
Of Every Description

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Send us your drawings for estimates.

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WELLAND ONTARIO

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on a Heavy, Rigid

FORD-SMITH GRINDER

Heavy Type Floor Grinders

Our new line of floor grinders has been designed to put these machines on a really efficient basis. All types are of the strongest and most rigid construction. Even the highly skilled mechanic will find a great difference in the quality of the work and the ease and speed with which it is done.

Full specifications, prices and photographs will be mailed upon request.

The Ford-Smith Machine Co., Ltd.

HAMILTON, CANADA

Foreign Agents:
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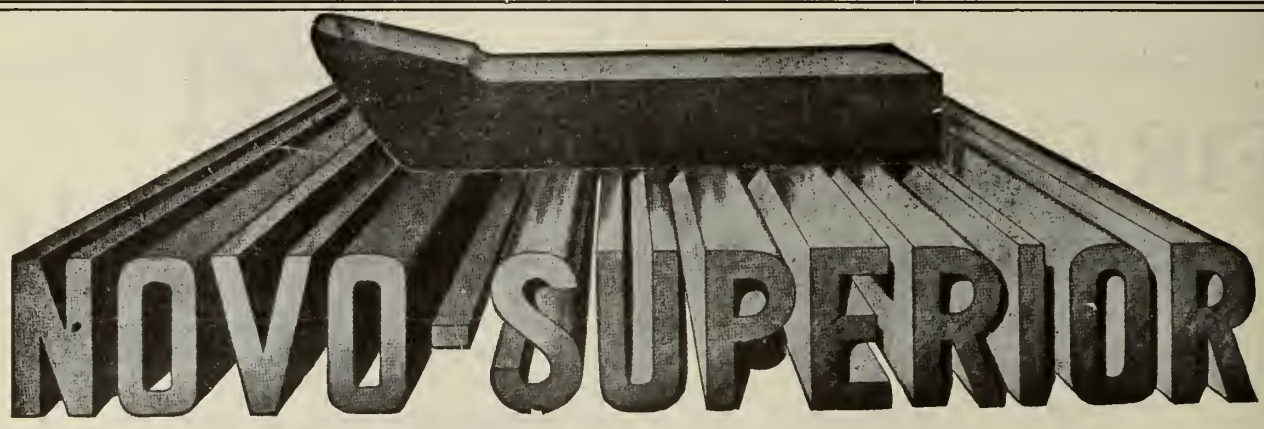
Gollin & Co., Melbourne, Australia



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Tool Steel for Every Purpose

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Twist Drills, Taps, Hack Saw Blades, Milling Cutters, Files, Etc.
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Electric furnaces, automatically regulated, the most modern methods, and the introduction of Uranium — make this a steel of truly remarkable cutting properties.
We know "Electrite" cannot be bettered — and stand ready to prove it to you.

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You can always depend upon Dunbar Springs being accurate. Before proceeding with any order the first few springs are carefully tested and checked up for this very purpose.
Seventy-two years' experience making flat and spiral springs of every description enables us to furnish you with springs of the highest quality, that can be depended upon under all conditions.

Send blue prints for estimates.

The Dunbar Brothers Co.
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THE MASTER METAL

STELLITE

Not Steel—but its master

A thing or two about this master metal.

Stellite is not steel—but its master. It is an alloy of semi-rare metals that is harder, tougher and more lasting than the hardest steel. It is immune to heat up to 1800° F.—far past red heat—where the highest speed steel goes to pieces.

Stellite tools can not only be worked much faster than steel, but they can take heavier cuts and last much longer between grindings.

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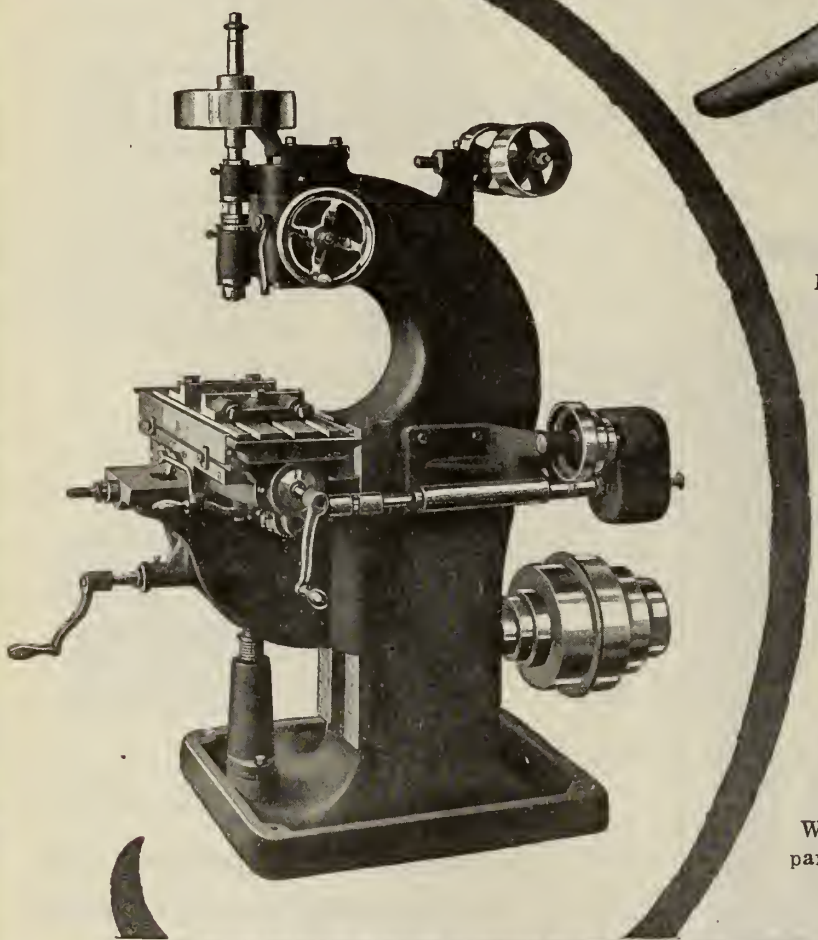
THE MASTER METAL

BRISTOOL

Bristol Vertical Milling Machine

A Tool of Large Capacity



Ball Bearings are used at the most important points making it a free running tool, which, combined with its being a belt-driven machine, makes it capable of turning out work on which an extra smooth finish is desired.

The longitudinal table feed is controlled by the gear change box which gives six different feeds for each change of spindle speed. A stop to gauge with micrometer adjustment is used on the head to regulate the depth of cuts.

Learn all about its production capacity.

Write for bulletin giving fullest particulars.

BRISTOL MACHINE TOOL CO.
SUCCESSORS TO C. G. GARRIGUS MACH. CO.
BRISTOL, CONN.

"WACO"

THE HIGH SPEED STEEL

MARSHALL, SON & BUNNEY
39 Richmond Street East TORONTO, ONT.

SOLE CANADIAN AGENTS FOR
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ALL SIZES
IN STOCK

LOCOMOTIVE AND CAR WHEEL TYRES

HIGH SPEED AND CARBON
TOOL STEEL

MISCELLANEOUS SHOP TOOLS
MADE IN CANADA

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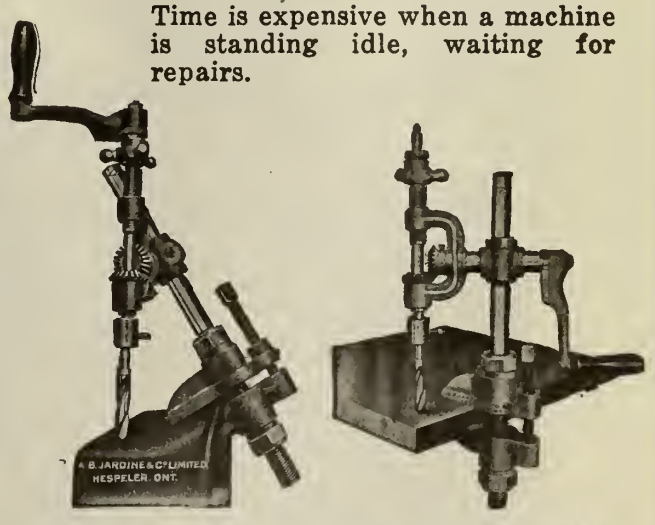
Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.



On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

Weight, 40 lbs. Price, $26.50 net.
Sold by all Machinery and Supply Houses

A. B. JARDINE & CO., Limited
HESPELER, ONTARIO

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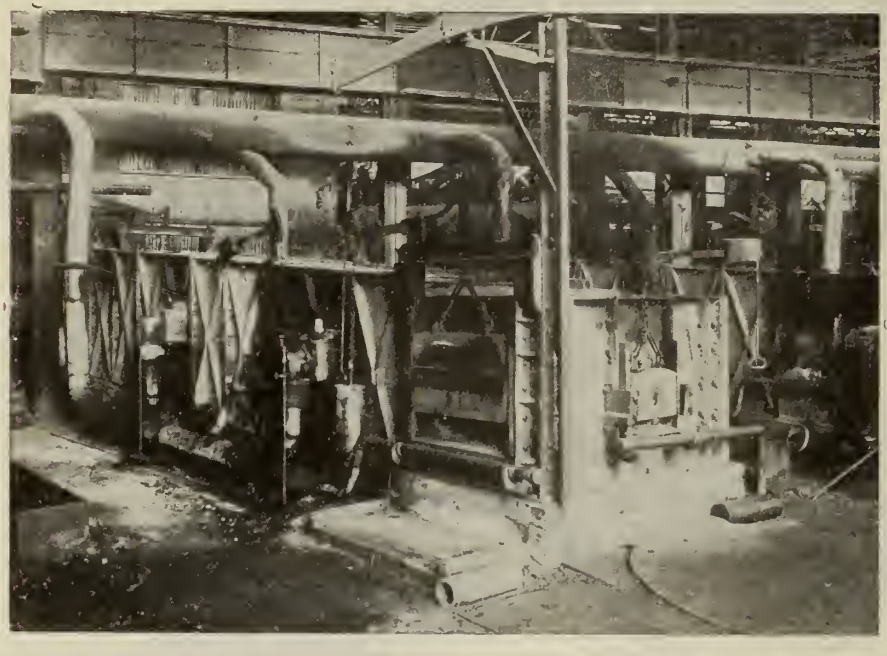
Another MECOL Furnace

demonstrated its superior features point by point to a group of men whose years of experience in the heat-treatment of metals made them appreciative judges.



We refer to the "Mecol" Furnace shown in this illustration, installed at the Pointe St. Charles Works of the Canadian Steel Foundries, Limited.

Our intimate knowledge of heat-treating methods, and our long experience in the building of efficient furnaces fit us to give helpful advice—and that we will do promptly if you

Write

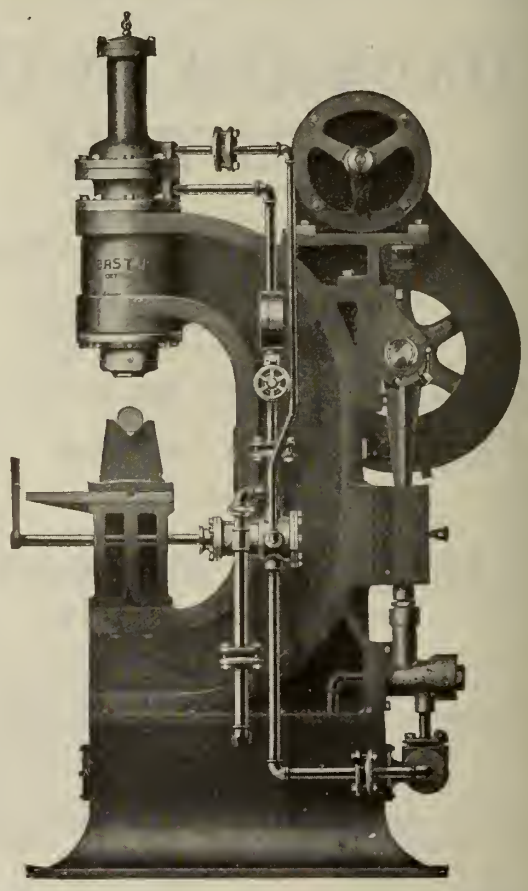
Mechanical Engineering
Company, Limited
Room 308, Bank of Toronto Bldg., Montreal
Three Rivers, Quebec, Canada

A SELF-CONTAINED HYDRAULIC UNIT

EASTERN UNIVERSAL HYDRAULIC PRESS. Supplied in 20-35 and 50 ton capacities, full hydraulic depending on no springs or weight for return of ram, delivering pressure instantly at a speed of 1½″ per second return of ram 3″ per second.

Length of Ram Travel . . . . . 6 in.
Depth of Throat . . . . . 10 in.
Length of Table . . . . . 8 ft.
Width of Table . . . . . 10 in.
Table to Ram . . . . . 10 to 14 in.

EASTERN UNIVERSAL PRESSES are tested before leaving our plant at 33 1/3% overload. They are furnished with rolling centres and are unexcelled for straightening of motor crankshafts, heavy wheel shafts, broaching splines in drive plate, differential gears, and others. Straightening front axles and spindles.



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EASTERN PRODUCTION COMPANY

137 Leib St., DETROIT, MICH.
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Canadian Representatives:
F. F. BARBER MACHINERY CO., Limited,
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Increase the Output and Reduce the Cost

Machine is always cutting metal. While the attendant is loading one vise or fixture, the cutter is milling work carried on the second table.

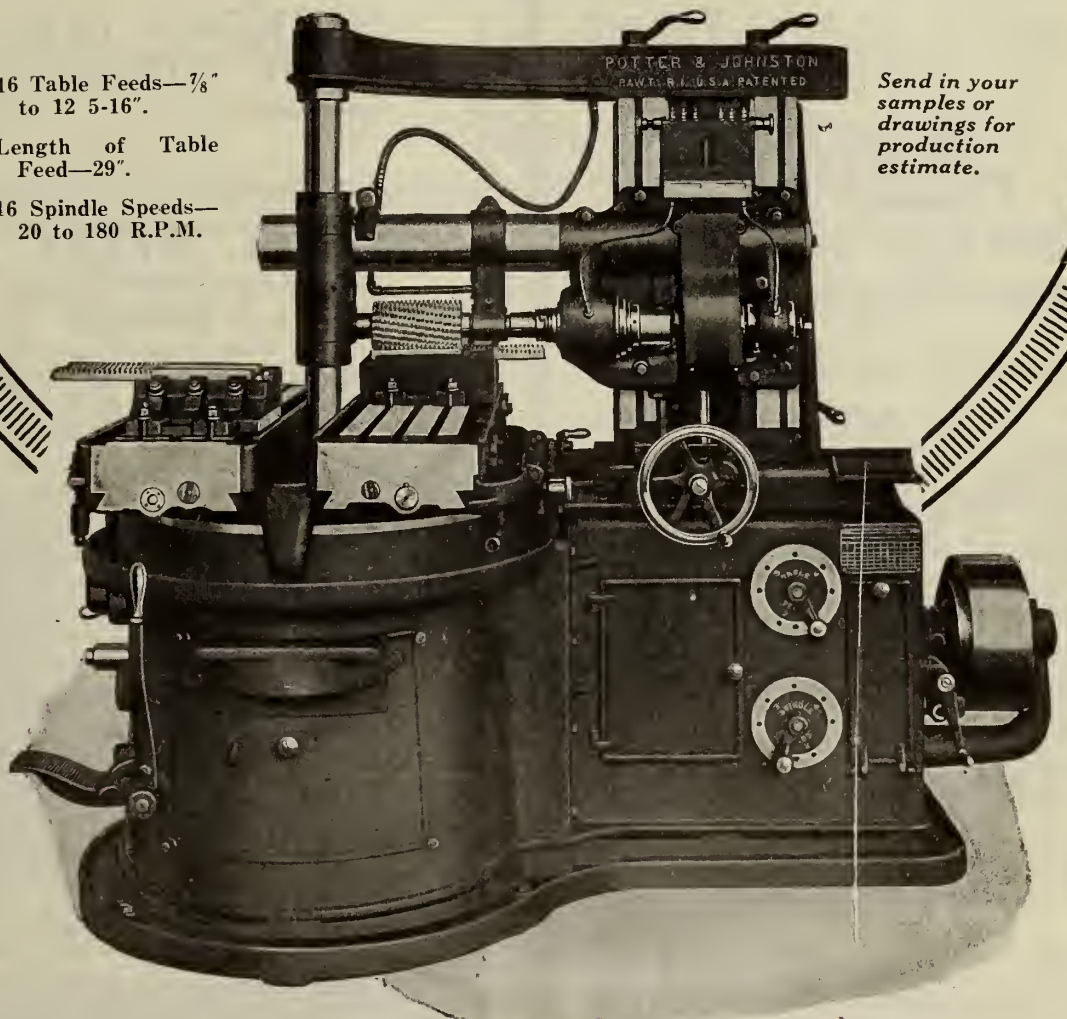
The finished work is never returned under the cutter, thus avoiding all marks or scratches on the milled surface.

We want you to know more about the possibilities of this Automatic Milling Machine for your duplicate milling.

16 Table Feeds—7/8" to 12 5-16".

Length of Table Feed—29".

16 Spindle Speeds—20 to 180 R.P.M.



Send in your samples or drawings for production estimate.

Canadian Office: POTTER & JOHNSTON MACHINE CO.

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Repairing a large Turbine dropped from a flat car, breaking one corner of reduction gear case.

In Ship Yards— In Large and Small Shops

Wherever there is a welding or cutting job to be done. You will find the mainstay to be

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DISSOLVED ACETYLENE

"The Universal Gas with the Universal Service"

Prest-O-Lite Service provides to users the best possible fuel supply —permanent, nation-wide, responsive to every demand.

Tell us how much gas you use. You'll be interested in the Prest-O-Lite plan, and the service our conveniently located plants and warehouses can insure you anywhere in Canada. Write

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Non-Flash "REGO" Torches

Based on a Brand New Principle

Save Oxygen No Backfire Better Welds

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"MADE IN CANADA"

Davis-Bournonville Oxy-Acetylene Welding and Cutting Apparatus

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ARMCO IRON WELDING RODS

AMERICAN ARMCO IRON

ARMCO IRON is the standard welding wire for both electric arc and oxy-acetylene welding. It has unequalled welding qualities, due to chemical and physical uniformity; 99.84 per cent. pure iron content (minimum) guaranteed. Distributors in all industrial centres. 66

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STEEL AND WIRE PAGE QUALITY PRODUCTS

Announcement

The Carter Welding Company of Toronto, Limited, has been appointed Exclusive Agents for the Dominion of Canada for the famous

"REGO"

No-flash welding and cutting torches and equipment

Agencies and Service Stations will be established in the following cities:

Toronto	**Montreal**	**St. John**	**Halifax**
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The Company is open to receive inquiries from live Dealers, who are confident they can produce results, and only such will be considered.

All Inquiries Strictly Confidential

The Carter Welding Co. of Toronto Ltd.

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IMPERIAL CARBIDE

For Welding Cutting and Lighting

HIGHEST GAS YIELD — IMPERIAL CARBIDE — MADE IN CANADA

It insures **effectiveness** and **economy** by **invariably** producing acetylene gas of **unusual purity.**

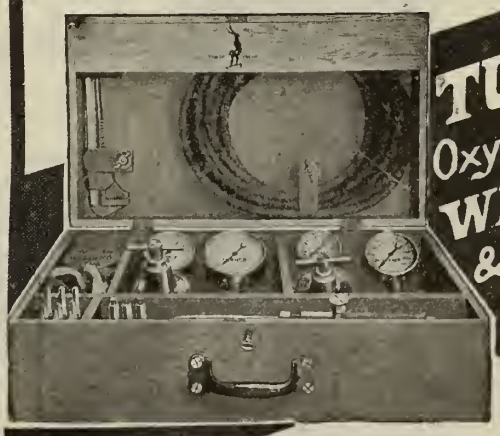
Manufactured by

Union Carbide Co. of Canada, Ltd.

WELLAND, ONTARIO

Large Stocks maintained at convenient distributing centres throughout Canada

For Repairing Broken Machinery or Tools of Medium Size



These outfits will soon pay their cost in machine parts or tools reclaimed. The sectional extensions of the torch enable the operator to adjust it to any desired length or angle. The location of valves is such that the flame is controlled by one hand, leaving the other hand free for the work at all times.

For full particulars write

The Turner Brass Works

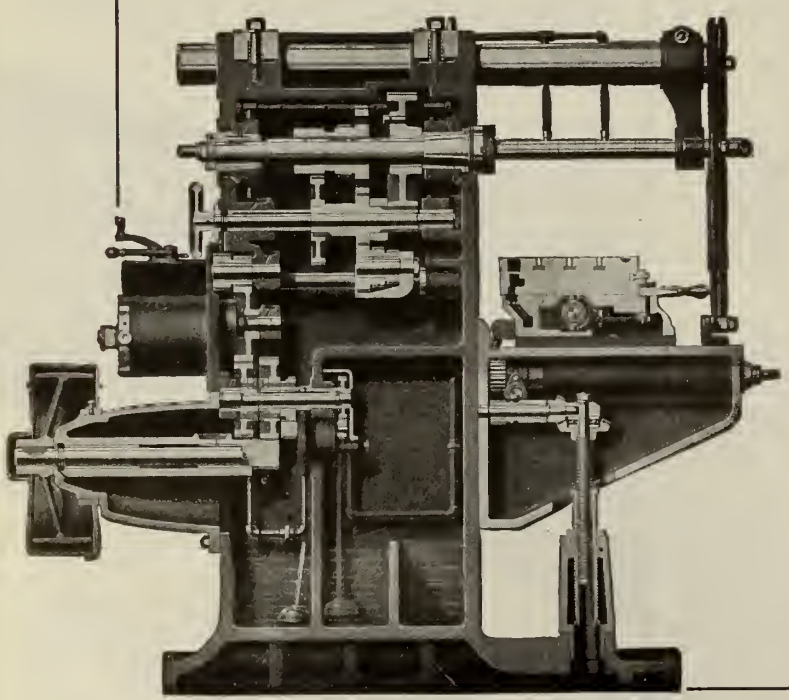
SYCAMORE, ILLINOIS, U. S. A.

If interested tear out this page and place with letters to be answered

MILWAUKEE MILLING MACHINES

Perfect Lubrication

ONE of the most important features of Milwaukee Milling Machines is the AUTOMATIC FLOODED LUBRICATION SYSTEM, which pumps six quarts of lubricant per minute through the bearings and over the hardened steel gearing in the column, feed box and pulley bracket. This system is highly efficient and it takes the responsibility of lubricating these parts of the machine off the operator, foreman or superintendent entirely, as the reservoir containing the lubricant has to be filled only two or three times a year. The pump for supplying lubricant operates whenever the driving pulley or motor revolves.



The CUTTER LUBRICATING SYSTEM, which is also very important, supplies the cutter lubricant or cooling compound to the cutters, through adjustable nozzles, by a pump in the base of the machine. The lubricant or cooling compound is returned from the table by a patented telescopic tubing arrangement instead of a flexible hose. The pump, piping, etc., are included in the price of the machine and are an integral part of the design. The pump for lubricating the cutters is so arranged that it operates only when the spindle revolves, or cutter lubricant may be shut off entirely when desired.

High speed operations may be performed continuously on Milwaukee Milling Machines with minimum supervision of lubrication.

For complete details, write for catalogue No. 21.

KEARNEY & TRECKER CO. MILWAUKEE, WIS. U.S.A.

Johansson Gages

One Price That Has Gone Down

TO BE able to reduce the price of a high quality article is always a noteworthy achievement. To-day with prices going up at the present rate, it is little less than a miracle. It is, therefore, with considerable pride that we announce that the price of Johansson Standard Gaging Sets has been appreciably reduced.

THIS has been made possible by the efforts of Mr. Johansson in training a corps of skilled toolmakers to produce these gages in increasing quantities. For years, with the assistance of only a few associates, he made and finished the blocks which go into the Standard Set in necessarily limited numbers. With the ever-increasing demand for these tools as standards of measurement throughout the world and particularly in America, he set upon the task of training a larger number of men in their production. This naturally resulted in reducing their cost while still maintaining their accuracy and has made possible the offering of these sets at a price which makes them applicable as actual working tools in the machine shop.

WHAT this means to the manufacturer of to-day who is confronted with under-production, can hardly be estimated. Engineers agree that the Limit System, where interchangeable parts are made with accurate tolerances is the acknowledged solution of this problem of under-production. Several sets of Johansson Gages in constant use is a big factor in the operation of the Limit System.

WRITE for a description of how Johansson Gages are employed in developing the Limit System in manufacturing. New prices of Johansson Gaging Sets on request.

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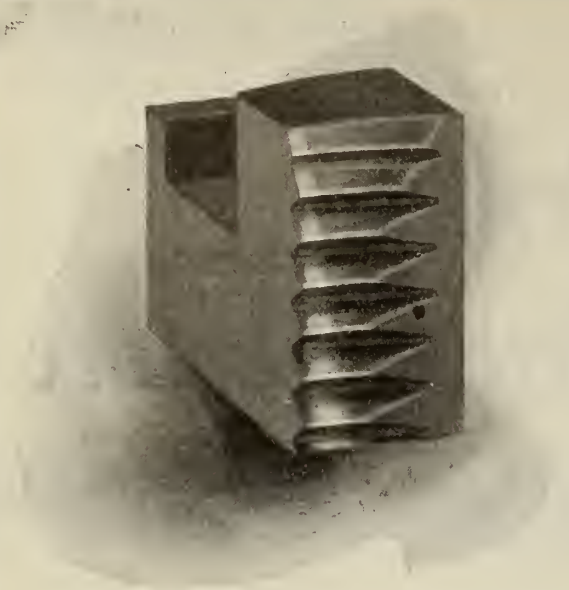

Don't Scrap the other Chasers

If one in a set breaks

Put in a New Chaser

Grinding set to uniformity.

This *Is* Practicable *If* You Use

HARTNESS AUTOMATIC DIES

Jones & Lamson Machine Company

(AUTOMATIC DIE DEPARTMENT)

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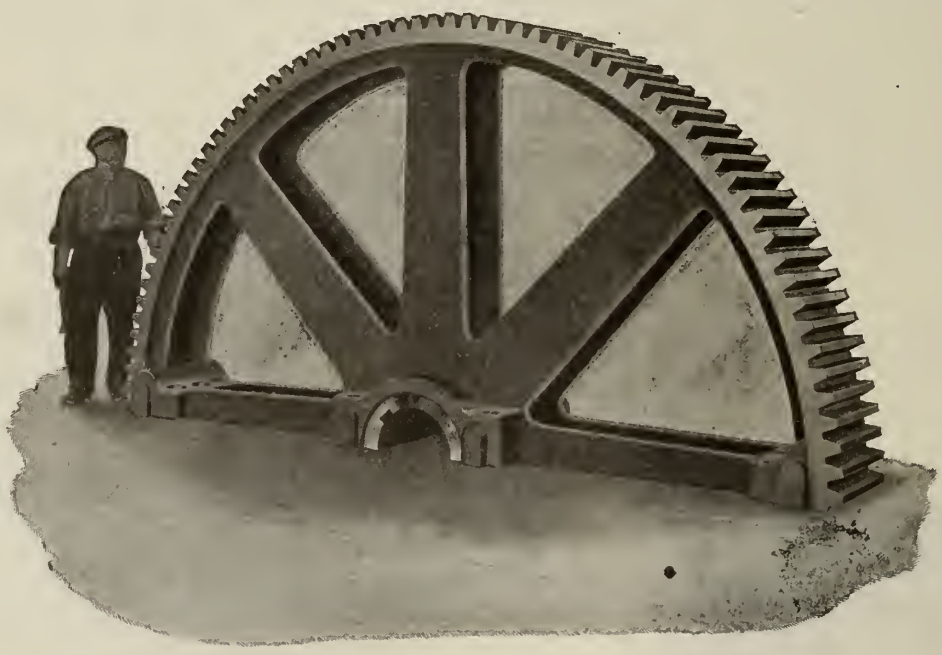
Japan, Manchuria, Korea, Formosa—Mitsui Bussan Kaisha, Ltd., Tokyo, Japan.



Fourteen Foot Diameter Half Section Cast-Steel Gear

DOMINION FOUNDRIES & STEEL, LIMITED

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Lying in the United Kingdom and

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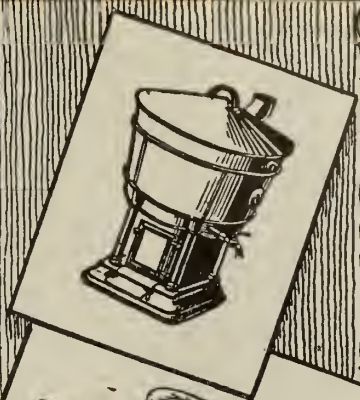

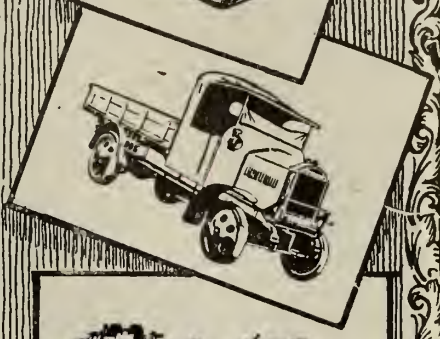

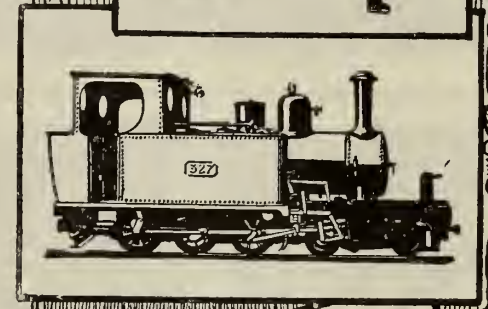

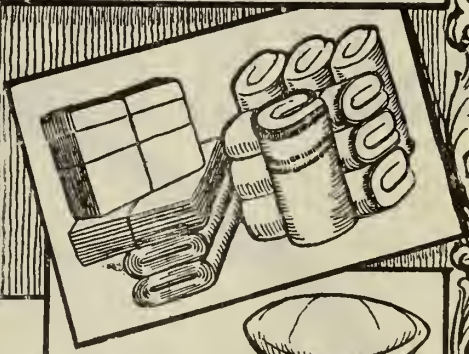

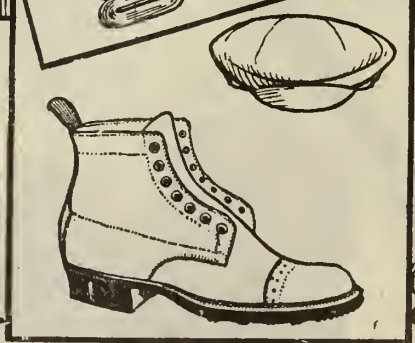

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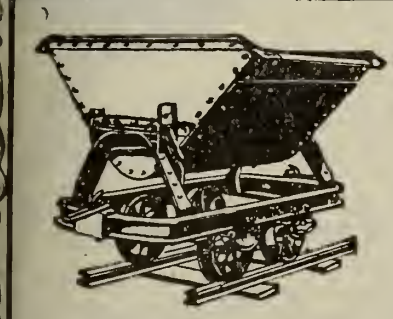

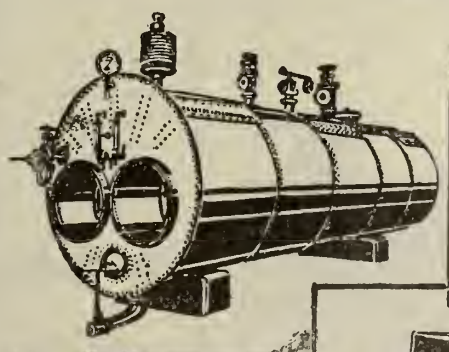

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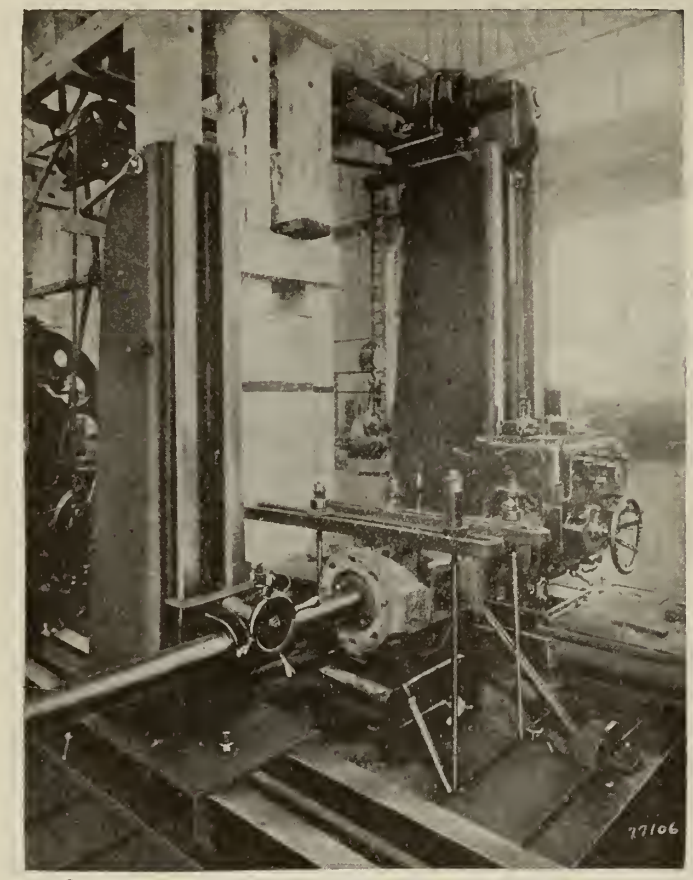

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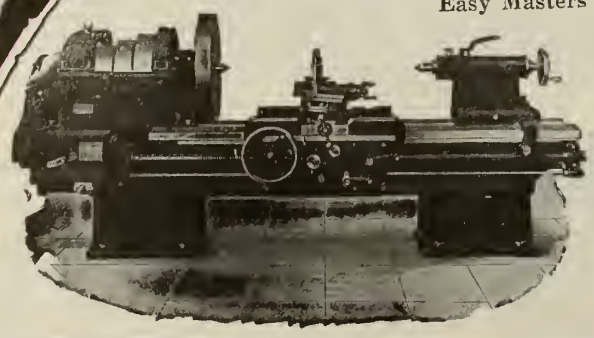

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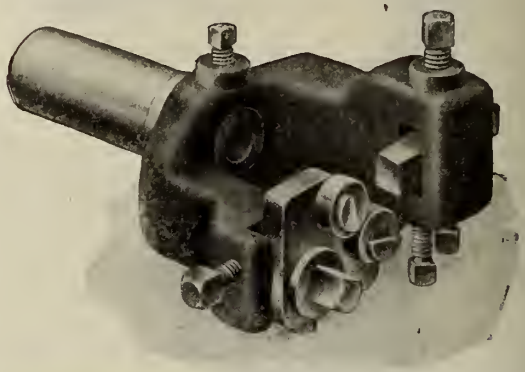

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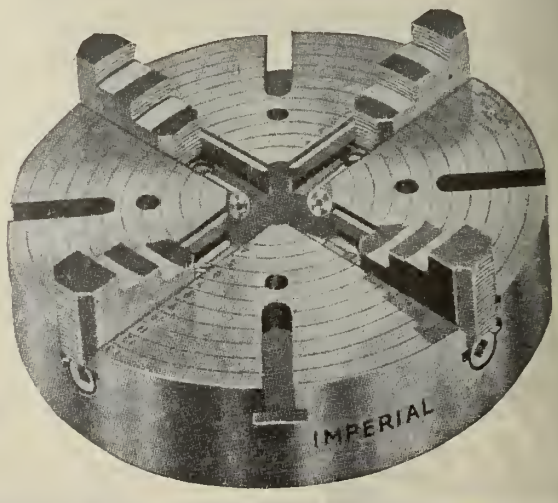

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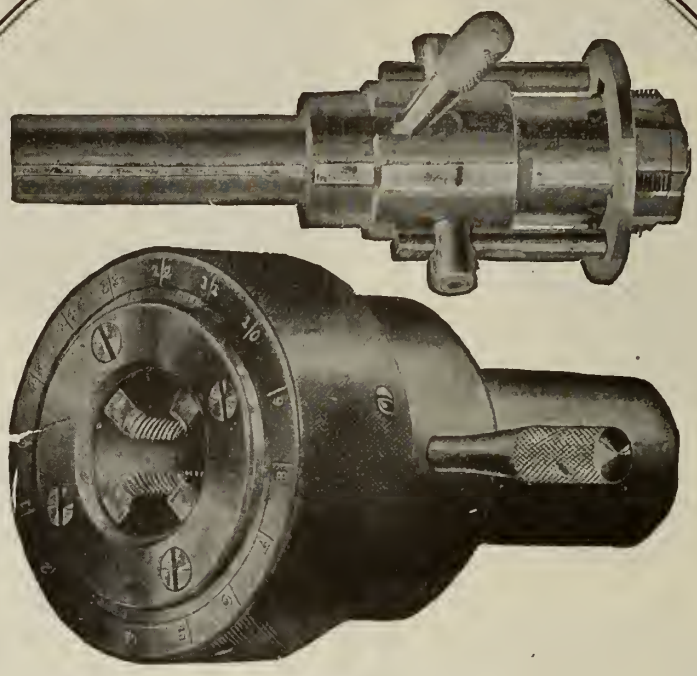

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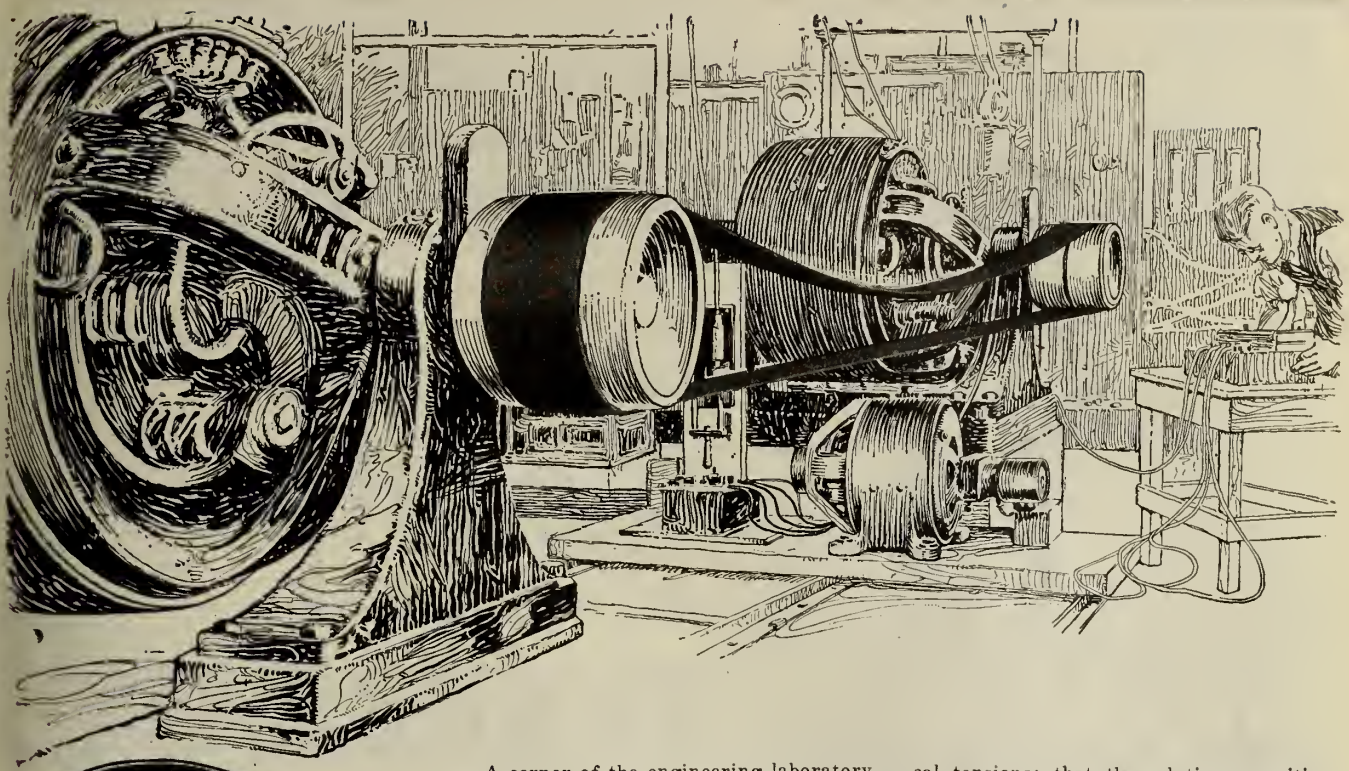

A corner of the engineering laboratory, Graton & Knight Manufacturing Company, Worcester, Mass., showing a G & K belt on a testing machine. Tests of this kind have demonstrated that leather belting possesses the highest capacity for power transmission in the belting field; that the advantages of leather belting are maintained at all speeds and at all practical tensions; that the relative capacities of various belts remain the same on various kinds of pulleys; that properly prepared leather, unlike substitute material, possesses a big overload capacity and that a leather belt will equal in load capacity, a substitute belt a quarter again as wide as the leather belt.

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Graton & Knight experts have made the transmission of power by belting an exact science. Ignorance is now the one excuse for waste. Graton & Knight belting engineers are just as certain what a belt will do under specific circumstances as an engineer is of a motor's performance.

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Many of the best belted plants ask us to specify the belting for every pulley drive. We shall be glad to solve your problems without committing you to buy our belts.

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Tanned by us for belting use

2 Minutes or 20?

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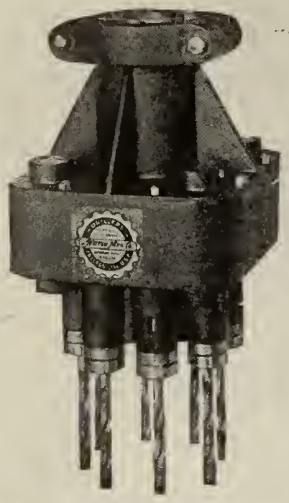

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16 and 20 inch

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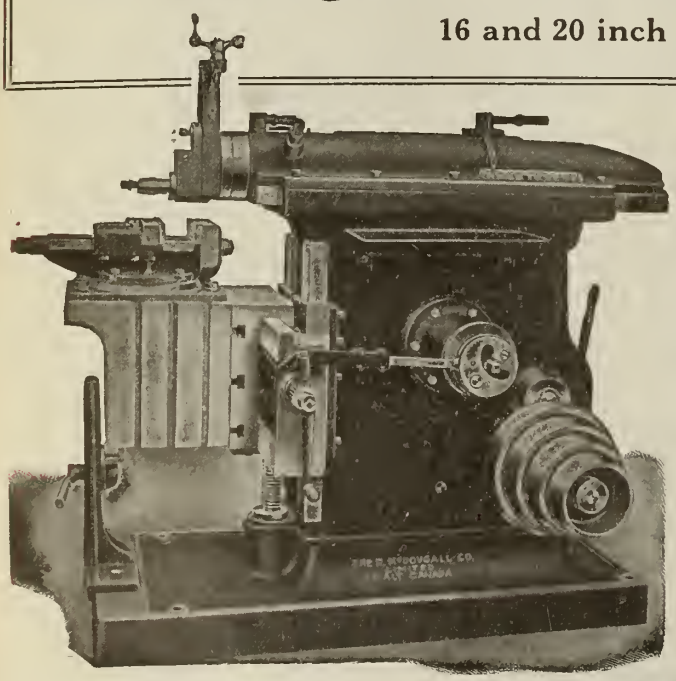

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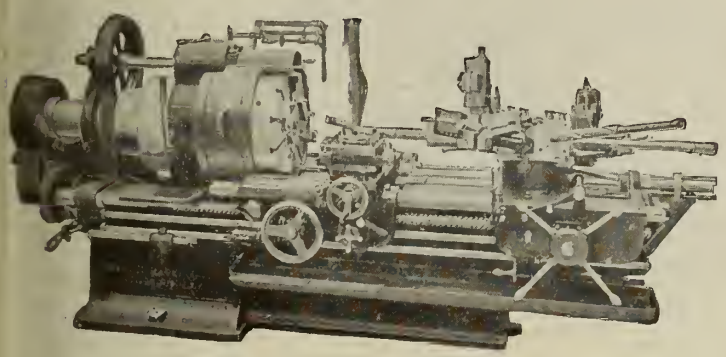

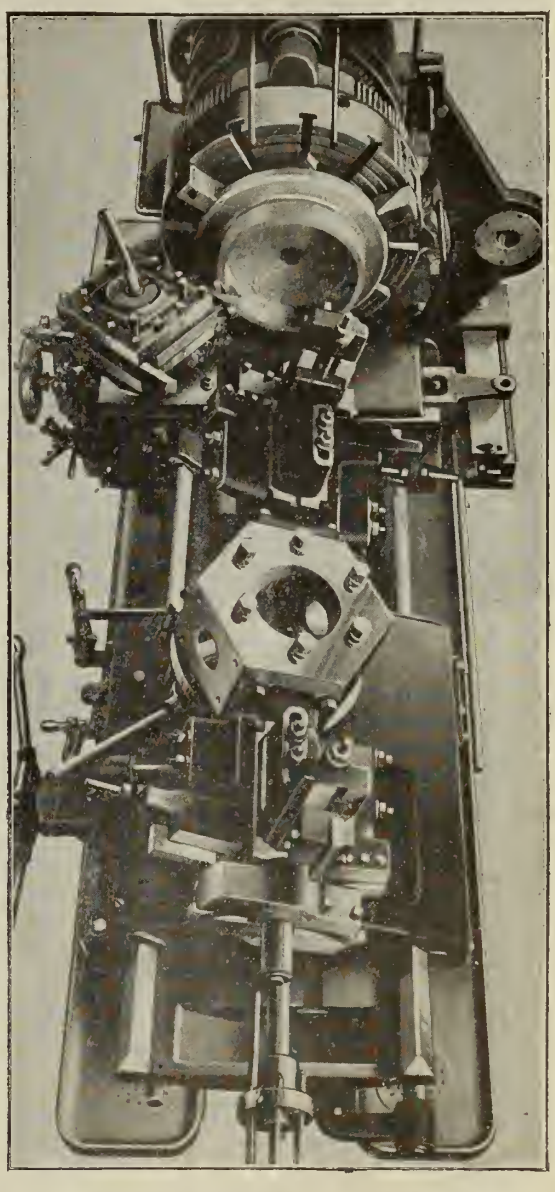

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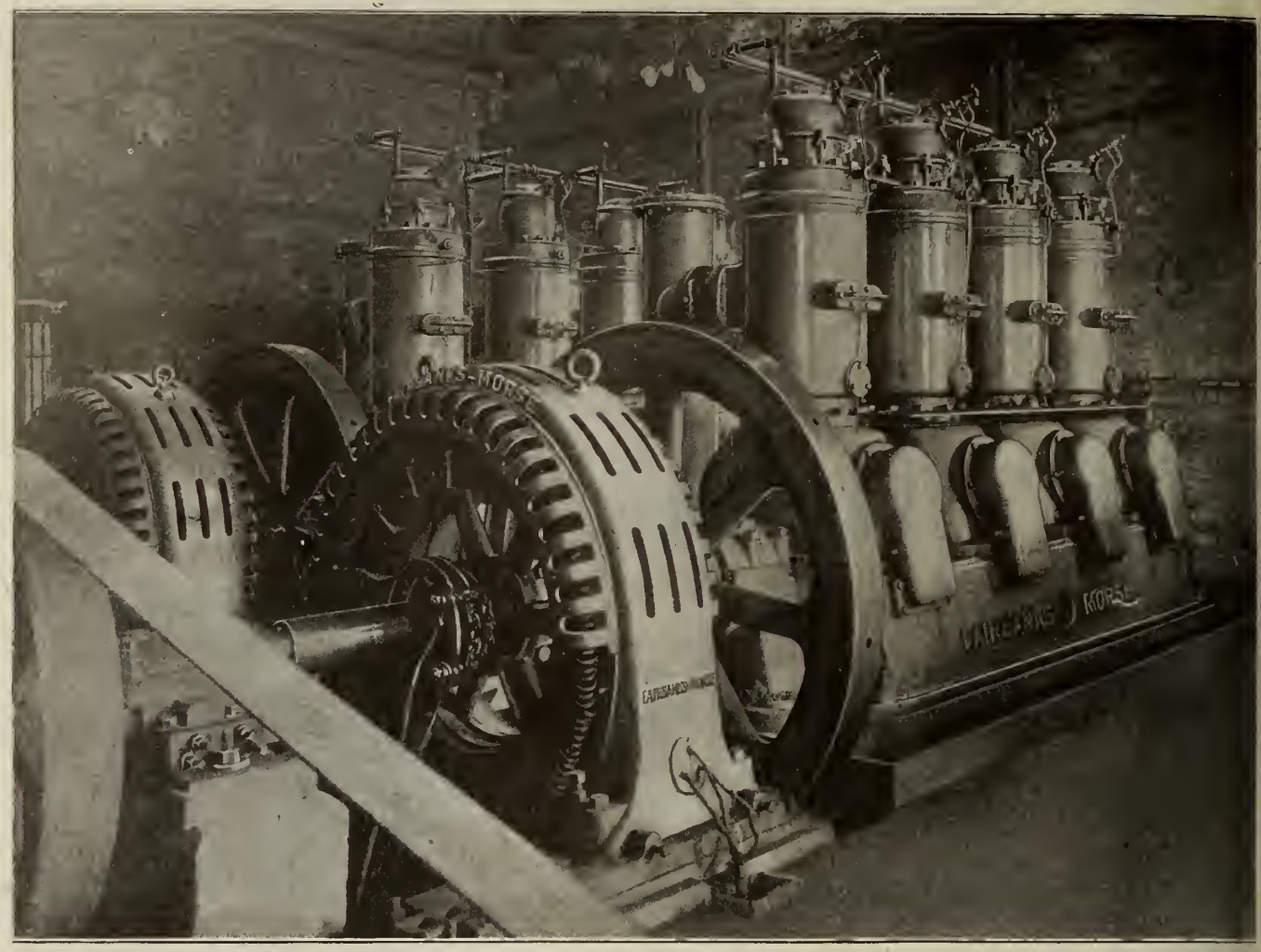

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CANADIAN MACHINERY
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Vol. XIII, No. 17. April 22, 1920

Troubles Caused by Moisture in Compressed Air

It is a Well-Known Fact That Moisture in Compressed Air is Something to be Avoided—The Discussion Explains How This Trouble May be Overcome

By F. A. McLean

MOISTURE in compressed air should always be avoided as much as possible, especially where it is to be used to operate reciprocating or rotating mechanisms on which it has a pernicious effect when carried into the working parts, tending to wash away the lubricant, thereby increasing the wear and shortening the life of the moving parts through leaving highly finished and closely fitted surfaces bare, and in sliding or rolling contact with each other. While this is true of practically all air-operated machines, it is particularly so in the case of those operating at high speeds, such as hammer drills, pneumatic tools, motor-driven air-hoists, sand rammers and the like, in which the surfaces exposed to wear are of necessity limited in size, and since air underpressure is hard to hold, the parts are machined to very close limits, and wear is particularly objectionable on the ground of lowered economy through increased air consumption and loss of power.

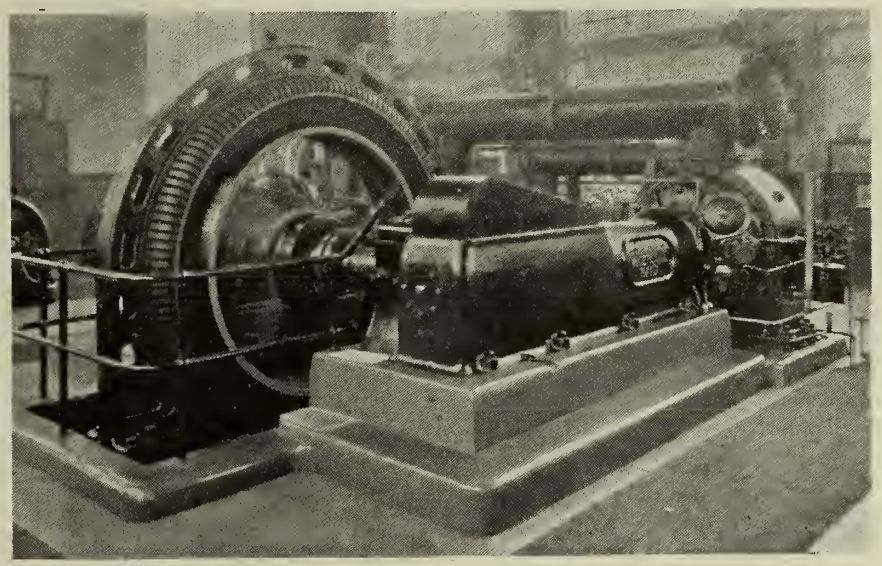

FIG. 2—MOTOR DRIVEN, DIRECT CONNECTED COMPRESSOR AND HORIZONTAL AFTERCOOLER. THE AFTERCOOLER IS DIRECTLY IN FRONT OF THE COMPRESSOR, AND NEAR THE WINDOW.

While moisture in wet air is bad enough in interior piping, its effects are likely to be far worse out of doors in open cut mining, quarrying, contracting, shipbuilding, switch and signal work, etc., where it is likely to collect at low points in the system, causing water hammer with consequent racking effect on the joints and loss of power through reduction of the air passages, as well as increasing the danger of freezing and bursting of the pipes during cold weather. The low temperatures caused by the rapid expansion of the air from the exhaust of rock drills, pneumatic hammers and other air-operated devices will often freeze the moisture, clogging the exhaust openings and preventing their efficient operation.

On railroad switch and signal work, freezing is a very serious matter, as, should these devices fail to funcation at the proper time through the freezing of the working parts, it is likely to cause considerable loss of life and property.

Time is generally an important factor in contracting and mining operations and losses in this respect are usually of more importance than in other directions. It is, therefore, essential that the proper precautions be taken to ensure freedom from interruptions which are too often caused by freezing of the pipe lines, drills or tools. In a case of this kind which came to the writer's attention late last fall, operations at a large Eastern mine were held up and the miners forced to sit around and "swap" stories for two hours while waiting for the pipes to be thawed out. This did not happen on a cold day, but on one that was damp and muggy.

While it is possible to compress air, it is practically impossible to compress water and sometimes breakage of the working parts of a tool is caused by too much water in the air lines. Pneumatic tools and other air-operated equipment are designed to operate on air and are not adapted for "hydraulic drive."

Where tools or drills are operated on air which contains an excessive amount of water and are then allowed to remain idle for a while without proper attention they soon get rusty and it is usually not long before losses from air leakage and maintenance costs grow larger.

The Importance of Cool Compressed Air

Air discharged from the cylinder of a compressor is hot in comparison with the atmosphere, and on entering the supply pipe lines heats them to some extent. this heating effect travelling further along the pipe lines with the continued operation of the compressor causes them to expand gradually, with the result that when the compressor is shut down for the night, in the cooler atmosphere, they are subjected to an equivalent, but more violent contraction. Although this effect may not be readily noticeable, it is likely to result in strained and loosened joints, with consequent loss of efficiency through leakage.

Aftercoolers—The Remedy

It is a well-known fact that atmospheric or free air always carries moisture (the amount varying with meteorological conditions in different localities),

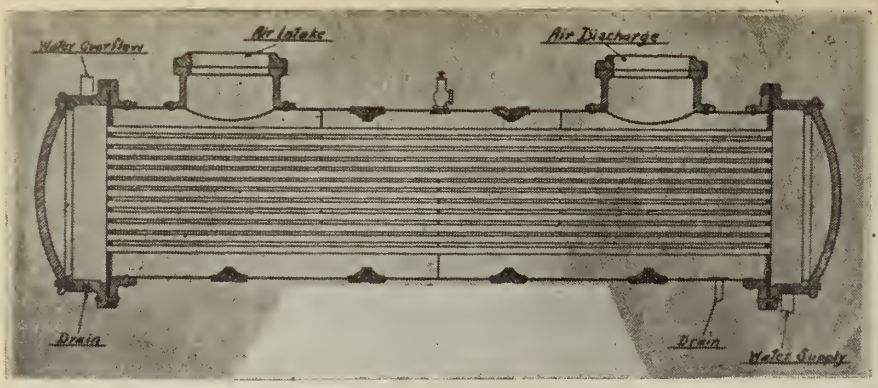

FIG. 1—DIAGRAMMATIC VIEW OF A HORIZONTAL AFTERCOOLER.

and that it also has the capacity to absorb more up to the time that its saturation point is reached.

The moisture carrying capacity of air increases rapidly with rises in its temperature and decreases, but not quite so rapidly with increases in pressure. As the pressure will always be at the highest point just as the air is leaving the compressor, if we can reduce its temperature to the lowest point, the air will be in a position to give up so much of its moisture that there will be little or none left to cause trouble when lower pressures and mayhap higher temperatures are reached further along the line. It is thus evident that the remedy for these conditions lies in reducing the temperature of the air after it leaves the compressor and before it enters the pipes, to as low a point as possible, which will not only prevent all of these troubles, but will ensure better all around distribution efficiency as a whole. Some cooling takes place in the intercooler of a compound or state compressor, and with the larger and better designed intercoolers used on modern compressors, more of the moisture is removed by this means than was possible with the older types. The air receiver also cools the air to some extent and serves as a receptacle for the collection of moisture from the air which passes through it, and for this reason is fitted with cocks by which the moisture can be drawn off at intervals.

In the simplest form of compressed air power plant, the receiver is the only means of removing moisture from the air that is employed. Too much reliance should not be placed on the receiver for this purpose, however, as when located close to the compressor as it should be and the consumption of air is heavy, the temperature of the receiver shell will usually be such that little or no condensation can occur. In some cases, the temperature of the receiver becomes so high that oil carried from the compressor cylinder becomes ignited, causing serious fires or explosions. It is, therefore, better to depend on some means of cooling and drying the air after it has left the compressor and before it enters the receiver and supply lines, and this is where the aftercooler "fits in."

What the Aftercooler Will Do

Aftercoolers cool and dry the air more thoroughly than is possible with the best type of receiver, and so reduce to a minimum the troubles which follow the use of wet air, and in addition remove some of the oil which might be carried into the receiver and perhaps to the pipe lines, to the detriment of the air supply hose. While of considerable importance in mining, quarrying and contracting, especially in tunnels and shafts where oil in the exhaust of rock drills or coal cutters tends to vitiate the air, clean air is even more of a necessity in the case of foundries or in wood-working and textile plants where the air is used for cleaning machinery, or spraying paints, varnishes and other finishes, and the aftercooler is of great value under such conditions.

One of the principal functions of an air receiver is to compensate for the pulsating effect of each stroke of the compressor piston and prevent rapid fluctuations in the air pressure. For this reason the receiver should have sufficient capacity to prevent any material rise in the receiver pressure by the volume of air forced into it at each stroke of the compressor piston. If the air is allowed to pass directly into the supply pipes, there will not be sufficient space for its immediate accommodation and the pressure will momentarily run up far in excess of the average pressure in use, accompanied by a periodic acceleration of flow. This results in an increase in the frictional resistance of the pipes and at the end of each stroke the compressor piston is required to force the air out of the cylinder against a pressure temporarily greatly in excess of normal, increasing the power consumption and putting an unnecessary strain on the compressor. In a single cylinder compressor the discharge pulsations are more violent than in stage compressors, as the total discharge must take place from a cylinder of larger diameter in a smaller portion of the stroke than is the case with the high pressure cylinder of a multistage compressor where the discharge valves open earlier in the stroke and the diameter of the air pipe is about one-half that of the cylinder. In this respect the installation of an aftercooler, since it increases the available receiver capacity, will be of considerable benefit, especially in intermittent work, such as running rock drills, pneumatic tools, hoists, etc., and will assist the governor

AIR AFTERCOOLERS

80 TO 100 POUNDS AIR PRESSURE

Number	Size of Aftercooler: Diameter Shell Inches	Size of Aftercooler: Height or Length Feet and Inches	Actual Square Feet of Cooling Surface	Pipe Connections: Air: Inlet, Inches	Pipe Connections: Air: Outlet, Inches	Pipe Connections: Water Inlet and Outlet	Maximum Capacity of Aftercoolers in Cu. Ft. of Free Air per Minute with Cooling Water at: 60° F.: Single Stage Compression	60° F.: Two Stage Compression	70° F.: Single Stage Compression	70° F.: Two Stage Compression	80° F.: Single Stage Compression	80° F.: Two Stage Compression	90° F.: Single Stage Compression	90° F.: Two Stage Compression	Shipping Weight lbs.: Domestic	Shipping Weight lbs.: Export
1	14	10'-0"	55	5	4	1	253	360	230	330	207	297	186	268	1800	2160
3	20¾	10'-6"	152	8	6	1½	705	1170	640	1051	575	957	518	860	3000	3600
5	22½	14'-6"	305	10	8	2½	1410	2360	1280	2135	1150	1920	1035	1725	4200	5000
7	30	17'-8"	757	14	10	3	3500	5840	3180	5299	2880	4750	2590	4270	8500	10200
9	39	19'-0"	1497	18	14	5	6900	11500	6280	10479	5650	9400	5100	8450	16100	19300
10	45¼	19'-0"	2012	18	14	6	9300	15500	8450	14084	7600	12650	6850	11350	19700	23700

FIG. 3—TABLE SHOWING CAPACITIES OF INGERSOLL-RAND HORIZONTAL AFTERCOOLER.

or regulator of the compressor in maintaining a steadier pressure.

Aftercoolers usually consist of a cylindrical steel or cast iron shell with cast heads supported on cast iron foot pieces surrounding a nest of iron or brass tubes, the ends of which are either expanded or fitted with copper ferrules and caulked into steel tube plates at each end of the casing, provision being made for expansion and contraction. Water enters the lower set of tubes, traverses each row and leaves at the top of the shell, while the air enters and leaves at the top, surrounding the tubes in transit and travelling in a direction opposite to the water. Baffle plates are arranged so as to cause the air to cross and recross the tubes several times. An open funnel is generally placed in the water discharge to show the amount of water flowing and facilitate its adjustment. The moisture collected from the air is prevented from escaping with the latter by a plate in front of the air discharge opening.

There is some difference of opinion as to the respective merits of iron and brass tubes for this class of service. Brass is a better conductor of heat than iron, but on the other hand, galvanized iron tubes are usually rougher and present more surface to the air, so that there is probably little or no difference between them in cooling effect. Vertical aftercoolers are sometimes preferred on account of the smaller floor space which they occupy, but aside from this, there is no reason for using one style in preference to the other. While aftercoolers of different makes vary in minor details, the essential principles of all are the same and their construction will be more readily understood by referring to Fig. 1.

Aftercoolers are usually equipped with pressure gauge, safety valve, flanged pipe connections, water fittings and drain cocks. When properly designed and supplied with the requisite amount of water they will readily reduce the temperature of the air passing through them to within 15 or 20 degrees of the entering cooling water. The temperature and quantity of the latter required depends on the cooling effect desired. The following figures which are based on good cooling results with air at 80 to 100 pounds gauge pressure when compressed by a two-stage machine, will be found accurate for use with aftercoolers of the type described:

Temperature of Cooling Water	Gallons per hour per 100 cu. ft. of actual free air per min.
50 Degrees Fahr.	120
60 Degrees Fahr.	150
70 Degrees Fahr.	180
80 Degrees Fahr.	210
90 Degrees Fahr.	240

Aftercoolers are made in a number of different sizes, the capacity of which varies with the temperature of the cooling water, and whether the air to be cooled is obtained by single or multi-stage compression. This point will be seen more clearly by examining the table in Figure 3, giving the sizes and capacities of Ingersoll-Rand aftercoolers.

An aftercooler may be suspended from the ceiling or mounted on or under the floor, as may be most convenient from the standpoint of economy of floor space or ease in making the necessary connections. It should be placed between the receiver and the compressor and as close to the latter as possible. Pipe of amply large size should be used in making the necessary connections and care should be taken to provide piping by which the moisture may be drained off at intervals. It is good practice to make connections from the compressor to the aftercooler and from the aftercooler to the receiver, one or two sizes larger than that leaving the receiver, using reducers to make the actual connections if necessary. Elbows should be avoided, any bends that are necessary being made by giving the pipes a wide sweep.

In some localities water is scarce, and where this condition exists it is often possible to use the cooling water from the aftercooler for hot boiler feeding, increasing the efficiency of the plant and adding to its economical operation to some extent through the recovery of waste heat.

While an aftercooler will not eliminate all of the moisture from compressed air, the best results in this respect, especially in the case of large installations, being obtained by the use of an aftercooler in conjunction with a number of small secondary receivers or moisture traps (of which there are a number now on the market, one of the best known as the Stratton) placed at intervals along the supply lines, it will be found that in the majority of cases the aftercooler alone will dry the air to such an extent that the troubles due to wet air and the consequent inconvenience and low efficiency which follows, are entirely done away with.

In addition to this, the installation of an aftercooler often results in increased economy in power consumption with no outlay other than the cost of the aftercooler, the necessary connections and a moderate supply of cool running water. It is thus evident that the inclusion of an aftercooler when securing estimates on new compressed air plant, or the addition of one to a plant already in existence, is a subject well worth the attention of anyone desirous of obtaining the highest efficiency from their compressed air equipment.

NEW MACHINE TOOLS FOR CANADIAN MARKET

It will be interesting to the Canadian machine tool trade in general to know that the Albert Herbert, Ltd., of Coventry, England, have opened up a Toronto office. Their present headquarters are at 31 Yonge Street, but this is by no means their permanent abode. They have merely opened up this office until they complete arrangements regarding proper warehouse premises.

It is their intention to carry in stock a representative line of machines made by the Albert Herbert, Ltd., also other various companies that they represent. They already have a number of machines en route for Canada, and it is their intention to have their stock assume considerable proportions in the near future.

One big point in their favor is the fact that the staff will consist of both practical and technical men who are thoroughly versed in modern machine tool practice, and intimately acquainted with the machines they will handle.

This allows them to be in a position to furnish the trade with all necessary technical information, and give full service in as far as service and the obtaining of maximum production is concerned. In addition to their own lines, they will handle other tools which are new to the Canadian market, a list of which follows:

The Webster & Bennet, Coventry, line of boring mills and automobile profilers.

The G. Stirk & Sons, Halifax, line of planers and boring mills.

The H. W. Kearns Co., Manchester, Horx boring, milling and facing machines.

The Lumsden Machine Co., Ltd., Gateshead-on-Tyne, line of grinding machines.

Power and hand presses made by J. Rhodes & Sons, Wakefield.

The L. Gardner & Son, Pancroft, Manchester, line of crankpin turning machines.

The Tangyes Limited, Birmingham, line of heavy machine tools.

The Britania Foundry Co., Coventry, line of foundry appliances.

The Manlove Alliot & Co., Ltd., Nottingham, line of oil separators.

The W. D. McKendrick & Co., Motherwell, line of girder radial drilling machines.

The B. Smith & Sons, Todmorden, line of chain mortising machines.

The Moses Eadon & Son, Ltd., Sheffield, line of high speed and carbon steels, saws, machine knives.

The Scriven & Company, Leeds, line of shipyard and rolling mill equipment.

The Vulcan Foundry Co., Ltd., Newton-le-Willows, line of Vulcan pneumatic riveter for locomotive work.

The George Taylor & Sons, Coventry, line of small vertical milling machines.

The H. Wallwork & Co., Ltd., Manchester, line of gear generating and hobbing machines.

The E. C. Wrigley & Co., Ltd., Birmingham, line of twist drills, reamers, milling cutters.

The E. G. Herbert & Co., Manchester, line of hack sawing machines and small tools.

The H. Atkins, Ltd., Peterboro, line of light machine tools.

The Herbert Eng. Company, Reading, line of floating tool holders.

J. Buckton & Co., Ltd., Leeds, line of heavy machine tools.

This varied line illustrates on what a scale the Herbert Co., Ltd., have entered the machine tool market. Many of these lines have special points of interest which will be presented to readers in the near future. Anyone interested can be assured of courteous treatment and careful attention at the hands of Mr. Blair, who is the representative of this company.

The Magnetic Chuck, Its Design, and Various Uses

A Continuation of Last Week's Article on the Principles of Design, Together With Various Uses of This Style of Chuck in the Modern Manufacturing Plant

By J. H. Moore

In Fig. 5 we show the work, B, bridging one of the gaps, but not the second gap. In this case the leakage induced by the intermediate piece is very much increased and therefore the pull correspondingly decreased. Theoretically this chuck is made up of independent poles. However, since all these poles are joined at the lower end magnetically and this end is carried up in the form of an enclosing wall which forms the body of the chuck, we really have a series of north and south poles along both sides of the chuck. This is most plainly demonstrated in the cross-section, AA, Fig. 3. In Fig. 6 this type of chuck is shown in use on a milling machine and from the diagram it is evident that a shunt magnetic circuit passes uninterrupted from the bottom of the chuck through the machine, returning by way of the milling cutter and therefore under these circumstances not only the machine, but the cutting tools themselves, will become magnetized. With the multiple-pole chuck, the magnetism that is shunted through the machine is produced by the magnetic force of one pole and alternates in polarity as the tool passes along the work. Magnetized tools accumulate and hold a certain amount of chips and steel dust which rapidly dull the cutting edges. The magnetized machine attracts iron dust and therefore invites wear to an undesirable degree.

In Fig. 7 we show a single-pole form of chuck which consists of a single-pole piece that fits on top of the main pole of the magnet.

In this type of chuck the body forms one pole and the serrated pole face forms the other. The two parts are held rigidly in proper relation by filling the space with a non-magnetic metal. This chuck has one advantage over the chuck shown in Fig. 3 in that there are no neutral spaces between adjacent poles in the pole face. The disadvantage of this type of construction lies in the use of a single-pole in connection with a serrated pole face, because a pole face of this kind provides an air gap of short length and very large area, which means a large amount of flux can leak through the circuit formed in the body of the chuck. The face-plate is made up of a grid, the bars of which are cast integral with the body and the spaces between the bars are filled with projections from a pole

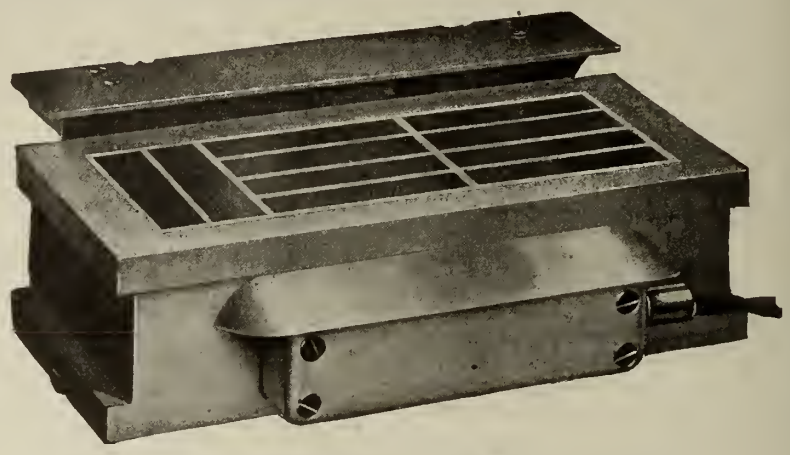

Fig. 11.—Simmons Unit-Pole Magnetic Chuck suitable for toolmakers.

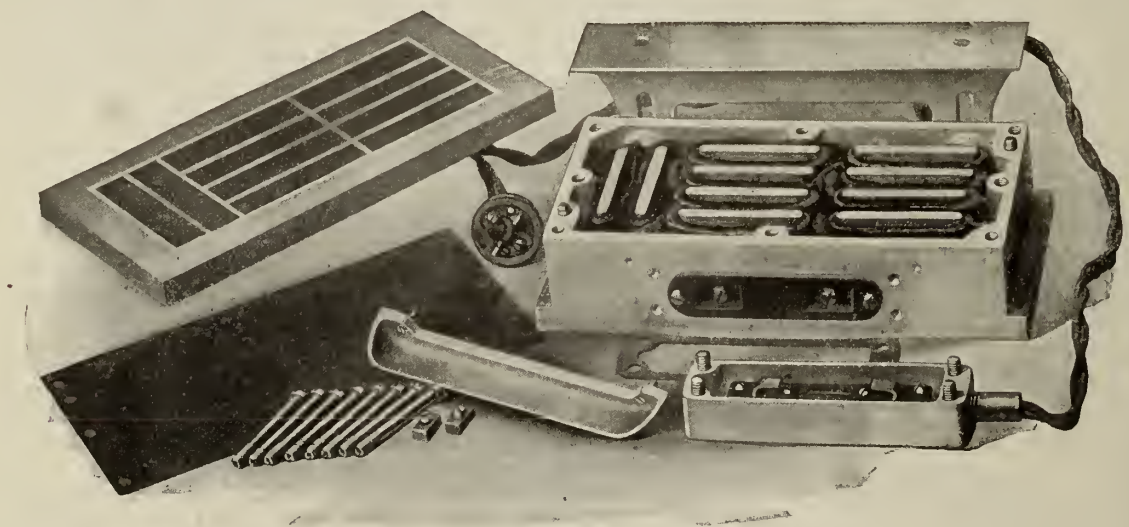

Fig. 12.—The same Chuck as used by toolmakers, disassembled.

circuit of the section, AA, is exactly the same in Fig. 3 as it is in Fig. 7. However, on account of the fact that the body of the multiple-pole chuck is utilized as a part of the magnetic circuit only to a slight degree and depending upon the work mounted on it, the magnetizing effect of the single-pole chuck is very much greater under the same circumstances because the total magnetism is polarized in one direction.

In Fig. 8 we show the effect of placing the work on the single-pole chuck in such a way that the area over one pole is very much less than that over a second pole. From this diagram it is evident that small pieces of work unless properly placed will have a very much reduced magnetic pull exerted upon them because the small area on one side, in this instance, north, is quickly saturated with magnetism which forces the rest of the

cuit unless the work that is on the chuck covers a considerable area.

Referring to Fig. 6 where we show the multiple-pole chuck mounted on a milling machine we see that the magnetic

Fig. 13.—Complete disassembled view of Simmons Unit-Pole Magnetic Rotary Chuck.

rounding them, the combination being included in a frame, which is attached to, and forms part of, the body of the chuck.

By mounting magnetic circuit, E, inside the body, F, and separating the two by non-magnetic material at all points of contact there are never any circumstances under which the magnetism will travel through the body of the chuck, therefore there can be no leakage from the chuck into the machine or the tools. In fact, the body of the chuck with this type of construction, when of iron, forms an effective barrier, or screen, for magnetism, so that magnetism from inside the chuck cannot get out, nor magnetism from the outside get in.

On account of the unit construction the magnetism produced in each pole passes into the adjacent pole piece, and nowhere else, which means a short path of maximum area and results in maximum magnetism and pull in a given space.

By interlocking the poles a condition such as shown in Fig. 8 is practically impossible. Furthermore, the interlocking produces a pull that offers con-

magnetism to leak out into the air. Then, too, it should always be borne in mind that when the permeance of the magnetic circuit is decreased by introducing air gaps or placing the work so that it saturates more in one place than another the total amount of magnetism produced by the exciting coils is less than when the work is so mounted on the face-plate that equal areas are in contact with opposite poles.

In Fig. 9 we show the construction of a unit-pole magnetic chuck. In this chuck the magnetic circuit is a complete unit entirely separate and distinct from the body of the chuck. The magnetic circuit is of the multiple-pole type and the face-plate is made up of a series of interlocking pole pieces mounted in position with non-magnetic metal between their adjacent sides and completely sur-

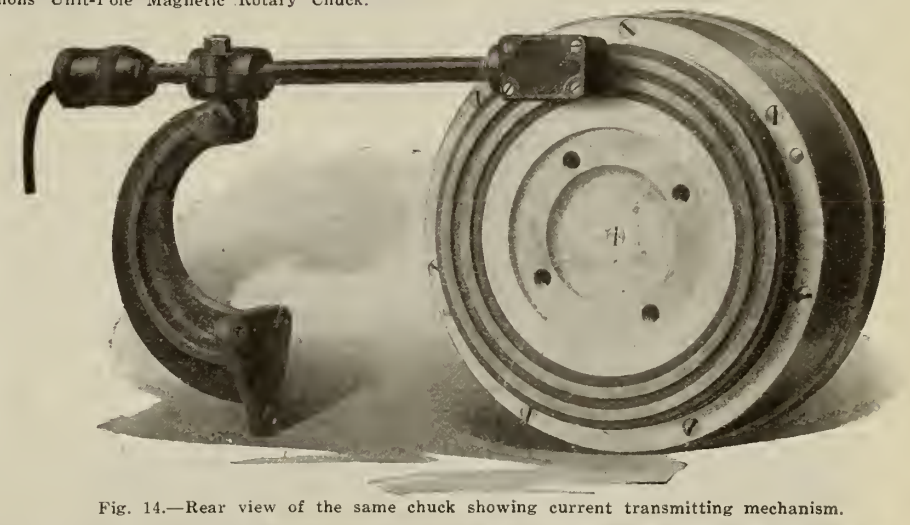

Fig. 14.—Rear view of the same chuck showing current transmitting mechanism.

Fig. 15.—Magnetic Chucks find many applications for which they were not originally intended. Scraping gibs is an example here illustrated.

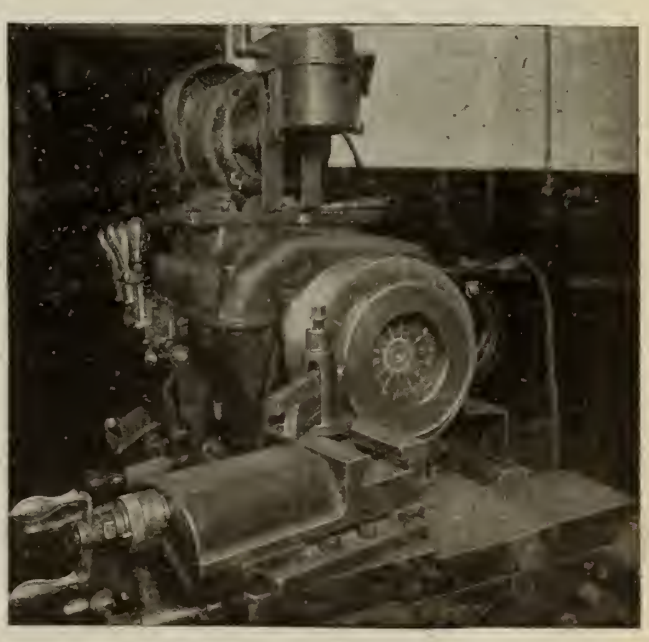

Fig. 16.—Application of ten-inch aluminum body Magnetic Chuck to second operation work on a Lodge & Shipley lathe.

siderable resistance to forces acting across the chuck. With straight parallel pole pieces a piece of work can be moved in such a way as to not change the number of lines of flux passing into the work and therefore there will be little resistance offered to motion in this direction.

In the Simmons unit-pole chuck the work, no matter how small it is (down to one inch square), cannot be moved in any direction without changing the number of lines of flux that pass over the work, and therefore it will oppose forces in all directions.

Although a large number of different types of these chucks are made, the basic principles of construction are practically the same. We have for illustrative purposes chosen an 8 x 10 in. chuck, which is shown disassembled at Fig. 10. This type is what is known as a rectangular T-slot chuck.

In this photograph the magnetic circuit with coils in position is shown in the body of the chuck. The face-plate and terminal blocks have been removed. The switch for magnetizing or demagnetizing the chuck can be installed at any convenient point on or near the machine. Leads run from one side of the switch to the supply line, and from the other side to the chuck. Of course this type of chuck is equipped with rubber hose covering for all lead wires, so that the chuck can be used for wet grinding as well as dry grinding. The back rest and back-plate as shown can be completely removed from the face-plate, as can also the end stop if desired. The end stop and back rest are also adjustable as far as height is concerned. On this style chuck two gaskets are used, one between the face-plate and body of chuck, the other between the terminal box and the chuck body. The object is obvious, namely, to make the chuck absolutely watertight.

Of course all the coils in the chuck are wound for the same resistance, a definite number of which are connected in series for 110 volts, half as many in series for 55 volts, and twice as many in series for 220 volts. The one shown, however, is too small to contain enough coils for such a voltage as 220, so that when it is to be used on the 220 circuit a special resistance unit has to be connected in series with the chuck.

On the other hand chucks that are large enough to contain a sufficient number of coils for 220 volt operation can be changed over to 110 volts by connecting in parallel a number of 110 volt groups. Special terminal blocks are used on 220 volt chucks which permit this change to be made without trouble. The use of the back rest is so self-apparent that comment is hardly necessary.

At Figs. 11 and 12 we illustrate a 4½ x 9½ unit-pole chuck, which is made with an aluminum body. It is also equipped with a special arrangement of pole pieces to facilitate the application of auxiliary devices on the face-plate. Such a chuck as shown is specially applicable to tool-room work, both for its general utility and lightness, as the complete chuck weighs only 15 pounds.

At Fig. 12 we show it disassembled, and its construction is exactly the same as previously described, with the exception that the body and frame of face-plate, also the back rest, is made of aluminum. The coils are arranged somewhat differently but are the standard type, and in the same relative proportions.

Fig. 17.—Simmons T-Slot Magnetic Chuck used for holding cast iron pieces in a vertical milling machine. Note carefully that chips are piled just as they naturally fall, and are not governed by magnetism. It should also be noted that the tool is perfectly free from any clinging pieces of iron.

The Rotary Chuck

We next show a disassembled view of a 10-in. rotary unit-pole magnetic chuck at Fig. 13. The body in this case is also made of aluminum. The face-plate when assembled is located by dowels, and a gasket placed between the plate and the body once more guaranteeing the chuck to be watertight.

In this style chuck an auxiliary face-plate is often used for extremely small work. Briefly the auxiliary plate is mounted on top of the standard plate in such a way as to carry the poles toward the centre. A bronze ring one-half the thickness of the face-plate holds the poles in position.

A rear view of this chuck, showing the method of connecting the current-transmitting mechanism, is shown at Fig. 14. The bracket as illustrated is mounted on the machine wherever desired, and as noticed, this bracket is so arranged as to be adjustable.

Various Applications

The possible uses for magnetic chucks are almost infinite in variety. This is especially true when the application of auxiliary pole pieces is considered. The subject is largely one of education and experience, and as the engineer and mechanic become educated in the application of magnetic principles the use of magnetic chucks is sure to extend to fields even greater than at present contemplated.

To commence with, let us look at Fig.

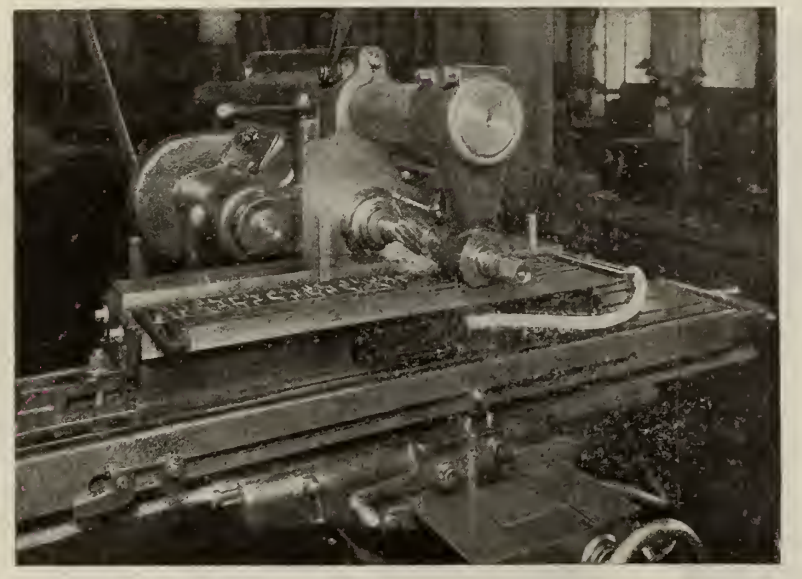

Fig. 18.—31 x 10¼ Magnetic Chuck mounted on Brown & Sharpe milling machine. The work is a piece of cold rolled steel 31 inches long, 4 inches wide, and ¾ inches deep. The cut is 4 inches wide by 7-16 inches deep. The feed is 1 5-16 inches per minute. The cutter 2¾ inches in diameter and is running at 69 r.p.m.

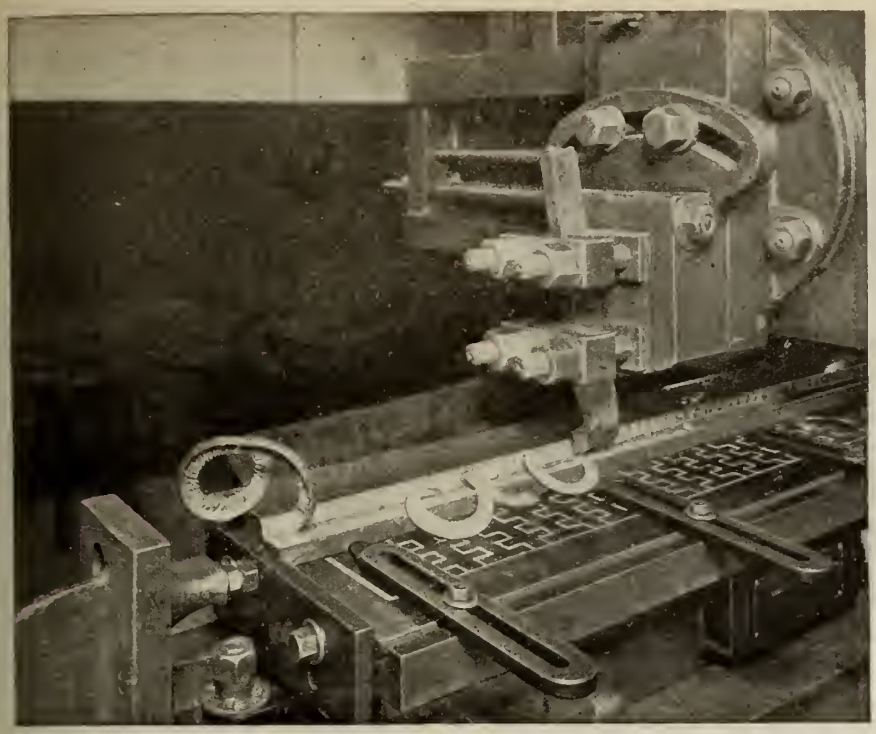

Fig. 19.—The holding power of the Magnetic Chuck is well exemplified in the illustration The chuck is 31 inches long by 10¼ inches wide. The work is a piece of cold rolled steel 31 inches long, 4 inches wide and ¾ inches deep. The chip is ⅝ inches deep and 3-16 inches thick, the table feed being 40 feet per minute. It stalled the machine at the point where the cut stopped.

15. Here we see a very good application of the use of a magnetic chuck, and one for which perhaps it was not originally intended. The workman is shown scraping gibs. He can concentrate on his task in hand, feeling sure the work will not move. Another advantage of using a chuck for this style of work is that it will hold the work firmly, which would perhaps become deformed through gripping in a vise. By this method strains are eliminated and no deformity can occur.

At Fig. 16 is illustrated an application of a 10-inch aluminum body rotary chuck on a Lodge and Shipley lathe. This chuck is used on second operation work as shown. The bracket carrying the brush rigging is plainly seen at the right. It is hardly necessary to comment on the efficiency of a magnetic chuck for work of this character, for its time-saving qualities are self-apparent. A chuck of this nature has also the advantage of giving a uniform support to the work without the application of any undue force at one point which would tend to cause distortion.

The use of a T slot chuck on a vertical miller is shown at Fig. 17. It is used in this case for holding cast iron pieces in position while being milled. An interesting feature in connection with this photograph is the fact that it furnishes evidence that there is perfect insulation in the magnetic circuit, for otherwise the chips could not be in the natural position as shown. The tool itself is also free from any clinging pieces of iron, again proving this point.

Another milling operation is shown at Fig. 18. This illustrates a 31 x 10¼ in. chuck mounted on a Brown and Sharpe miller. The work being performed is that of a piece of cold-rolled steel 31 inches long, 4 inches wide, and ¾ inch deep. The cut being taken is 4 inches wide by 7-16 inch deep. The feed is 1 5-16 inches per minute. The cutter is 2¼ inches diameter, and is running at 69 revs. per minute. From these figures one cannot help but admit that a magnetic chuck has more holding power than often accredited it.

The next photograph, Fig. 19, exemplifies once more the holding power of a magnetic chuck, together with its variance of uses. The chuck illustrated is 31 inches long, 10¼ inches wide, and is installed on a 30-inch planer. The work being held is a piece of cold-rolled steel 31 inches long, 4 inches wide, and ¾ inch deep. The chip being taken is ⅝ inch wide and 3-16 inch thick, and the table speed is 40 feet per minute. So great was the speed of the table feed that it stalled the machine at the point where cut is shown to end. Of course, as can be noted, the back and end stops, together with side stress clamps, are employed, but one can readily realize the necessity of these in work of such a heavy character. It speaks well of the chuck's holding power to think that even though the planer stalled the work stayed in position.

Some Grinding Installations

It is in the field of grinding that the magnetic chuck is perhaps best known. At Fig. 20 we show an application where V-blocks are employed in the grinding of brass washers. The V-blocks are made from steel and the sides of the V-block are undercut to a knife edge, and of such thickness that the knife edge grips the edge of the washer with sufficient power to hold it.

Another case where special designed chucks can be used to good advantage for special purposes is shown at Fig. 21. In this case the chuck contains four longitudinal poles. The two adjacent poles in the middle are carried as shown and machined to receive the small wedges, three of which may be seen on the front of the chuck. These wedges are only ⅜ inch long, 3-16 inch wide, and

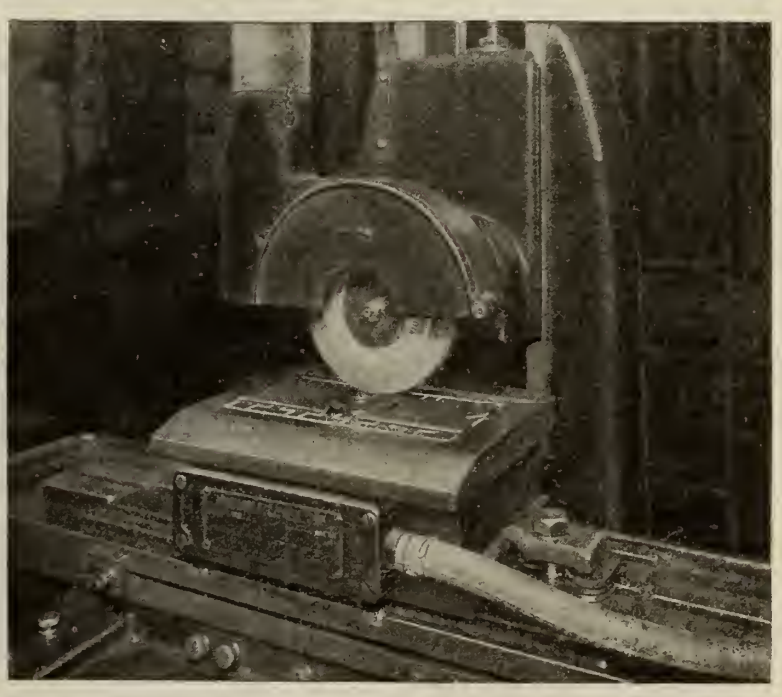

Fig. 20.—Showing the application of V-blocks in the grinding of brass washers. The V-blocks are made of steel and the sides of the V are under-cut to a knife edge and of such thickness that the knife edge grips the edge of the washer with sufficient power to hold it.

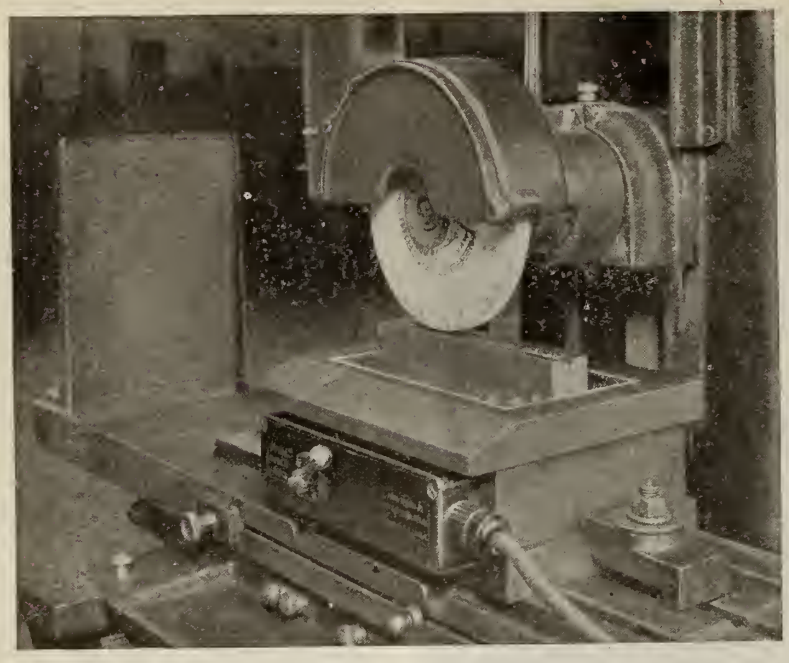

Fig. 21.—Magnetic Chucks are often made up in special designs for special purposes. In this instance, the chuck contains four longitudinal poles. The two adjacent poles in the middle are carried as shown and machined to receive the small wedges, three of which may be seen on the front of the chuck. These wedges are ground to an extremely accurate angle. The face of the chuck is accurately ground to determine this angle and the pull exerted upon them is 210 pounds per square inch, which assures very perfect seating on the holding surface.

are ground at a bevel of 14 degrees, 2 minutes, and 6 seconds. The face of the chuck is accurately ground to determine this angle, and a pull of 210 pounds per square inch is exerted, which assumes a perfect seating on the holding surface. It is in such cases as this that the advantage of magnetic chucking is apparent.

At Fig. 22 we illustrate a special auxiliary pole piece for use with the regular chuck when grinding a definite bevel. The pull of all the poles is transmitted to the two auxiliary poles as illustrated. It will be noticed that these poles are made up of two pieces separated from each other by a strip of brass with feet staggered in such a way as to rest on alternate poles of the chuck.

There should be no hesitation in accepting the magnetic chuck as a valuable asset in the manufacturing plant and machine shop of to-day. As stated at the beginning of one article, it is lack of education in their uses that precents their being as well known as they should be, and it is a safe prediction to say that magnetic chucks are bound to become more and more popular as their uses and merits are realized.

STEEL TREATERS ORGANIZE

The 14th of April will always remain an important date in the minds of those interested in heat treatment. The need of some channel through which experiences in the heat-treating field may be exchanged has been felt in Canada for some time, but it remained for the American Steel Treaters' Society to offer the solution.

It is unnecessary to comment on the good work accomplished by this organization. Enough to say that, realizing the need of such a society in Canada they instructed their national secretary, Mr. W. H. Eisenman, to visit Toronto and acquaint Canadians of their opportunity of joining the American society.

A meeting was held in the King Edward Hotel, at which Mr. Eisenman presided. He briefly but very forcefully explained the aims and purposes of the American Steel Treaters' Society.

"The purpose of the society is not to make money for itself," said Mr. Eisenman, "but to promote the arts and sciences connected with the heat treatment of steel; to hold meetings (by the establishment of local chapters) for the reading and discussion of papers bearing upon processes, instruments, equipments, apparatus, etc., employed in practical and research work connected with the art; to collect, publish and disseminate technical and practical knowledge for the improvement of conditions in connection with the heat treatment of steel, and to closely unite those engaged in the practical and technical branches of the same."

The recognition and reception our society has received since its establishment is a marked indication of the worth of its aims and objects—and the confidence of the craft at large in the spirit, judgment, sincerity and vision of the founders.

Local chapters of our society have been established in Chicago, Cleveland, Pittsburgh, Milwaukee, Philadelphia, Cincinnati, Buffalo, Rochester, New York City, Minneapolis-St. Paul, Tri-Cities (Davenport) and St. Louis. Other chapters are in process of formation, and the membership of hundreds is further distributed throughout the United States, Canada, Italy, France, Japan, England and Australia.

All the papers and discussion before the various local chapters are collected, published and sent to you through the pages of the society's monthly publication, "The Journal," and thus you will be able to keep in touch with the best and latest progress and development in all industrial centres.

No one person knows or can conceive of anyone knowing all about heat treatment. No one makes such a claim, yet there are many with excellent worth-

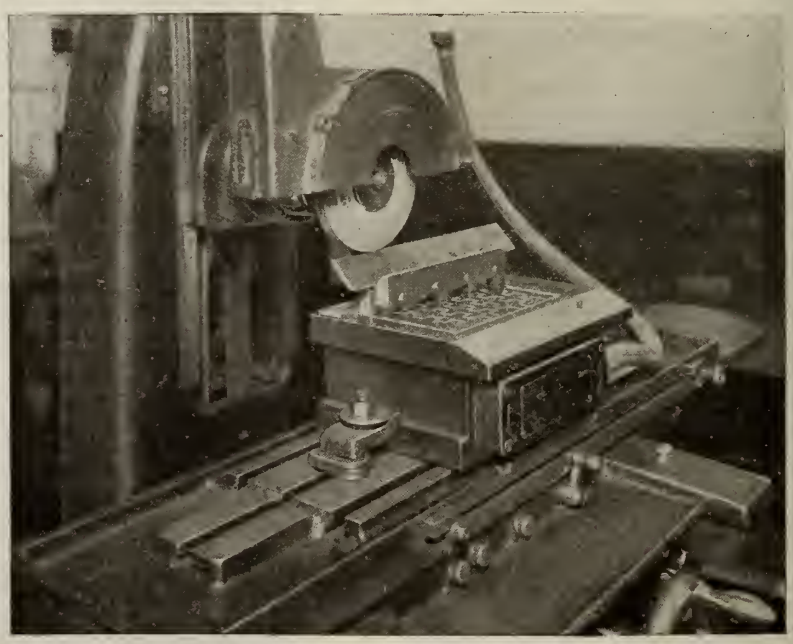

Fig. 22.—Special auxiliary pole piece for use with Simmons Unit-Pole Magnetic Chuck when grinding a definite bevel. The pull of all the poles is transmitted to the two auxiliary poles as plainly shown on the above illustration. It will be seen that the auxiliary poles are made up of two pieces separated from each other by a strip of brass with feet staggered in such a way as to rest on alternate poles of the chuck.

while ideas and improved methods, who are more than willing to effect an even exchange.

Advantages of Membership

The advantages of membership in the society are many; you will receive "The Journal"; be entitled to the free use of the Employment Service Bureau; receive valuable data sheets, and have the privilege of attending meetings of any chapter of the society.

The journal of the society is the best publication in the heat-treating field. Its main articles in every issue are written by experts in their line and they are both practical and theoretical. All the papers presented at the annual convention of the society in September are being published from month to month in the journal. A series of special articles on "Practical Talks on Case Hardening" appear every month. Special arrangements have been made so that new members may secure back numbers of the journal at small cost. In addition to the main articles there are also important departments such as the editorial, book reviews, correspondence, employment service, commercial items, and abstracts of recent patents of interest to heat treaters. The Board of Associate Editors is composed of some of the leading research men of the country who have contributed papers to the Journal and are continuing to do so.

The need of a Toronto chapter is self-evident and, my appeal to you to start such a local chapter will, I feel sure, receive a hearty response, because then you will have the privilege of attending regular monthly meetings in your own locality, at which papers and discussions of interest to the workers in steel will be read and discussed by men who know the practical side of the game as well as the theoretical. At these meetings friendships and associates will be formed that will be of inestimable value to you. You will become acquainted with the men in your own line of work. There you can talk over your troubles and experiences with others, and compare notes. The day when a man believed that he had secrets in his heat treating department he could not divulge is passing rapidly, and the open door policy of the exchange of ideas is gaining rapid headway.

You might ask whether you ought to join such a society, to this I would say: "If you are in any way interested in the manufacture of steel, the manufacture of tools, machine parts, the heat treatment of same, or the use of the finished product, you will find the American Steel Treaters' Society to be a real and practical benefit. No matter in what line of activity you may be engaged if the products you use are heat treated you should be interested in membership and would receive practical benefit and help from the society."

Every firm should be represented, because you need not receive but one small idea a year in order to feel more than repaid for the dues.

Membership in the society now includes: Leading manufacturers, general managers, superintendents, work managers, metallurgists, chemists, supervisors of heat-treating rooms, furnace men, sales representatives, designers, purchasing agents and inspectors.

This educational movement, founded for the increased efficiency of all those interested in heat treating, deserves your strongest support. It is educational in its purposes, co-operative in its management. All money received from all sources is all devoted to making the society of greater value to the members.

It is only by having all people who are interested become members that we shall be able to secure the greatest and best results.

After Mr. Eisenman had concluded his address he asked for the opinions of those present. Each speaker was very enthusiastic in his ideas regarding the possibilities of such a society in Canada, and after various views had been heard on the subject it was unanimously decided to start a local chapter.

Officers were elected, and the first meeting of the new chapter was fixed for Tuesday, April 20.

Invitations were forwarded to those interested, and while every effort was made to reach all parties concerned it was felt that many had probably been omitted from the list, it being impossible in such a short time to cover the field completely.

CANADIAN MACHINERY takes this means of still further inviting anyone interested to attend. It is not necessary to be actually engaged in the heat treating business. Anyone is welcome, no matter what their position. The main thing is this:

Are you interested in heat treatment? If so, your place is at these meetings. They will be held once a month and we shall acquaint readers through our columns with the activities of the organization.

We cannot too strongly endorse the necessity of such a society. In these days of strenuous competition the old haphazard methods of guessing the temperature, etc., are past. We must know what we are doing to the steel, why we are doing it, and what the results will be. These facts will be discussed and spoken of by the very best authorities on the subject, as the society will bring in from time to time various speakers to talk on heat treatment in its many phases.

We strongly advise anyone interested to enquire for further information of Mr. A. Lowry, secretary-treasurer and chemist of the Massey-Harris Co.

Following were the officers elected: J. H. Moore, associated editor, CANADIAN MACHINERY, chairman; H. A. Phillips, mechanical engineer, Canadian Cycle and Motor Co., vice chairman; A. Lowry, chemist, Massey-Harris Co., secretary-treasurer; executive committee: Charles N. Dawson, metallurgist, Machine & Stamping Co.; Chester Hamilton, president, Hamilton Gear & Machine Co.; Charles Hack, chief inspector, Canadian Allis-Chalmers Co.; W. O. Oliver, superintendent, Steel Company of Canada.

Those present at the initial meeting: W. F. Sutherland, editor "Power House"; Capt. Grant, chief inspector, and A. G. Marr, superintendent of heat-treating department Willys Overland Co., Ltd.; Mr. Lay, sales manager, and W. W. Doran, salesman of the Keystone Products Co.; A. P. Inglis, manager, and P. G. Christie, salesman, of the Crucible Steel Co. of America; W. Oliver, superintendent, T. Holmes, superintendent of heat treating and G. Wyse, master mechanic of The Steel Co. of Canada; James Lewis, superintendent of the John Inglis Co.; J. W. Brown, superintendent of the Capewell Horse Nail Co.; Gordon Lee, mechanical superintendent, Machine & Stamping Co.; J. H. Martin, president of the Precision Tool Co.; W. J. Trybell, Canada Metals Co.; Chas. Bailey, manager. Jessop Steel Co.; J. W. Bartlett, works manager, Chase Tractor Co.; George Wilkins, superintendent of tools, Bawden Machine Tool Co.; T. J. Segwick, machinery superintendent, C. Hack, chief inspector, and G. Farrar, mechanical superintendent of the Canadian Allis-Chalmers Co., and N. B Ferguson, manager, Edgar Allen Co., Ltd.

An array of names such as these cannot fail to impress readers with the fact that the need of proper heat treatment is recognized by the big men. Show you are interested by writing for all details; in other words, get behind them and help place Canada on the map in so far as studying and discussing heat-treating methods and practices are concerned.

A new French tool steel, known as Etiquette Rouge is according to L'Importateur Francais, a cast steel containing tungsten and suitable for the manufacture of screw taps and dies. It can easily be tempered and resists corrosion, it is claimed, to a remarkable degree. After being carefully and completely heated to a bright red at a temperature of from 760 deg. to 780 deg. C, it is dipped in water at about 15 deg. C. Small sections can be dipped at a lower temperature. A second grade of tool steel, K9, used in making precision tools, is also described. This steel, it is said, is practically free from expansion and contraction during tempering. Its treatment requires gentle and complete heating at from 780 deg. to 880 deg. C., and the use of an oil bath. The two steels are delivered annealed and ready to be worked.

A substitute for cork can be made, according to the "Berlingske Tidende" by the action of acetylene on the oxides of copper and nickel.

The city of Calgary, Alta., is asking for tenders for the supply of three 200 k.v.a. 12,000 volts to 2,300 volts transformers. Specifications can be had from the city engineer. Tenders to be addressed to the city clerk, Mr. J. M. Miller.

WELDING AND CUTTING

Lessons on the A.B.C. of Good Welding

These Articles Will Give Valuable Hints on the Art of Good Welding—The Second Lesson Will Appear in an Early Issue

By W. B. Perdue*

ONE of the first things that must be taught a student of any mechanical trade is to handle his tools in a professional and effective manner.

One point that often escapes attention and is vitally important to the proper manipulation of the welding torch, is elimination of wrist motion. The torch must be kept on the job. If permitted to bob up and down, or to swing in any otherwise irregular movement, the action of the oxygen in the air on the melting metal in the weld will greatly reduce its strength and efficiency.

The torch must be swung across and the flame played upon both sides of the metal to be welded by a free arm motion in which the elbow and shoulder form the only axial points.

A long oscillatory movement in which the torch swings in the direction AB (Fig. 1) will be found the easiest to acquire and in practice the most rapid and economical. The turns at each end of the stroke should be made in a right-hand direction, like the hands of a watch, when using the torch in the right hand. This overcomes the tendency to assume a "Spencerian slant" as in penmanship, and has certain other advantages.

Music in Business

This movement must be regular and rhythmic. When the Government demanded an intensified training course for welders I originated the phrase, "Whistle a waltz while you are working and get the music into your weld." The tests of time have proved the value of this important, but often neglected, part of the welder's training.

To acquire proficiency in this motion requires considerable patience and practice. It is, however, the foundation of all good welding, and can be mastered by anyone who will devote sufficient time

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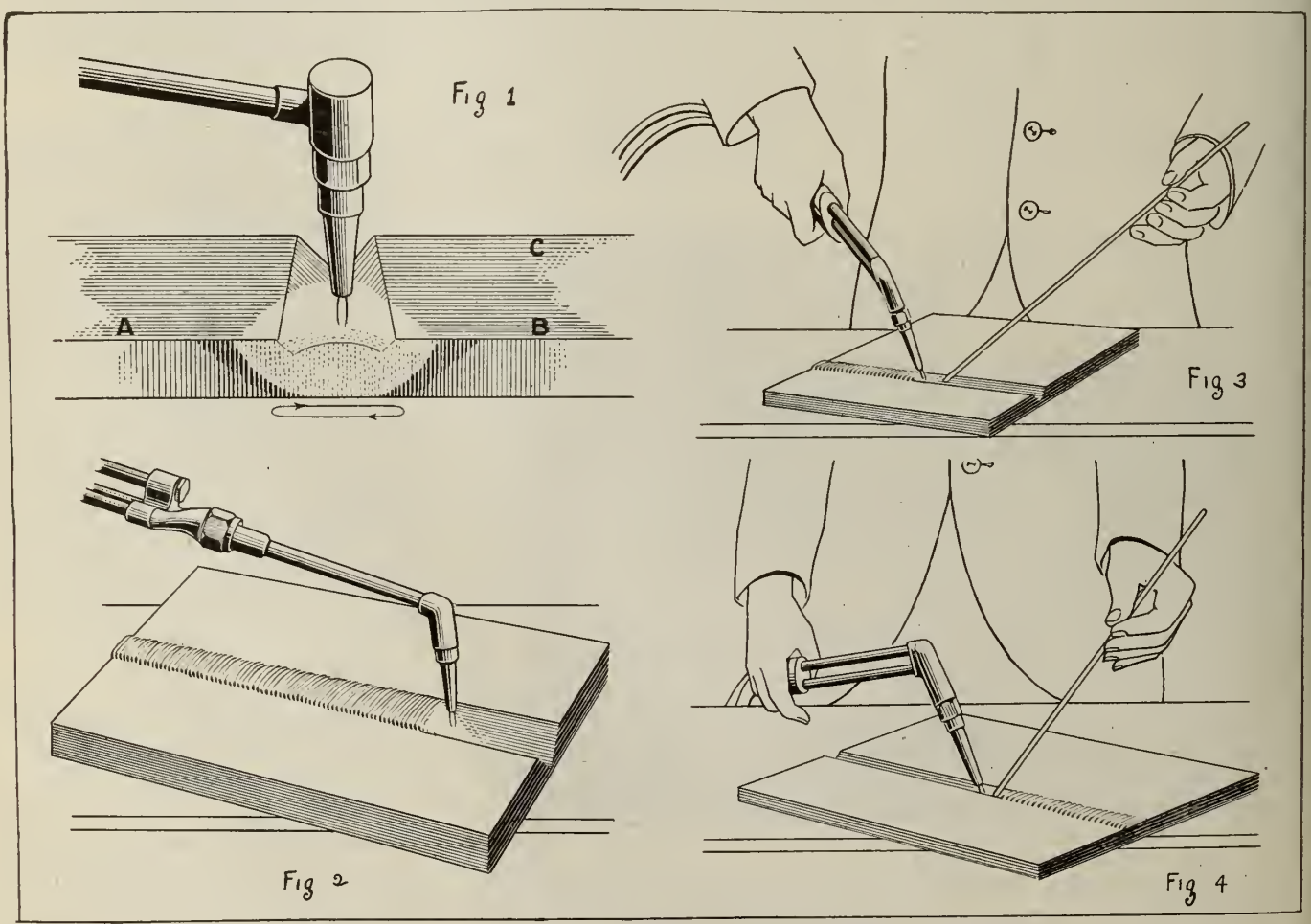


FIGS 1 TO 4—ILLUSTRATING VARIOUS WAYS OF HOLDING THE TORCH.

and effort thereto. To a very great extent the progress of a welder and the quality of his work can be determined by the skill with which he manipulates his torch and rod. In all cases it is certain that metal that is "plastered on" hit and miss cannot preduce a sound weld.

New Method Used

In Fig. 2 is shown a method that was formerly more commonly used than at present. Here both the torch and the flame are directed in the line of welding, with the work progressing away from the operator. It is still in use by many operators on light sheet steel and barrel work. Others modify the method slightly by drawing the handle of the torch toward them enough to keep the hand and the hose from being directly over the heated section just welded. In some cases the filler rod is worked into the weld behind the flame and beneath the torch.

This method of handling the filler rod is not especially recommended. It is believed that greater proficiency is possible by handling the rod in such manner that the same relative position can be assumed for both rod and torch in surface, side, vertical and overhead welding, and to some degree in handling any and all metals. This method and the modification next illustrated utilizes the heat of the outer envelope of the flame to preheat the section to be welded. This preheating not only increases the speed of the work and decreases the cost but also tends to produce a better weld.

Position Used in Welding

Fig. 3 illustrates the proper position for holding both rod and torch. Here the line of welding is also away from the operator but not directly so. The heel of the torch is held sufficiently high to permit the tip to point in the same direction as the line of welding. The tip may be permitted to incline very slightly toward the operator. Under no circumstances must the torch hand be allowed to sag and direct the flame against the side of the weld opposite the operator in the slovenly manner illustrated in Fig. 4. It is of the utmost importance that both edges of the weld shall be in perfect fusion. To direct the flame against the opposite side would cause it to melt first and to be washed by the right hand motion against the side next the welder and merely stick without welding and without strength. Inclining the flame slightly toward the side of the weld next the operator insures fusion of that side that is less distinctly visible, while the right hand motion of the torch supports the metal and prevents it from flowing down until the opposite side is in proper fusion. The same applies to the left hand motion of the welder who holds his torch in his left hand; the metal on the side toward him is similarly supported.

Method of Securing Position

To secure the proper position it is necessary to grasp the torch in the hand firmly in such manner that the thumb and the tip point in parallel directions. Depress the head of the torch until the hose lines are felt to touch the wrist or forearm. Bending the wrist in this manner may at first be tiresome, but it is necessary to prevent wrist motion. By devoting considerable attention to the proper holding of the torch and the development of the welding motion previously described, a graceful free-arm motion will be acquired which swings the torch across the weld and maintains the uniform height of the tip from the melted metal.

The tip should not be held too near the vertical, since in this case the pre-heating effect of the envelope or secondary flame is not properly applied. Holding the tip too near the vertical also tends to prevent proper combustion of the remaining elements of the acetylene that should be consumed in the secondary flame. with the result that they may be deposited as impurities within the weld. This position also tends to overheat the tip and head of the torch, with the result that the acetylene may be broken down into other gases, which may cause the weld to be seriously defective. Some prominent authorities contend that a torch should flash under such misuse and thus warn the operator of his error.

Oxygen Used

When the tip is inclined at an angle of about 60 degrees to the plane of the weld sufficient oxygen will be drawn in from the air to completely consume the combustible gases in the outer envelope. For each cubic foot of acetylene drawn from the generator or cylinder, about ten cubic feet of the surrounding air is robbed of 75 per cent. of its oxygen content. This, with proper manipulation of the torch, creates a zone which protects the weld. Oxygen should be drawn from the air and not from the oxygen cylinder. Its ability to deoxidize the surrounding air accounts for the superiority of the oxy-acetylene over all other welding processes.

Fig. 4 is an illustration of how not to hold the welding torch in this position or in any other lax position which permits wrist motion to be imparted to the torch, is an indication of slovenliness which should at all times be avoided.

Some instructors permit students to weld backward as shown in Fig. 4, their contention being that beginners who attempt to weld forward, as shown in Fig. 3, may flow the melted metal from the rod ahead and over the unmelted edges to be welded. In welding cast iron, brass, copper, and aluminum, it is essential that the welder be able to work forward; in welding steel it is very desirable to be able to work either way.

The only solution, therefore, is for the beginner to practise on scrap steel until he is able to secure proper penetration while working forward and to avoid driving the melted metal along the weld in front of the torch. He should thoroughly master the principles of the art and practise until thoroughly competent to execute a good weld. There is no surer way to injure your own good reputation and that of oxy-acetylene welding than to fall down on a job for a customer.

The student who thoroughly masters the art of welding forward will find no difficulty in welding backward whenever the occasion demands. Therefore, let us learn how to weld forward, first, as any division of effort which causes us to divert time or attention from these essentials will but delay progress and invite failure.

Beginners may hasten their progress by practising several hours per day with a sharpened stick or rod—anything that will cast a pointed shadow—the point of which should be held about ¼ inch above the diagram below Fig. 1. The shadow cast by this stick should be made to follow the diagram, using only elbow and shoulder motion, keeping the wrist bent at all times so that the upper end of the stick is in contact with the forearm.

The output of lead and silver by the Bawdin Mine, in Burma, for the year 1918 was valued at over £1,000,000, although it was only worked on a comparatively small scale. It is now extending its work so as to increase its output from 20,000 tons of refined lead per annum to 7,000,000 oz. per annum. With plant which will shortly come into operation it will be able to produce, in addition, 40,000 tons of zinc product, and 25,000 tons of copper per annum.

The Electric Furnace Construction Co. of Philadelphia have recently installed and successfully started up electric furnaces of the "Greaves Etchell" type in the following plants:—Dodge Steel Casting Co., Philadelphia; American Radiator Co., Buffalo, N.Y.; and the Hammond Steel Co., Syracuse, N.Y.

A new process of electroplating, described in a paper read by Mr. O. P. Watts before the American Electro-Chemical Society, comprises the immersion of iron for a few moments in an acidified solution of arsenious oxide. By these means an adherent copper-plate may be deposited from an acid electrolyte, but no adequate explanation has been offered for this unique effect of arsenic. Certain solutions of lead and antimony may be substituted for the arsenic dip, previous to the direct-current plating of copper on iron from copper sulphate. It appears to be impossible to obtain a perfect plate on iron from solutions of bismuth chloride by the usual methods of electro-plating; but use of the arsenic or antimony dip is attended with the same success as in copper plating. The successful substitution of solutions of antimony and lead for arsenic, and the application of these dips to plating on iron with bismuth, show that the beneficial effect of the arsenic alone, but is the result of coating the iron with a metal whose potential in acid solutions is so near to that of copper that it is possible to deposit a good copper plate upon it, yet whose potential is not so far below iron that it will deposit on iron in a powdery, non-adherent form.

DEVELOPMENTS IN SHOP EQUIPMENT

MILLER ATTACHMENTS

The Ryerson-Conradson Co. have, in conjunction with their helical drive miller, placed on the market a dividing head and vertical milling attachment.

The vertical attachment is shown at Fig. 1, and as can be noted, this attachment is of the semi-universal type.

The fixture fits both their plain and universal machines, and is made in light, medium, and heavy patterns.

The base is clamped to the column dovetail, no dependence being placed on the overarm. The heavy pattern type has the same diameter spindle and the same size bronze bearings as the main spindle. The taper hole face plate and driving keys also are the same, permitting as heavy a cut to be taken as on the horizontal spindle.

The drive is effected by a large aluminum bronze gear bolted to the face plate of the main spindle and driven by the cross key. In return, it engages a steel gear on a horizontal shaft, driving the vertical spindle through a set of bevel gears. This allows the spindle to be set at any angle parallel to the face of column. A draw-in bolt is furnished.

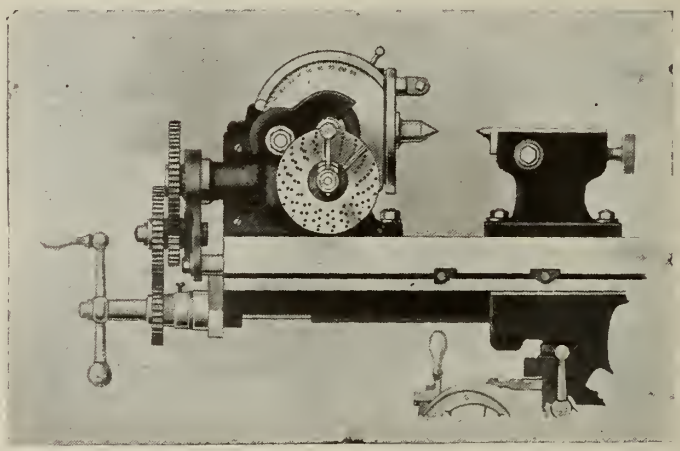


FIG. 2—GENERAL APPEARANCE OF UNIVERSAL DIVIDING HEAD.

The dividing head as shown has been designed to meet the exacting requirements of modern shop practice. It is especially rigid and provided with an extra large worm wheel, meshing with a worm journaled in large bearings. The worm and worm shaft are of one piece, made of high-grade steel, heat treated and then ground to secure extreme accuracy. Means are provided for quickly disengaging the worm from spindle and to take up all backlash that may arise in the course of time. The spindle and face plate are forged in one piece from high carbon steel. This design provides an exceptionally rigid arrangement for mounting chucks and fixtures on the face plate. The hole through the spindle is very large, 3 1-16 in. in diameter, and a No. 14 B. & S. taper is used. The face plate is 8 in. in diameter, has 24

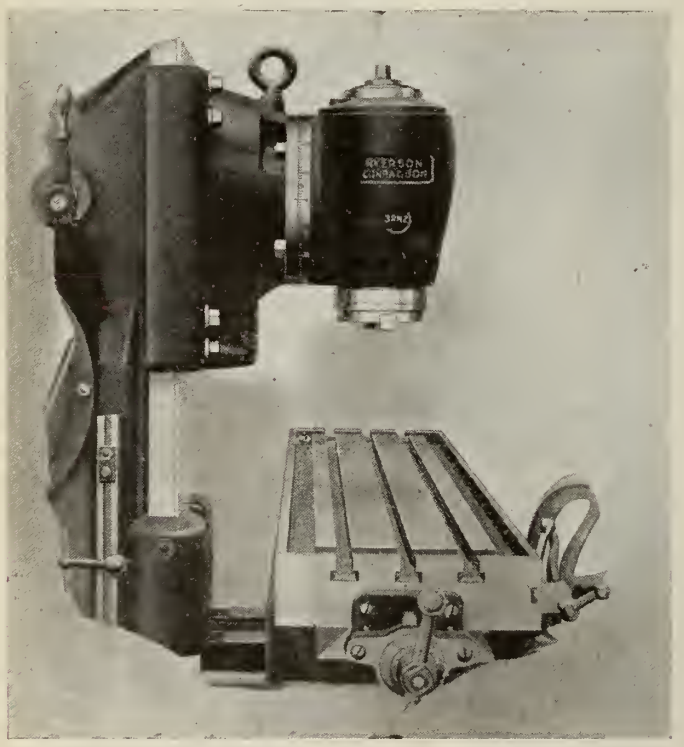
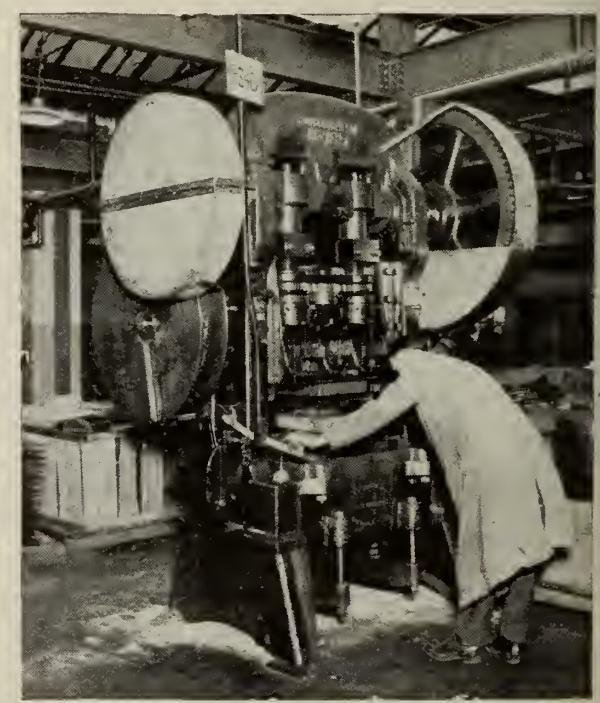


FIG. 1—VIEW OF VERTICAL ATTACHMENT.



GENERAL VIEW OF THE SAFETY DEVICE.

holes for direct indexing and a ⅝ in. x 7-32 in. slot for holding the driving dog. The centres will swing 14¼ in. in diameter. The head is graduated and can be securely clamped in any position from 10 degrees below horizontal to 10 degrees beyond the perpendicular. The entire dividing head shows careful designing, especially in the absence of delicate details.

The regular equipment consists of three index plates that divide all numbers to 50 and many beyond; wrenches, bolts, driving dog and index table giving all divisions up to 360.

LEVER SAFETY ATTACHMENT FOR SIDE PRESSES

The accompanying photograph illustrates a motor-operated side press in use in the machine shop of the Square D Co., Detroit, which is provided with an effective safety device for protecting the hands of the operator. The press is actuated by a tread or lever, which throws the clutch. Without the safety device the operator, while operating the press with his right hand may unconsciously fail to remove his left hand from the metal he has placed on the die and thus lose his fingers or perhaps his entire hand when the press closes. To prevent this inadvertency a lever is provided also for the left hand. This is connected in the rear of the press to the right-hand lever by means of a rod. Both levers, right and left handed, must be held down at once to throw the clutch. To press but one only raises the opposite lever and allows the clutch to slip. The operator is compelled to keep both hands out of danger in order to operate the press.

This side press, as shown, stamps, presses, perforates and fashions sheet-steel into boxes which are used to enclose the live parts of electric switches—a protective device for household and industrial users of electric current.

NEW THINGS IN MACHINE TOOLS

The Superior Collet Chuck Company of Grand Rapids, Mich., are now making a new type of collet chuck for drilling machines.

The Victor Tool Company, of Waynesboro, Pa., has recently placed on the market a new collapsible taper-cutting pipe tap. Some interesting details are incorporated in the design of these tools. Sizes range from 2 to 12 inches.

The Bicknell-Thomas Company, of Greenfield, Mass., has added to its line a vertical tapping machine for bench use, with a capacity from 0 to 3-16 in. taps. A special work fixture may be used in place of the ordinary table. The machine stands 15 inches high and weighs about 48 pounds complete.

The Atlas Press Company of Kalamazoo, Mich., are placing two new arbor presses on the market, one of 6 ton and the other of 15 ton capacity. They are adapted for a variety of work, such as forcing arbors in and out of work to be turned, for straightening and broaching operations, in assembling parts where force fits are required, and for other similar purposes.

A special line of air-operated chucks for service on Jones and Lamson double-spindle turret lathes has been developed by the Frank G. Payson Co., of Chicago, Ill. The body of the chuck is made in one piece and requires no adapter for its attachment to the spindle. The air chuck is located at the rear of the spindle and is connected to the chuck by a rod running through the hollow spindle.

A special tool for use in drilling machines, for the counterboring of holes, facing, forming and similar operations, has been placed on the market by the Genesee Manufacturing Company of Rochester, N.Y. These tools are made in two styles, with two and three cutters, and each style is made in four sizes, ranging from 1¼ to 3 inches outside diameter.

The Detroit Hexagon Drill Company of Detroit, Mich., are now making a line of special tools for the cutting of square and hexagon-shaped holes. These tools may be used either in the drill press, where the drill revolves, or in other machines where the drill is fixed and the work revolves. Tools of this type have been successfully used on steel, iron, brass, aluminum, micarta, bakelite, wood, marble, etc.

The Dauber-Kratsch Company, Oshkosh, Wis., has added a new type of drilling machine to their Wisconsin line. The all-geared mechanism is similar to their gear-driven 20 inch machine, which at present is being made up as two, three and four-spindle drills. The new design has a base of unit construction, so that machines of two or more spindles can be built up as desired and added to as occasion requires.

The Simmons Machine Company, of Albany, N.Y., are now manufacturing an open-side planer that will take care of work 42 inches wide, 48 inches high and up to 12 feet in length. The table is of the double-deck type and has three T-slots, the centre one running the entire length of the table. The column is of box pattern and amply reinforced with inside ribs. The L-shaped cross rail is designed to resist the severest strains and has a long bearing on the column.

A new manufacturing type of milling machine has been placed on the market by the Gabrielson Manufacturing Corporation of Syracuse, N.Y. The arbor support is an integral part of the frame, extending up from the front of the machine, this construction eliminating the need of an overhanging arm. The frame is of cast iron and made in one piece and supported on a base that is built as a tank for holding cutting compound. The spindle is hardened and ground, adjustable for wear, and runs in bronze bearings. These machines are built in three sizes, 6, 9 and 12 inches between the spindle and the table.

To meet the requirements of those manufacturers whose product calls for volume production from 3 and 4 inch bar stock, the National Acme Company of Cleveland, Ohio, has developed an automatic which is constructed on the multiple spindle principle so common in the smaller sizes. This machine makes it possible to complete all operations in the time taken for the longest cut. While the general design is similar to that of the smaller machines, many of the details have been modified to meet the needs of the larger product. Some of the factors that have been given special attention are: convenience of operation, minimizing the consumption of power, application of safety devices, simplification of design, and standardization of auxiliary appliances.

The Toledo Milling Machine Company has placed on the market a new type of vertical milling machine. The unit method of construction has been adopted so that the table, saddle or the knee may be quickly taken off and replaced and the feed-gear case may be taken off with the gears intact by the removal of six screws. A feature of the machine is the control of the different movements, which is carried out from the one operating position, and, by means of an engaging lever, the control of the table movements, lateral, cross or vertical, can be transferred to the centrally-located handwheel on the knee. Automatic disengagement of the feeds are provided. The spindle has eight changes of speed, ranging from 97 to 411 r.p.m. with open drive, and eight with the back gears, ranging from 18 to 76 r.p.m. Longitudinal movement of the table is 46 inches and the traverse 14 inches, and a vertical movement equal to the traverse. The spindle has a vertical movement of 6½ inches. The table surface is 56 by 14 inches. Total weight of the machine is approximately 7,000 pounds.

Some experiments are in progress, according to the "Aerial Age," on the effects in the process of brazing steel on long immersion—that is to say, from three minutes to one hour—in the bath of molten spelter. So far no deleterious effects have been noted. The steel gradually goes into solution at the rate of about 0.001 in. on each surface every two minutes. It has been found that the presence of dissolved iron increases the strength of the spelter. Experiments are being continued with traces of manganese in the spelter, and it is thought posible to obtain an ultimate strength of between 100,000 and 200,000 lb. per square inch for the brazed parts.

The Morse Chain Company, Ithaca, N.Y., announce that they have moved their South-eastern States office from Greensboro, N.C., to Charlotte, N.C. This has been necessitated by the great growth of the textile industry, who are large users of the Morse Company's product.

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Where the Money Went

THE people of United States had a very practical demonstration of what a mess could be made out of so complicated a utility as a railway system.

The Government controlled the roads. They raised passenger and freight rates enormously, and then lost money in millions.

Here is what happened in an average month of 30 days:

"The earnings of 17½ days of each month were paid to labor in wages.

"The earnings of 3 days were paid for fuel.

"The earnings of 5 days were paid for materials and supplies.

"The earnings of 1½ days were paid out for taxes and equipment and facility rents.

"This consumed the earnings of 27 days of each month.

"The earnings of the remaining 3 days went to net operating income and were used by the Government to pay the guaranteed standard return to the companies. The net operating income was insufficient for this purpose and in consequence there was a direct levy on the Government to meet the deficit."

It is easy for agitators who have nothing at stake to paint a great picture of the corporation gouging the public, but it is quite another matter to make the same dear general public see and realize that they have been well and properly gouged by their flier into state ownership of railways.

Heat Treaters Organizing

HEAT treaters are forming an association in this district, and it is well that they should.

With the changing conditions in the mechanical world, with the enlarged use of alloys and special metals for special purposes, there is opening up a great field for the metallurgist and the specialist in heat treating.

Firms are beginning to see the need of being sure of what they are GOING TO GET, rather than experimenting with what they have got in order to see if it will stand the strain.

Firms in this district will be making a capital investment if they see to it that the efforts of the heat-treaters to unite for scientific advancement are not allowed to sag by reason of poor financial support.

Sugar and the Mechanic

PRICES of sugar, according to reports, jumped to 22 and 25 cents per pound in London and Hamilton respectively.

And if wages do not jump in proportion the man who must buy is short that much and he comes back on his employer.

The price tinkers have something to answer for in keeping the agitation up for more pay.

The price of a pound of sugar is of supreme importance to the mechanical world, because the jumping price of a pound of sugar makes the mechanic constantly wonder if there is to be no end to this gouging business.

British Empire Steel

THE bringing to pass of a merger of Canadian Eastern steel and coal interests, transportation companies and shipyards, and the linking up of these with large British steel interests, is an important move in the development of Canada's natural resources.

It is also valuable as helping to bring the British and Canadian steel interests closer together. It will provide Canada with an opening to world trade in steel which her captains of industry could hardly hope to accomplish if left to their own resources.

The new arrangement will also end the litigation that has hindered and hampered the development of iron and steel is Nova Scotia and the Atlantic seaboard in general. There has been a lot of energy expended in that direction that can now be liberated and employed in more remunerative lines.

The development of steel and iron in Canada means the building up of a substantial, basic industry, and the linking up with British finishing capacity, distributing organizations and financial strength means the elimination of much of the risk and uncertainty that would attend the venture if undertaken under less substantial auspices.

"Free Press Evening Bulletin (Winnipeg)
What do Canadians think about it?

The Romance of the Advertising Pages

By F. A. McLean

LAYING aside for a moment the usual dollars and cents angle of advertising, have you ever stopped to consider the advertising pages of your magazine or trade paper from their human interest point of view?

Now an advertisement is just as much a news item as a notice in your home town paper that Sallie Jones was married in a red hat and that she is going to live in Podunk after the honeymoon, or that Bill Bailey lost three fingers last Friday while trying to clean the teeth of a buzz saw and swears that next time he tries it it won't be on a Friday.

The ads. tell you who, why, where, when and what and they come mighty close to us because they speak in a language that we know, the language of our hobby or our business.

Many of the brightest lights of our modern literary world are not too proud to write advertisements, or our famous artists to illustrate them. Where but in the advertising pages can we find finer examples of that almost extinct art of the etcher and the wood engraver?

Advertisements must compete for attention with the news pages, editorials, the stories, the articles and the pictures in the body of the magazine or the trade paper. Hence nothing is too good or too costly to illustrate the ads., which are often the finest examples of the best work of our photographers and photo engravers to-day.

So fine are some of these illustrations, and so beautifully worded and illuminated the texts, that they rank with the best in literature and art that have come down to us through the ages. In the colored inserts of our magazines we find reproduction of cakes, candies and other goodies, so resplendent and so natural that our mouths water, figures and faces of men and women so natural that we want to smile or cry when they do, look to see what they are looking at, gloves and clothing so realistic that we feel like picking them off the pages and putting them on, etc.

Let us imagine what we could do, you and I, if we had an Aladdin's Lamp and could bring all of the people shops, machines and other products out of the pages of a single issue of **Canadian Machinery** and place them along a single city street.

Wouldn't it be a tremendously long street, and how interesting it would be to go down one side of this street and up the other, looking at all the wonderful array of people, shops and goods displayed? Just think how much we could probably learn with little or no trouble in a single trip.

Or let us shift the scene and let's pretend for a few minutes that we are back in the middle ages, and that each one of the ads. represents a town crier or a roadside stand. What an experience it would be to walk along listening to this great army of criers calling our attention to their masters' goods in all the varying tones, high, medium and low, which such a throng might be expected to use!

Or coming nearer home, let's go back a few years to the time we pitched marbles in the streets or played "Chaw Raw Beef" by the "Ole Swimmin' Hole," and imagine a circus coming to town—and such a circus as it would be if all the ads. could come to life and all their characters and products step down from the printed pages and form up in the ground parade!

How we, and other youthful "Captain Kidds," Jesse Jameses, and "Rain in the Faces" would have followed that parade and how quickly would the elephant, the clown, the painted lady and the fat man have been forgotten amidst such an array of wonders!

When you read the ads. you gain the pleasure and profit of clear thinking and store up in your memory for future use, for yourself or your friends, the endless supply of interesting and valuable information they contain.

Read the advertisements in your magazines, your newspapers, your trade journals—for the news they contain—for their educational value—for the life, vitality, art, wit and humor to be found in them—to raise your ideals and to guide you in your family and business affairs.

Here is what I found in a recent issue of CANADIAN MACHINERY:

Why I need a good die stock if I need one at all.

The story of a drill which worked for a piano company for two years without any trouble.

Some interesting facts about a town in Quebec.

How fast a hack saw should cut when in proper condition.

The solution of a brass working plant's cleaning problem.

What Canada's steel mills are making.

The clutch I should use for the place that's hard to get at, or where space is scarce.

The tale of a miller that keeps five die-sinkers busy and has been doing it for four long years.

The kind of machinery that should be used to grind parts with accuracy and despatch.

Vanadium and its effect on steel.

A metal that has mastered all other metals.

The kind of tools that are used in Canada's great logging camps.

The story of Mr. Punch and his fifteen hundred good tools.

The why and the wherefore of goggles in industrial plants.

A method by which drilling time may be cut from 20 to 2 minutes.

How motor truck makers grind their shafts.

A belt that will stand up under steam without going to pieces.

Why Gisholts are so successful.

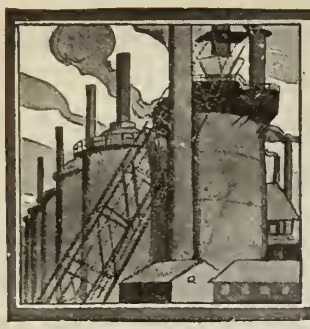
One method that enabled a manufacturer to increase his production by 220 per cent.

A little detail in the construction of a wire fence that makes it stand up well.

The furnaces in which nichrome, the master of oxidation and heat, is made.

A conveyor belt that gives exceptional service because it is built like an automobile tire.

A means of cutting down overhead expense by using the right kind of hoisting and handling equipment, and many equally interesting and helpful pieces of news, human interest stories, etc.



MARKET DEVELOPMENTS

Steel Prices Not Raised for Third Quarter

Formation of New Combination of Canadian and British Companies Attracts Much Interest—Deliveries Do Not Improve, But Prices Are Not Jumping as Formerly

INTEREST centres in the steel world on the prices for the third quarter booking. It seems likely that the Steel Corporation will adhere very closely to their old schedule, which keeps the price down to the market of March 21, last year. Some of the independents and premium mills are selling now without difficulty at 50 per cent. above the Corporation prices, and there are many individual instances where much higher figures have ruled.

The bringing together of the various Canadian and British interests concerned to form what will probably be called the British Empire Steel Corporation is attracting no small amount of attention in trade circles this week. That Canadian mills on the Atlantic seaboard shall make semi-finished material and ship to the finishing mills of the Old Country, thus getting the use of their great distributing agencies, opens a big field.

There is a monotonous sameness to the situation now. Week after week dealers and consumers have the same story. Deliveries bad, worse, or indifferent. Prices jumping and uncertain. And in spite of all these, there is still a large amount of business in the market, although it is certain that some projected industries are holding back to see what the future is going to bring forth.

There is not much on the surface in the way of May-day troubles, but there are many rumors of strikes and walkouts, and there are some industries where such a happening would mean that there would be a shut-down with no effort being made to operate.

MONTREAL MARKET MAY FEEL BETTER AFTER THE FIRST OF MAY

Special to CANADIAN MACHINERY.

MONTREAL, April 22.—Commercial and industrial interests here are hoping for some relief to the irregular delivery of materials that has been a feature of the trading during the past few months by the opening of navigation on the St. Lawrence, which is now practically in effect, the river having cleared of ice during the past few days. During the past week or more the general steel situation, both here and in the States, has been more or less affected by the strike that has been in force on American railroads. While not general in character, the resultant disorganization was sufficient to place a serious handicap on other lines of activity as it aggravated a condition that has been none too good for many a month, namely, the transportation of materials. Many steel mills, which, in the past have experienced considerable difficulty in obtaining material for normal production, were compelled to curtail their operations, and in consequence other industries depending on steel for their existence were affected in a proportionate degree. Dealers here, who a few weeks ago were optimistic regarding the spring outlook, are again troubled when faced with conditions that now confront them. Warehouses are still low in standard lines and no definite promise can be obtained from producers relative to the delivery of material on order. Some dealers are able to get ample material for the urgent needs of regular customers, but little is available for emergency operations. In some instances the offer of premiums will bring forth the material, but frequently even the show of real money is not always followed by the delivery of supplies. It is almost impossible to get a dealer to make a prediction for the early future as they invariably state that it would only be a guess at the best, and the opinion of one is, well, just one man's opinion. The present uncertainty is increased with the near approach of the first of May when the habitual demands of labor are most pronounced. While little trouble of an extensive character is anticipated one can never tell just what might happen. The supply of sheets and tubes has shown slight improvement but not enough to provide a surplus over the existing requirements. Prices quoted in this district are unchanged as dealers state they are as good as any other under existing conditions, where price is a question of supply and delivery.

Supplies Difficult to Obtain

The feeling that May Day may develop additional demands from labor has had the effect of disturbing the general trend of business, not that the demand for equipment has shown any material shrinkage, but rather that the buyers are operating in a more conservative manner. The possibility of higher prices is not the only deterring factor, as the uncertainty of delivery is still the problem that prevents a more liberal placing of orders. The greater volume of trade done by machine-tool dealers, at present, is in the way of supplies. When it is possible to obtain the class of material asked for, dealers report a good turnover of business, but in many instances the filling of orders is accompanied by considerable difficulty in locating the supplies required by the customer. A certain manufacturer here requested a dealer to secure for him some special high-speed drills for drilling through an extra thick piece of metal. The town was apparently "dry," and it was several days before the dealer could obtain the desired article, and even then some grinding of the shank was necessary to meet the manufacturer's requirements. This condition virtually applies to many lines. A maker of rawhide gears here has been unable to obtain rawhide for nearly six months. The demand for all classes of supplies is a feature of present trading; the price is generally high but more frequently of secondary consideration.

Dullness in Scrap Trading

There is little to be said in regard to scrap other than the situation remains

about the same with a steady movement of material. Buying has not improved but the demand for cast iron scrap is heavier than supply will accommodate. Local dealers are trying to meet the needs of the situation but the marked scarcity of scattered supplies is pronounced in the poor returns of the smaller dealers. Non-ferrous scraps are not active and weakness is increasing, although dealers refrain from changing prices as now quoted, stating that these are only nominal at the best.

THE STRIKE MAKES WORK HARDER HERE

Buyers Who Have Been in U. S. Markets Find No Help There

TORONTO.—The various strikes that have been staged in the U. S. are begining to have their effect on deliveries to a rather serious extent. This is particularly the case where manufacturers are bringing in certain parts from that country to be used in turning out the product, the rest of which is made here. A number of cases are reported where cancellation of sales has taken place on account of the inability of the maker to get the goods out on time.

There is also a feeling of uncertainty on both sides of the line as to what may or may not happen on the first of May this year. There are plenty of rumors around of strikes and walkouts, and it would not take much of this sort of thing to make the going pretty doubtful in several lines.

Delivery schedules are still well into the future in many lines of machine tools. Firms delaying the placing of business find that they cannot get attended to for some months now and are inclined at times to drop their whole idea of extension or renewal or equipment. Dealers attribute much of this—and they are no doubt right—to the fact that manufacturers do not plan the placing of equipment far enough ahead in order to give the machine tool man a chance to give him good service.

The Trend of Prices

Some speculation is going on in steel circles as to where the U. S. Steel Corporation will place their prices for third quarter booking. Indications seem to be that the price will be very close to that prevailing at the present time. The prices have been announced for a good many of the mills in the United States, and the price here hinges largely on whether the U. S. firms consider Canadian business as being domestic or export. The claim is that the former is the rating but there is some difference among the Canadian dealers.

One selling agency representing mills outside of the corporation gave the warehouse interests in this district a price of black sheets last week, and the first of this week notified them that in case they were considering buying they would have to pay $10 a ton more. There are cases where the independents and the premium operators are selling at about 50 per cent. above corporation prices, and the trade is hard pressed for an explanation. They begin to figure that either the independents are too high or the corporation too low, and there is not much danger of the latter being the case.

There is probably good reason to believe that the corporation will be in a position to cash in later on the goodwill that it is creating at the present time by reason of the moderation of its selling price, which still holds closely to the schedule of March 21, 1919.

Got Little Encouragement

One Toronto buyer who spent ten days in New York and Pittsburgh returned with little encouragement of anything better on ahead. Conditions at the mills are not improving. They fear that more trouble may come to the surface on May 1st. The production costs are increasing, but with them there is nothing better in the quantity of material produced for the extra money. The railroad strike across the line has had the effect of making it hard for some of the mills to keep rolling. One very effective way to deal with the steel business is to interfere with the supply of coal or coke, and this was done.

Canadian mills seem to be holding the price of bar iron at the price announced some weeks ago now. Dealers are not anxious to see it go any higher, but it is worthy of note that in these days of hopping values the mills have kept the price of bar iron at the same figure for some six weeks or two months now.

A new list is out on wrought pipe, showing an advance. For instance, the old price for 1/8 inch was $6 against a new quotation of $6.50, with all others increased in proportion.

Small tools and supplies are selling in good quantities. Some of the orders coming in indicate that some of the smaller firms are resorting to buying in larger quantities than for some time. They apparently think there is little danger of values going down, and they are anxious to protect themselves as to price and delivery.

Scrap Market is Dull

Although several points in the States report prices on the scrap market as inclined to sag, there has been no reflection here on this as far as the actual quotation is concerned. Consumers are not tempted to come into the market because they hold in many cases that the prices demanded by the yards for their holdings are too high. The yards are firmly of the opinion that lower prices are not coming for the present, and they are standing pat on their figures. In such an atmosphere where it is a hard matter for buyer and seller to get together, and that is exactly how it is working out—they are staying apart.

POINTS IN WEEK'S MARKETING NOTES

The machine-tool trade in New York is reported good, but with possibilities of a strike on May 1 interfering seriously with production.

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The possibility of labor trouble on the first of May is causing uneasiness on both sides of the border, and the various strikes which have already occurred in the United States are having a serious effect on deliveries.

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U.S. Steel prices for third quarter delivery are forecast to be very close to that prevailing at the present time.

—

A new list is out on wrought pipe showing an advance for all sizes.

—

The scrap market is in a comatose condition owing to the inability of buyers and dealers to get together over prices.

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The striking switchmen at U. S. points have also interfered with the scrap iron market, no real prices being quoted and scrap in many cases being hung up in the yards.

—

Pig iron shipments have also been stopped for the same reason.

NEW YORK FIGURES ON MACHINISTS' STRIKE

And Many Plants Claim They Will Shut Down As Conditions Are Only Fair Now

Special to CANADIAN MACHINERY.

NEW YORK, April 22.—Despite the extreme difficulties confronting the industries of the East during the past week or ten days, resulting from the strikes of railroad workers, a very good business in machine tools has been done. Moreover, the metal working industries are facing a possible strike of machinists on May 1. Demands have been presented by the International Association of Machinists, which it is believed employers will not accede to, and the result may be further industrial paralysis.

In the East 40,000 machinists will go out, according to union officials. All machine shops, shipyards and other places where machinists are employed will be affected. Other sections of the country will likewise be affected.

The demands of the machinists are for $1.10 an hour for toolmakers, $1 for machinists, and riggers, 80 cents for specialists, 75 cents for helpers, 60 cents for women helpers, 30 cents for apprentices during the first six months and 40 cents for six months thereafter, 50 cents for the second year, 65 cents for the third year and the regular minimum thereafter; double time for overtime, thirty minutes intermission before overtime and single time during this

intermission; the closed shop; night work to consist of forty hours' work during five nights and 25 per cent. over the day rate to be paid for night work.

It is almost certain that the metal working industries will not accede to these demands, especially to the closed shop. There is some talk that many industries, in the event of a strike, will make no effort to operate. They have been seriously hampered by car shortage, scarcity and high prices of raw materials and the general apathy of labor, and would prefer, in some cases, not to attempt to run under the added burden which a machinists' strike would impose.

The railroad embargoes have caused an even greater shortage of raw materials, and some plants have temporarily laid off a part of their working forces.

Among the Eastern manufacturers who have bought machine tools in the past week are the Willys Corporation, Elizabeth, N. J.; the Van Sicklen Speedometer Co., Newark, N. J., and Toledo, Ohio; the Simms Magneto Co., East Orange, N. J.; the Singer Mfg. Co., Bridgeport, Conn.; the Lehigh Valley Railroad.

WOULD RATHER WAIT FOR MARKET CONDITIONS TO MAKE FRESH START

Special to CANADIAN MACHINERY.

PITTSBURGH, April 22.—The dominant factor in the iron and steel situation has been the rail strike, which curtailed production quite largely and at the same time put a damper on the market. The movement of Connellsville coke was entirely stopped, except for some shipments East. Production was not curtailed in like proportion, but was cut down by more than one-half. At the beginning of last week the rail strike was practically at its height, but there was a fair supply of empties, and day by day the railroads were able to dig up a few more, so that there was some producing and shipping. This was not a movement of coke, however, as the loaded cars got no farther than the yards, and some merely got on to sidings. The by-product coke ovens had hardly any coal, and their shipments were almost entirely suspended, so that altogether but little coke was available for furnaces in the regions affected by the strike. Some of the stacks, however, had stocks of coke laid up against any emergency that might arise, so that the curtailment in pig iron production has been only about one-third of the production and perhaps not altogether as much as that.

In the Youngstown district the situation has been worst, as the mills there have received scarcely any coal, and all are practically down except one or two that had stocks of coal. In the immediate Pittsburgh district there have been some works closed, but the larger works have limped along.

For several days the strike has been waning, but it will be a week, at best, before the coke works, blast furnaces and steel mills have regular rail service again. The roads affected had to get their passenger trains running first, and then they paid attention to foodstuffs and perishables. All told, the loss of production may run not much less than half a million tons in both pig iron and steel ingots.

Divergent Sheet Prices

Since opening its order books Tuesday of last week, as noted in past report, the American Sheet & Tin Plate Company has been entering tonnages from regular customers for the second half with manufacturing consumers and for the third quarter with jobbers. The selling really consists in allotting tonnages, the customers having no hesitancy in taking the tonnages allotted, on account of the price. Even now the independent sheet manufacturers show no signs of modifying their sales policies by reason of the leading interest opening its order books for the second half. All the independents have had higher prices than the leading interest, and none has thus far showed any disposition to book at the basis prices. The independents cannot, of course, sell to the end of the year at premium prices, and they would rather get premiums while the premiums last, particularly as there is no definite evidence that the premiums will not continue for a long time. There is nothing like uniformity of price among the independents, the delivery time determining the premium, several cents a pound for deliveries in the next few weeks, down to say half a cent a pound for August or September delivered, and mills that cannot make earlier delivery than that do not seem anxious to book any tonnage at all.

Tin plate stands in an entirely different category, as the great majority of independents will book their regular customers at least at the regular price of $7 per base box. Doubtless, however, more tonnage will be saved to sell in the prompt market, at premiums, than was the case when contracts for the present half year were made.

Bars, Plates and Shapes

The large independents making bars, plates and shapes, have not, as a rule, opened their order books for third quarter deliveries, and apparently they have doubts whether they could sell all their tonnage for third quarter at the prices they have been asking of late, say 3 cents for bars, 3.10c for shapes and 3.25c for plates. For very early delivery much higher prices are obtainable, 4 cents for bars being far from uncommon, so that there is a natural temptation to hold off in hopes of securing higher prices by waiting. Buyers in general show an indisposition to make any commitments for delivery beyond July 1, unless at basic prices, the prices of the Industrial Board schedule of March 21, 1919, to which the Steel Corporation has steadfastly adhered.

A Quiet Market

The rail strike and the divergence in prices between the Steel Corporation and independents are strong factors in making the market as quiet as it is, but there is good reason to suspect there are other causes. There is a widespread fear that industrial and financial conditions will not be satisfactory a few months hence, and there is good reason for that fear when one considers that the conditions are not satisfactory now. Money is extremely tight, even on Liberty bonds and real estate mortgages. Everybody is busy, although some workmen are busy holding their jobs rather than striving for maximum efficiency, but nearly all along the line there is the feeling that the activity is only temporary. Factories that are busy filling orders, many being far behind on orders, do not feel certain that they will continue busy. This does not mean that there is clearly discerned trouble ahead, but that it is impossible to see for certain whether or not there is going to be trouble, hence throughout industry there is a feeling of conservatism. As soon as the future can be foreseen with more certainty business will make a fresh start.

Pig Iron Firm

All the appearances are of pig iron being very firm. Furnaces are altogether indisposed to cut prices, while in the case of foundry iron sales are being made at prices higher than the figure formerly accepted as defining the market in general. There is, however, practically no buying for second half, and as pig iron still remains somewhat scarce, at least there is no difficulty in securing full prices and sometimes premiums on the small lots that are sold for early delivery. Bessemer remains at $42 valley, basic being generally quotable at $41.50 valley. Foundry iron, however, is quotable at an advance, on a sort of technical basis. Formerly, the chief sales were for second half, at $42 valley, and that was the quotable basis of the market, sales of prompt at higher prices being regarded as involving a premium for the delivery. Now, however, there is no second half business going, and sales of prompt continue at $43 to $44, valley. As these are the only sales made they represent the market, which is thus quotable $1 to $2 higher than the old quotation.

Galt Foundry Extends. — The Galt Brass Company has started work on two additions to their plant, at an estimated cost of $50 000 The foundry building will be 60 by 140 feet, and the other 40 by 50 feet.

U.S. SCRAP METAL

Strike Also Has Its Scrap Market

The striking switchmen have pretty well demoralized the scrap iron market, and some small dealers who have considerable money tied up in material which is on the road, are feeling the pinch financially. From every district in the United States the reports are of markets from which all interest has departed. Under the circumstances there are no real prices to be quoted, though most grades have gone off to some extent. In Chicago, Pittsburgh and St. Louis the railroads have heavy lists of old material to offer. The underlying situation is good, but till the transportation situation is improved, the market will continue to suffer.

PIG IRON TRADE

Strike Holds Up Pig Iron Market

The strike on the railroads has had the effect of suspending shipments of pig iron almost entirely. Consumers have to depend on the stocks they have in their yards, while furnaces are piling iron. In the Pennsylvania region the shortage of fuel has compelled many furnaces to bank, as they have had but little reserve to draw from. There was a good volume of business transacted in this district during the week, despite the handicaps. Eastern Pennsylvania iron is at a base price of $45 for No. 2 plain, while in Central Pennsylvania the base price is $43 to $44. Chicago reports tell of a very quiescent market. Transportation is tied up by the strike, and there is practically no trading. Foundries are getting along as well as possible with the stocks they have on hand. Pittsburgh is experiencing a large volume of enquiry, though the tonnage actually closed falls below the enquiry figures considerably. Enquiries for basic iron for the second quarter of the first half amount to about 20,000 tons. Some of this was expected to be closed at $43 valley furnace. Foundry iron for prompt delivery has been done at $45 for No. 2 foundry in this district. The market in Cleveland had been showing a more active spirit up till the time of the strike, but with the cutting off of shipment and the sudden stoppage of fuel supplies, there was a cessation of trading. Some of the furnaces may be compelled to bank, while there are others which are in a fairly good position as far as fuel is concerned. Prompt iron which was being offered at $42 valley is now $44 valley. There is a good enquiry for basic and $43 is the average price at the furnace. The situation in New England, according to reports from Boston, shows a sudden stagnation following in the wake of the strike. Everybody's efforts have been turned to getting deliveries, and the trading has been neglected. Foundries are operating on a very narrow margin of supplies, and at least one has been closed down. Prices are irregular. From New York the reports are better, both actual sales and enquiry having been good. There have been several sales for export of both foundry and basic to Europe and there is a fair demand from this quarter. Foundry iron is at about the same price as last week. There has been little business done in Buffalo, and that mostly for first half delivery, at the $45 base price for foundry iron. St. Louis and Birmingham report a fair amount of selling, mostly in small lots. Cincinnati reports a strong market and considerable second half iron has been sold. No. 2 Southern iron is at $43 to $44 for either prompt or second half delivery.

BRINGING THEM BACK TO LIFE

How to bring back to life people who apparently are dead from drowning, gas asphyxiation, electric shock or a sudden severe blow is told in simple, direct language with photographic illustrations in National Safety Council Bulletin No. 910. The Prone Pressure method of resuscitation described in detail in this bulletin should be taught to every man, woman and child, for its application—if prompt and efficient—will save lives in situations likely to be met in any industry and in any walk of life. The opportunity to save a life by the intelligent use of the Prone Pressure method comes at least once in the life of nearly everyone.

Classes Practice Resuscitation

A rapidly increasing number of employers are now teaching and requiring their employees to practise the Prone Pressure method of resuscitation. The rules for practice are, of course, most rigid in departments where employees are most likely to be exposed to the danger of asphyxiation, electric shock, or drowning. Such instruction in most cases, is given in classes.

Employees who daily are exposed to these hazards should be required to practise use of the Prone Pressure method of resuscitation at least once a week and during the practice each workman should be required to demonstrate his ability by applying the method to a fellow workman. It is recommended that at least four times a year examinations be held to classify workmen into those competent to apply the method successfully and those incompetent to do so. Workmen who fall into the incompetent class should be given special instruction until they are able to perform the operation successfully.

Employees in departments where the hazards of asphyxiation, drowning, or electric shock are less frequent, should be required to practise the resuscitation method at least once a month. Every new employee should be taught this method within twenty-four hours after being put to work. Some companies require workmen to practise once a week until each man in the gang or division is proficient, after which practice is held on alternate weeks.

Every Employee Should be Taught

Many members of the council consider it desirable to offer instruction in this resuscitation method to all employees so that office workers and others, though having no direct contact with the hazard, may become proficient in the practice of resuscitation.

The increasing use of electricity and gas for light, heat, and power, and the increasing popularity of swimming, are constantly adding to the large numbers of persons exposed to the hazards of asphyxiation, electric shock, and drowning. The stopping of breathing from a sudden blow or physical shock may occur at any time and at any place.

It is no longer uncommon to hear of instances in which employees of public utilities saved the lives of other employees or of the general public by use of the Prone Pressure method of resuscitation. Unfortunately, however, we cannot always expect that employees of public utilities will be in the vicinity when the need for the application of the Prone Pressure method arises—hence the desirability of transmitting this knowledge and of affording opportunities to practise the method to as many men, women, and children as possible.—"National Safety News."

The American Gear Manufacturers Association will hold their fourth annual meeting at the Hotel Statler, Detroit, on April 29, 30 and May 1. An interesting programme has been arranged, some of the papers being "Gears from a Purchaser's Standpoint" by D. G. Stanbrough of the Packard Motor Co. through the Factory," by J. A. Urquhart of the Brown & Sharpe Manufacturing Co. ""The Science of Manufacturing" by Henry M. Leland, president of the Lincoln Motors Company. A visit will be paid to the Ford Motor.

Never make a contract like a jug, with the handle all on one side; be fair, for you cannot succeed in any other way.

The Lord will provide. John D. Rockefeller does not deny this, but he says, "The Lord is very busy; I think we had better provide a fund."

Do a driving business, says the hammer.

Order is Heaven's first law. If we would have Heaven on earth, keep order.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$42 40
Lake Superior, charcoal, Chicago	57 00
Standard low phos., Philadelphia	50 00
Bessemer, Pittsburgh	43 00
Basic, Valley furnace	42 90
Toronto price:—	
Silicon, 2.25% to 2.75%	52 00
No. 2 Foundry, 1.75 to 2.25%	50 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 50
Steel bars, base, Toronto	5 50
Iron bars, base, Montreal	5 50
Steel bars, base, Montreal	5 50
Reinforcing bars, base	5 00
Steel hoops	7 00
Norway iron	11 00
Tire steel	5 75
Spring steel	10 00
Band steel, No. 10 gauge and 3-16 in. base	6 00
Chequered floor plate, 3-16 in.	9 40
Chequered floor plate, ¼ in.	9 00
Staybolt iron	9 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	4 00
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 90
Small shapes under 3"	3 62

C.L. L.C.L.

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points		
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

	Gross. Montreal	Toronto
Lake copper	$25 00	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	77 00	75 00
Spelter	12 50	12 25
Lead	12 00	12 00
Antimony	14 50	14 00
Aluminum	34 00	35 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$ 7 25	$ 7 25
Plates, ¼ up	6 50	6 50

PIPE—WROUGHT

Price List No. 44—April, 1920.

STANDARD BUTTWELD S/C

	Steel Black	Steel Galv.	Gen. Wrot. Iron Black	Gen. Wrot. Iron Galv.
⅛ in.	$6 50	$ 8 50	....	....
¼ in.	5 13	7 26	$ 5 43	$ 7 56
⅜ in.	5 13	7 26	5 43	7 56
½ in.	6 84	8 42	7 27	8 84
¾ in.	8 45	10 58	9 03	11 16
1 in.	12 50	15 64	13 35	16 49
1¼ in.	16 91	21 16	18 06	22 31
1½ in.	20 21	25 30	21 59	26 68
2 in.	27 20	34 04	29 05	35 89
2½ in.	43 00	53 82	....	....
3 in.	56 23	70 38	....	....
3½ in.	71 30	88 32	....	....
4 in.	84 48	104 64	....	....

STANDARD LAPWELD S/C

	Steel Black	Steel Galv.	Gen. Wrot. Iron Black	Gen. Wrot. Iron Galv.
2 in.	$30 90	$37 74	$34 60	$41 44
2½ in.	45 34	56 16	51 19	62 01
3 in.	59 29	73 44	66 94	81 09
3½ in.	73 14	90 16	82 34	99 36
4 in.	86 66	106 82	97 56	117 72
4½ in.	0 98	1 23	1 24	1 49
5 in.	1 15	1 44	1 44	1 73
6½ in.	1 49	1 86	1 87	2 25
7 in.	1 94	2 43	2 42	2 90
8-L in.	2 04	2 55	2 54	3 05
8 in.	2 35	2 94	2 92	3 51
9 in.	2 81	3 52	3 50	4 21
10-L in.	2 61	3 26	3 25	3 90
10 in.	3 36	4 20	4 18	5 03

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.

4½" and larger 50%.

4" and under, running thread, 30%.

Standard couplings, 4-in. and under, 30%

Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds. Montreal	Toronto
Copper, light	$15 00	$14 00
Copper, crucible	18 00	18 00
Copper, heavy	18 00	18 00
Copper wire	18 00	18 00
No. 1 machine composition	16 00	17 00
New brass cuttings	11 00	11 75
Red brass cuttings	14 00	15 75
Yellow brass turnings	8 50	9 50
Light brass	6 50	7 00
Medium brass	8 00	7 75
Scrap zinc	6 50	6 00
Heavy lead	7 00	7 75
Tea lead	4 50	5 00
Aluminum	19 00	20 00

	Per Ton	Gross
Heavy melting steel	18 00	18 00
Boiler plate	15 50	15 00
Axles (wrought iron)	22 00	20 00
Rails (scrap)	18 00	18 00
Malleable scrap	25 00	25 00
No. 1 machine cast iron	32 00	33 00
Pipe, wrought	12 00	12 00
Car wheels	22 00	26 00
Steel axles	22 00	20 00
Mach. shop turnings	11 00	11 00
Stove plate	25 00	25 00
Cast boring	12 00	12 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜-in. and less	10
Carriage bolts, 7-16 and up	Net
Coach and lag screws	25
Stove bolts	55
Wrought washers	45
Elevator bolts	Net
Machine bolts, 7/16 and over	Net
Machine bolts, ⅜-in. and less	15
Blank bolts	Net
Bolt ends	Net
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square, blank	add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 50
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	25 and 5
Sq. and hex. hd. cap screws	22½
Rd. and fil. hd. cap screws	plus 17½
Flat but. hd. cap screws	plus 30
Fin. and semi-fin. nuts up to 1-in.	20
Fin. and Semi-fin. nuts, over 1 in., up to 1½-in.	10
Fin. and Semi-fin. nuts over 1½ in., up to 2-in.	Net
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$60 00
Open-hearth billets	60 00
O.H. sheet bars	76 00
Forging billets	56 00-75 00
Wire rods	52 00-70 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

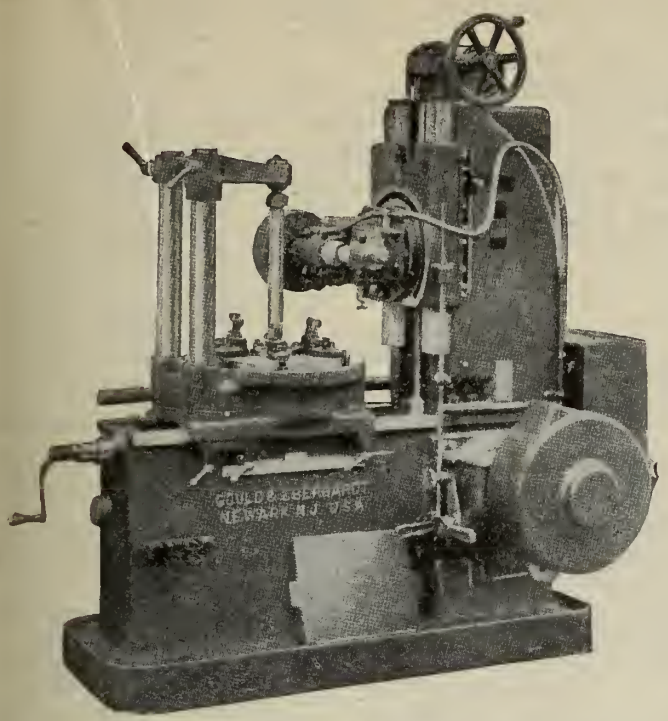
Wire nails	$5 70
Cut nails	5 85
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 35½
British Manila rope	0 28
New Zealand hemp	0 28
Transmission rope, Manila	0 47
Cotton rope, ¼-in. and up	0 88

POLISHED DRILL ROD

Discount off list, Montreal and Toronto net



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GEAR HOBBERS
are
Automatic** therefore **Economical

If you cut gears in quantities they can be cut with advantage on G. & E. Gear Cutting Machinery.

For gears up to 120" dia.

Catalog describing full line of Gear-cutting, Hobbing and Rack-cutting machines on request

Write for prices and deliveries.

The A. R. Williams Machinery Company, Limited

ST. JOHN, N.B.
WINNIPEG, VANCOUVER

"If It's Machinery, Write Williams"

64 Front Street West
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STEEL CASTINGS

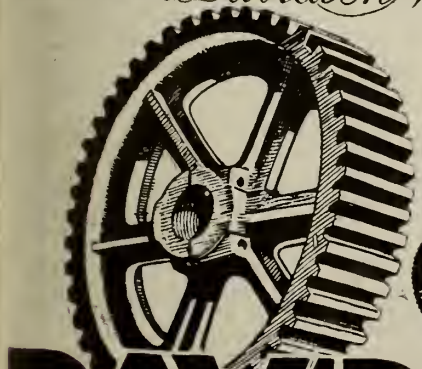
We shall be glad to supply, in addition to our General Catalogue, literature on

Steel Castings	Lithographed Ware
Galvanizing	Enamelled Signs
Wire Goods	
Stoves	

made by the Acid Electric process up to fifteen tons. Castings made by this process are free from blow holes, easy to machine, and superior in every way to ordinary Steel Castings.

Castings supplied for shipbuilding, cars, locomotives, all classes of machinery, etc.

The Thos Davidson Mfg Co Limited



Steel Foundry Division
Lachine Canal, Turcot.

DAVIDSON

A SIMPLE STEP

to better filing.

Use P. H. or Imperial Files.

P H IMPERIAL

"They Cut Faster and Wear Longer."

BE-FILE-WISE.

Ingersoll File Company, Limited.
John Morrow Screw & Nut Co., Limited
Sole Distributors.
Ingersoll, Ontario.

INGERSOLL

If interested tear out this page and place with letters to be answered

MISCELLANEOUS

Solder, strictly	$ 0 40
Solder, guaranteed	0 43
Babbitt metals	18 to 70
Soldering coppers, lb.	0 62
Lead wool, per lb.	0 16
Putty, 100-lb. drums	8 30
White lead, pure, cwt.	20 00
Red dry lead, 100-lb. kegs, per cwt.	16 50
Glue, English	0 40
Tarred slater's paper, roll	1 30
Gasoline, per gal., bulk	0 35
Benzine, per gal., bulk	0 35
Pure turp., single bbls., gal.	3 60
Linseed oil, raw, single bbls.	3 00
Linseed oil, boiled, single bbls.	3 03
Sandpaper, B. & A.	List plus 43
Emery cloth	List plus 37½
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin, "D," per lb.	0 14
Borax crystal and granular	0 14
Wood alcohol, per gal.	2 70
Whiting, plain, per 100 lbs.	2 75

CARBON DRILLS AND REAMERS

S.S. drills, wire sizes	32½
Can. carbon cutters, plus	20
Standard drills, all sizes	32½
3-fluted drills, plus	10
Jobbers' and letter sizes	32½
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	net
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	20 to 40
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At warehouse]

Rounds and squares	$7 base
Hexagons and flats	$7.75 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	60	75
Class B	27	37
Class C	18	27

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 8 50	$ 9 50
Sheets, black, No. 10	8 50	9 00
Canada plates, dull, 52 sheets	8 50	10 00
Can. plates, all bright	8 60	9 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	11 00	....
Fleur-de-Lis, 28 B.W.G.	10 50	....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28.	....	....
Premier, No. 28, U.S.	11 50	10 50
Premier, 10¾-oz.	11 50	10 90
Zinc sheets	16 50	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	29 50
1¾ in.	31 50	30 00
2 in.	30 00	30 00
2¼ in.	35 00	29 00
2½ in.	42 00	37 00
3 in.	50 00	48 00
3¼ in.	.. ..	48 50
3½ in.	63 00	51 50
4 in.	85 00	65 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	24½
Palacine	27½
Machine oil, per gal.	43½
Black oil, per gal.	18½
Cylinder oil, Capital	82
Cylinder oil, Acme	70
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	$2 60
Union thread cutting oil, antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil, bbls., net	13½

BELTING—No 1 OAK TANNED

Extra heavy, single and double	10%
Standard	10%
Cut leather lacing, No. 1	2 75
Leather in side	2 40

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 60
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	09
Pumice, ground	06
Emery glue	30
Tripoli composition	09
Crocus composition	12
Emery composition	10
Rouge, silver	60
Rouge, powder, nickel	45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 4
Brass tubing, seamless	0 4
Copper tubing, seamless	0 4

WASTE

XXX Extra	.24	Atlas	.20
Peerless	.22½	X Empire	.19½
Grand	.22½	Ideal	.19
Superior	.22½	X Press	.17½
X L C R	.21		

Colored

Lion	.17	Popular	.13
Standard	.15	Keen	.11
No. 1	.15		

Wool Packing

Arrow	.35	Anvil	.22
Axle	.28	Anchor	.17

Washed Wipers

Select White	.20	Dark colored	.09
Mixed colored	.10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades... 15%

ANODES

Nickel	.58 to .65
Copper	.38 to .45
Tin	.70 to .70
Zinc	.18 to .18

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10.		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6 x 4 base	45 00	44 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 75	$14 50
Sheets, 3½ lbs. sq. ft.	10 50	14 00
Sheets, 4 to 6 lbs. sq. ft.	10 25	13 50

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

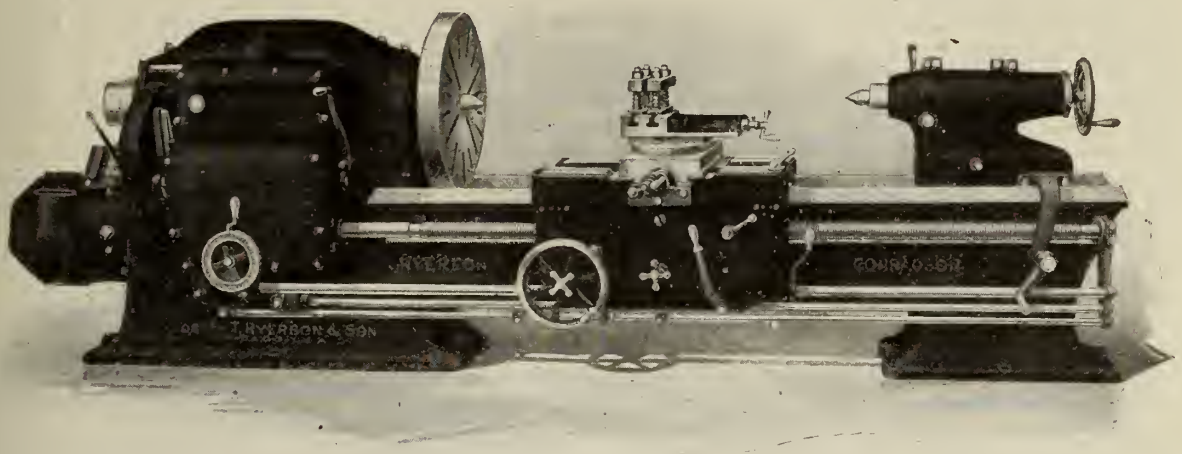
PLATING CHEMICALS

Acid, boracic	$ .23
Acid, hydrochloric	.03¼
Acid, nitric	.10
Acid, sulphuric	.03¼
Ammonia, aqua	.15
Ammonium, carbonate	.20
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.14
Copper, carbonate, ammy.	.41
Copper, sulphate	.16
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.08
Nickel carbonate	.32
Nickel sulphate	.19
Potassium sulphide (substitute)	.42
Silver chloride (per oz.)	1.25
Silver nitrate (per oz.)	1.20
Sodium bisulphate	.11
Sodium carbonate crystals	.06
Sodium cyanide, 127-130%	.38
Sodium hyposulphite per 100 lbs	8.00
Sodium phosphate	.18
Tin chloride	1.00
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated

Announcing the New

Ryerson-Conradson High Power Precision Selective Head Engine Lathes



27" Lathe Arranged for Single Pulley Drive

Our extensive domestic and foreign relations have continuously demonstrated the demand for an engine lathe which can be successfully employed for quantity production as well as general machine shop work. We are offering a completely balanced line of engine lathes embodying the most advanced designs, high quality, workmanship and finish, speed and ease of operation, and accuracy of the finished product. We are manufacturing these lathes in five different sizes, 15", 18", 22", 27" and 33" swing with any length of bed.

Special Features in the Design, Construction and Operation

Head stock cast integral with bed.
Splash oiling system (All gears running in bath of oil.)
Extra large spindle and spindle bearings.
(27" Lathe, front spindle bearing, 6¾" x 10".)
(Hole through spindle, 4¼".)
Herringbone gear drive to spindle.
Exceptional speed range (12 Speeds, 28 Feeds.)
All gears permanently in mesh.
All operations controlled from apron.
Ways have large bearing surface and are of new design.
Special design of apron feed mechanism.
Weight commensurate with liberal size of all parts.

The new Bulletin 1301-C gives complete information.

ESTABLISHED 1842 INCORPORATED 1888

JOSEPH T. RYERSON & SON

CHICAGO, ILL., U.S.A.
MACHINERY

Canadian Representatives:

GARLOCK-WALKER MACHINERY CO., 32-34 Front Street, TORONTO
MONTREAL WINNIPEG

If interested tear out this page and place with letters to be answered

Canadian and British Interests Combine

Nova Scotia Steel & Coal, Dominion Steel Corporation and Canada Steamship Lines Come to Understanding With Some of the Big Steel Finishing Industries in England

THE name British Empire Steel Corporation gives some idea of the scope of the amalgamation of Canadian and British steel, coal and transportation interests, about to be consummated. The Canadian companies interested are, for the present: Nova Scotia Steel and Coal, Dominion Steel Corporation, and the Canada Steamship Lines, and in turn the shipbuilding yards on the Atlantic coast, the St. Lawrence and the Great Lakes. Transportation is one of the greatest problems of the steel trade, the carrying of iron ore, coal or coke and the taking away of the finished or semi-finished products being no small problem. It is thought that by this combination of activities the solution of the question will be made less difficult.

The Nova Scotia and Dominion interests have had conflicting problems in the way of iron and coal deposits for some time. There is now before the Nova Scotia House special legislation seeking to allot these claims on a basis of the actual needs of the companies. This legislation, it is thought, will, in view of the merger, simply be forgotten, as the combining of the interests will iron out many of the difficulties that have arisen in the past.

From what CANADIAN MACHINERY can learn, the companies will operate as separate units for some time at least, but their policies will be directed from the one office, and in this way they will be able to curtail considerable overlapping at the outset.

From the very nature of the location of the steel companies, and the understanding that has been arrived at with the finishing mills of the Old Land, it is apparent that export trade will be the big aim of the new corporation.

Col. Morden's Explanation

Col. Grant Morden, a Canadian financier who has taken a keen interest in British affairs recently, and who is a member of the British House, has had much to do with arranging the details and securing a basis from which the various interests could work. He appeared at Ottawa recently, and laid the plans before a group of members of the House and Senate. He went so far as to declare that the plans were for the formation of the greatest industrial organization in the British Empire. Some of his statements follow:

As I surveyed the industrial field in England, I looked back over the past years and their developments. I was rather under the impression that the great mercantile marine of England, having the supremacy of the seas, had made possible, to a large extent, the great industrial success of England, but I found this was not so. I found that it was only a contributory feature.

It was coal and iron, coal and iron, that made this success! It was coal and iron that made it possible for ships to go out loaded to the four corners of the earth to bring back cargoes necessary for England, but in every case, to leave a margin of credit in every place that ship went, and this margin kept on growing and growing the world over.

I found that the basic industry of England was steel; in fact, it is the basic industry of the world to-day, and I said to myself, this, then, is where we should start in building up a real Empire industrial partnership.

On the Atlantic seaboard of Canada lies the greatest deposit of ore and coal known of in the world to-day. There are over 5,000 million tons of iron ore, fifteen per cent. of the total estimated iron ore in the world, lying there; and side by side with it, is over 6,500 million tons of coal, all lying at tide-water with some of the finest harbors in the world. Consequently, steel should be manufactured there cheaper than in any other part of the world.

The geographical location is unique. It sits up over the North Atlantic ocean; it is closer to South America than the United States; closer to South Africa than England; a ferry service could be run across to the Clyde. But what is lacking? Two things—capital and experience!

I happened to be associated with some of the largest steel masters in England. I went to them and I said, you have the capital, you have your great finishing mills in England, you have your established connections in the markets of the world, but we have in Canada the raw materials, and we can make you your slabs and your billets much cheaper than you can produce or secure them in any other place. They agreed, and so have made possible the plans which we are now completing for the formation of the greatest industrial organization in the British Empire.

U. S. Steel Corporation Plans

Col. Morden also intimated that while in New York recently he had met the head of one of the greatest steel companies in United States. "He came to me," said Col. Morden, "the other day in New York and stated to me that he was well acquainted with the great ore and coal deposits of Newfoundland and Nova Scotia, but he said that no Canadian concern could make a success of itself in making steel for export trade. He pointed out that it had been necessary to get the Government at Washington to pass special legislation changing the Sherman law so as to enable all the great steel companies in United States to come together to form one export company to handle their export steel trade. He said that if it was necessary for them to do this in the United States to meet the competition of the world's markets, what chance would a Canadian company have, who could only manufacture a few lines of steel, against the combined resources of the great American corporations?"

In short, the Canadian steel companies in the East have linked up with the British interests that made it necessary for the United States Steel Corporation to come into existence in the first place.

The Week's Events in Montreal Industry

Repairs to the broken syphon beneath the Lachine Canal is progresing so favorably that the reopening of the waterway is anticipated about the first of May.

* * *

Capt. R. C. Brown, O. B. E., the newly appointed Deputy Warden of the Port of Montreal, has assumed the duties of the office, having arrived in Canada on the last trip of the Cassandra, of which vessel he has been in command for the past seven years.

* * *

The work of regulating the flow of the St. Maurice River, by means of the Gouin Dam, was described at last week's meeting of the Engineering Institute of Canada by Mr. O. Lefebvre, the chief engineer of the Quebec Streams Commission. The work, says Mr. Lefebvre, had proved a great success, a total of 400,000 horse-power being developed on the St. Maurice River, with the possibility of an additional half a million more.

* * *

The British Manufacturers' Association, through their representative, Rafael de la Cova, who has recently come to Canada, is endeavoring to improve trade conditions between the two

THE GEOMETRIC WAY

Where quantity and exactness have to be considered, the Geometric Threading Machine is just the way that suits. These machines have been tested and proved over and over again on speed, accuracy and endurance.

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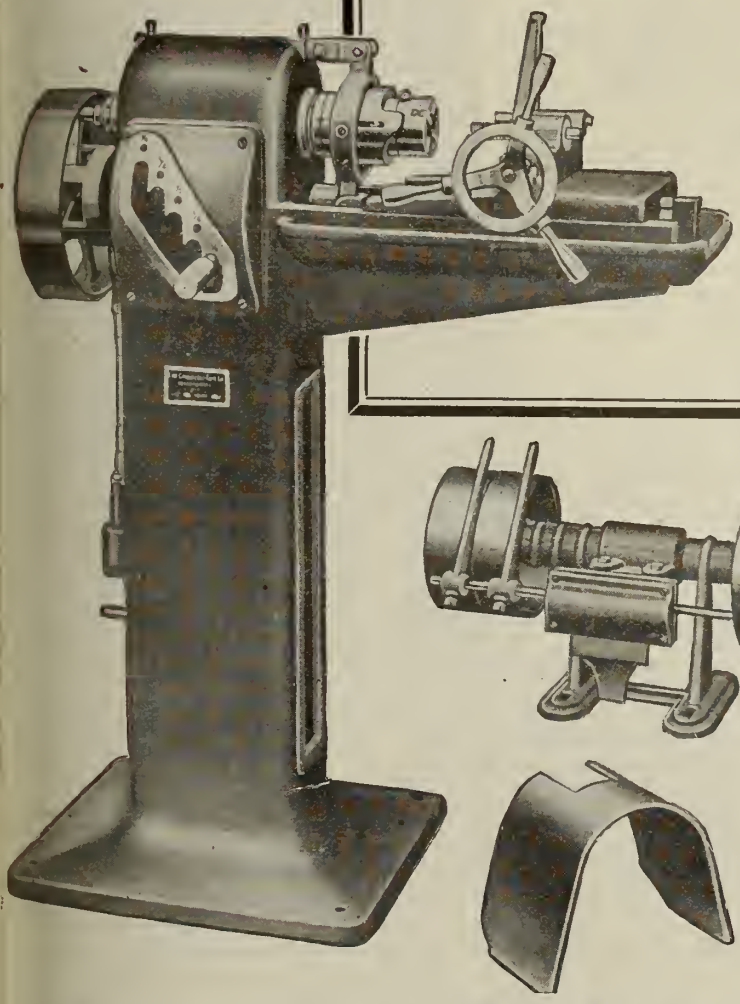

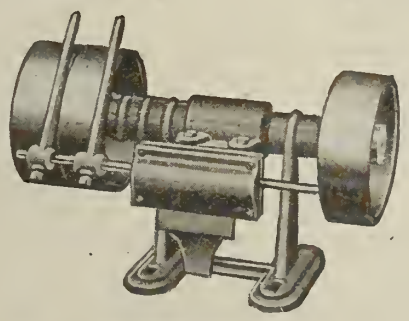

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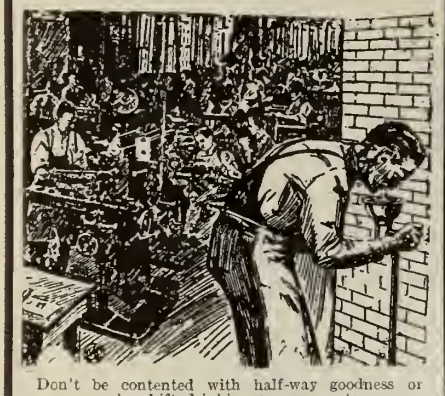

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countries. Several conferences have already been held between Mr. de la Cova, the Board of Trade, and other business interests. In addition to his tour of Canada, Mr. de la Cova will visit many other countries in the interest of British trade development.

* * *

The appointment of consulting engineers by both the Canadian and American Governments marks a further step in the development of plans for the deepening of the St. Lawrence River between Montreal and Lake Ontario. Canada's representative will be W. A. Bowden, B.A.S.E., M.E.I.C., chief engineer of the Railways and Canals Department. Lt.-Col. Wooton, an engineer in the American Government service, will be the United States' chief consultant.

* * *

An extensive suite of offices in the Ottawa Building, Montreal, has been taken over by the British Trade Commission for Canada to provide more adequate facilities for gathering and distributing information to both Canadian importers and exporters, and also to British trade emissaries visiting Montreal. A large sample room and well-equipped library of Empire wide trade and technical papers has been provided for the convenience and education of business patrons.

* * *

The St. Lawrence Welding Company of Montreal has just about completed the new addition to their plant and recently purchased equipment will be installed within a week or so. In addition to their general line of welding and boiler work the company will be in a position to take care of every line of engineering work. The boiler and tank end of the business will be in charge of John Murphy, who has had 43 years of continuous experience in boiler work. He was four years with the Hall Engineering Works, two years with Burland and Johnson of Amherst, N.S., and thirteen years as foreman with J. & R. Weir of Montreal.

* * *

At a recent meeting of the Dominion Council of the Canadian Engineering Institute of Canada, held at the headquarters in Montreal, the question of revising the remunerative scale now in force was the chief subject of discussion, and, as a result of this meeting, it is expected that the executive will take some action regarding the economic welfare of the individual members of the society. It was pointed out that the Engineering Institute was in no sense a union, but a body of Canadian professional men, organized to carry out its work so as to advance the professional interests of the members, by means of papers and addresses, and in other ways, including such attention to material conditions as might be warranted.

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THERE'S a toolmaking shop in Detroit that refused to be stumped by any of the many problems our motor car builders present—the Michigan Tool Company.

This concern is fully equipped for any job—which means Dumore Grinders are there to do their bit.

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PERSONALS

A change of management is announced by the Robb Engineering Works of Amherst, N.S., by which Mr. D. W. Robb, who has been engaged in the active management of the concern for the past forty-five years, now takes the position of vice-president. In a circular letter Mr. Robb states that the company are taking up new lines, including the development of farm tractors. The new manager of the company will be Mr. George E. Newill. Mr. Newill received his engineering training in England and has had considerable engineering and business experience in Canada and other countries. Mr. Robb will continue to act in an advisory capacity.

STARTS NEW COMPANY

Chas. Watt, who has been associated with the Geo. F. Foss Machinery and Supply Company for the past two years, has opened an office at 212 McGill St., Montreal, and will carry on business under the name of the Watt Machinery and Equipment Company. Mr. Watt has had a wide experience in machine and engineering matters; he was born on June 15, 1877, in the town of St. Louis, Que. His early years were spent on the farm of his father, but at the age of 18 he came to Montreal and started his apprenticeship with the John McDougall Caledonia Iron Works. After five years with this firm he worked eighteen months with the Laurie Engine Company and from there he went to Dundas,

CHARLES WATT

working for John Bertram and Sons for two years. He then returned East to Peterborough and served with the Peter Hamilton Company for two years. In 1903 he started with the Dominion Bridge Company of Montreal, working there for ten years, the last eight as foreman. From 1913 to 1915 he was engaged in real estate activities. Early in 1915, when the demand for munitions became excessive and when executives were urgently needed, he was appointed superintendent of the shell department of the Canada Stove and Foundry Company at St. Laurent, retaining this position until 1918, when he became a salesman with the Geo. F. Foss Company, leaving there on March 15 last to open an office of his own.

Car Plant to Start.—The Canadian Car and Foundry Company at Fort William expect to have their plant in operation on the 3,000 cars for the Canadian Pacific Railway by June. The Company are taking on men at present to complete rush repairs on 1,500 cars for the Canadian National Railways.

NOTABLE TELEPHONE DEVELOPMENT

A war-time invention in connection with telephony of which very little has been heard hitherto has very considerable possibilities in everyday use. The development in question arose on account of the difficulties experienced in communication on aeroplanes between the pilot and observers in the early days of the war and the task of devising a telephonic apparatus which would enable good articulation between a pilot and his observer under the conditions of noise which obtain on an aeroplane. It was taken in hand by Captain Cohen, of the Post Office Telephone Department, who was lent to the Air Ministry for the purpose. The main difficulty of course was to overcome the difficulty introduced by the noise of the engine and the other extraneous noises due to the speed of the machine through the air, and the problem resolved itself into evolving a suitable transmitter for the purpose, as obviously an ordinary mouth transmitter was out of the question. Eventually a throat transmitter was devised, which eliminated entirely the mouth transmitter and gave articulation which is as good as, if not better than, ordinary commercial speech over the telephone when using the standard mouth transmitter. The best position for this throat transmitter is in the hollows on either side of the windpipe, and by speaking in a normal tone in the midst of such noises as those produced by the exhaust of an aeroplane engine the speech obtained is quite clear and distinct. We understand that in addition to its successful use on aeroplanes during the war, this transmitter has been tested against very much greater noises, such, for instance, as that produced by four large aeroplane engines at full speed. There is little doubt as to the efficient character of the device, and we foresee two useful applications for it in ordinary commercial use. One is in noisy engine-rooms and machine shops and similar places which abound in industrial life, whilst an even more important use for it, perhaps, from the hygienic point of view, is on public telephones. The condition of the average public telephone is usually such that it can only be regarded as a virulent type of disease spreader, and the replacement of the mouthpiece, with its objectionable condensation, by a transmitter which is placed against the throat is a development which appeals to all on sanitary grounds. The moving system of this new throat transmitter consists of a metal diaphragm with an attached mushroom of insulating material and a carbon chamber with a mica diaphragm. We understand that the company which is making this apparatus has already had several applications for the instrument from industries in which noise is a necessary corollary, but so far the transmitter has not been made on a large scale, and for that reason the present cost is somewhat higher than the usual mouth transmitter apparatus; but when commercial manufacture is commenced a material reduction in cost is looked for.—"Practical Engineer."

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Shall We Divide Canada

IN 1867 our fathers consummated at great price a union of all the provinces and interest of Canada. For over half a century the provinces of Canada have developed together, each the complement of the other.

Canada must be bound together as it is to-day, not so much by the machinery of government as by ideas held in common by all and freely exchanged, so that all sections sympathize with each other. This result has been accomplished primarily by the press, particularly the weekly and monthly periodicals and business papers.

They have no local or sectional bias. They go to all parts of the Dominion. They serve all parts alike. Their service is in bringing all provinces close together into one great nation through one common understanding.

Canada must not be split into a half-dozen sections—weak with the evils of sectionalism, disastrous in the extreme—overflowing with narrow provincialism.

Emanating from we know not whither, comes an idea that will rip asunder all the good done in over half a century of patient building.

It is proposed to tax the very thing that has bound Canada into one—to place on the nation-binding press a zone postal tax which would increase the postal charge upon national periodicals as high as 800 per cent. It means loss to you personally and a loss to your country. It will weaken, cripple and in some cases destroy Canadian national periodicals. You will be deprived of papers that have kept you informed on your country's problems, your business problems, that have helped you in your work, and such magazines as do survive will cost you much more.

The publishers are not trying to evade fair taxation. They will gladly accept any fair tax upon their profits.

But is it fair that you should be taxed out of getting journals, papers and magazines that have helped you build your business and in turn built the business of the country?

If you believe in national ideals and national periodicals, sign attached form.

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INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS PERSONAL AND TRADE NOTES

TRADE GOSSIP

Closing Down Offices.—The work of the Imperial Munition Board is now completed, and the staff are preparing to finally close down the offices.

The oil shale beds of the Wakkerstroom district, which is on the borders of the Transvaal and Natal Provinces of South Africa, are said to yield up to 50 gallons of oil and 57 lb. of ammonium sulphate per ton of shale. The seams of shale are 6 ft. thick in places.

Smelter Purchased. — The Ontario Smelters and Refiners Ltd., of Chippawa, have purchased a smelter, located in Welland, formerly operated by the Metals Chemical Company. The new owners expect to recover metals from the dump left by the previous owners. New machinery and alterations to plant will be necessary at Welland, and work is now going on for these purposes.

Canada Foundries to Expand.—The plant of the Canada Foundries and Forgings Ltd. at Welland, Ont., will be extended to increase the production of drop-forgings. This was decided at a meeting of the company's directors held in New York recently. The machinery to be installed will include steam drop-hammers, hydraulic presses, upsetting machinery and continuous heating furnaces.

Freight Blockade Clearing.—The situation at the U. S. border caused by the strike of switchmen is rapidly improving. The embargo will probably be lifted in the near future. The supply of coal to Ontario is now practically normal, and while a few days ago 4,500 cars in transit to U. S. points were held up, this number had now been reduced to 3,000, and was steadily decreasing.

Some experiments are being carried out near Lyons, at the confluence of the Rhone and Saone with a "toupie hydro-electrique," with the object of obtaining power from the river. It appears from an article in "l'Outillage" that the toupie, invented by MM. Gilbert, Planche and Aason, is virtually a totally immersed water wheel, supported by a pontoon floating in the stream. It is said that one wheel will give 25 horse-power and have an efficiency of 60 per cent.

The Dodge Sales and Engineering Company, of Mishawaka, Ind., have issued several circulars dealing with their new heavy oil engine, which was formerly known as the "Burnoil." The engines are made in 12½ and 37½ h.p. units, and can be made in any combination up to 6 cylinders, thus giving 75 h.p. on the smaller sizes and 225 h.p. on the larger sized 6-cylinder engines. The engines operate on the Diesel principle, but an ingenious method of introducing the fuel charge has eliminated the necessity of high-pressure air for the purpose. This of course simplifies the engine considerably.

By-Law Carries.—The by-law to advance a loan of $25,000 for extending the plant of the Elliot & Whitehall Machine & Tool Co., Galt, Ontario, was approved by the electors. This firm have made very rapid strides since their inauguration in January 1918, when they started operations with three men. They have now a staff of 20 men, and figure on having employment for sixty men in the near future. The firm manufacture milling cutters, reamers, taps, hobs, etc. The loan will be secured by a first mortgage on the land and buildings of the company.

New Plant at Meaford.—The Meaford Steel Products Ltd. has taken over the premises of the Meaford Wheelbarrow Factory, the largest plant of its kind in Canada, which has been closed down since 1916. The new concern will make wheelbarrows, scrapers, warehouse trucks and platform scales, for which a number of orders have been already received. The officers of the new company are Mr. James A. Brown, London, president; E. S. Cleland, vice-president and manager; James S. Reynolds, Sault Ste. Marie, secretary-treasurer. The directors are George Fox, London, and Dr. F. A. Cleland, Toronto.

MARINE

Vancouver.—Much dissatisfaction is felt by the officials of the Genoa Bay Lumber Company over a decision of the Government steamship agent that forbids the loading of the Canadian Government steamers at Genoa Bay. The reason given is that it is not a safe harbor for large steamers. The alternative is that the lumber will have to be shipped to Vancouver by scow and then loaded on to the steamers. The mill officials claim that they have excellent loading facilities at Genoa Bay, and are taking up the question with J. C. McIntosh, M.P., in an effort to have the matter adjusted.

Vancouver. — The Union Steamship Company of British Columbia have called for tenders for a new steamer, which will be operated on the Prince Rupert-Vancouver run. The vessel has been designed by Henry Darling, naval architect and consulting engineer of Vancouver. The leading dimensions of the vessel will be: Length overall, 251 ft. 6 ins; between perpendiculars, 240 ft. 6 ins.; breadth moulded, 37 ft. 3 ins.; depth moulded, 16 ft.; depth to awning deck, 23 ft. 6 ins.; mean draft loaded, 13 ft. There will be accommodation for 98 first-class and 32 second-class passengers, while standee berths for 200 steerage passengers will be available.

TENDERS

The Committee on Fire, Light, Heat and Water, of Winnipeg, Man., are calling for tenders up till May 3 for the supply of cast iron pipe and specials, cast iron transformer rails and accessories for the extension to the power house at Point du Bois. Specifications may be obtained at the office of the City Light & Power Department, 54 King Street, Winnipeg.

OXWELDED DEVICE COMBATS H. C. OF L.

This is the day of H. C. of L., plus—but it is also the day of new and crafty ways of sidestepping the onslaughts of the ugly ogre. The latest device to enlist on the side of the people is the detachable broom handle.

At first thought the broom handle seems inconsequential. Isolated and individually it is. Multiply it by some fifty millions or more, which probably approximates the number of brooms sold yearly in the United States, and you have something quite different.

The detachable broom handle is a brand new idea, and it is "taking." At the present time there is a factory in Vermont devoted exclusively to manufacturing brooms with this type of handle. The handle is of wood fitted into an oxywelded metal holder that clamps easily onto the brush of the broom. The metal part is light but very strong, being securely welded by the oxy-acetylene process, which not only makes it rigid but allows the entire piece to be neatly finished.

THE APPLICATION AND MAINTENANCE OF RAWHIDE GEARING

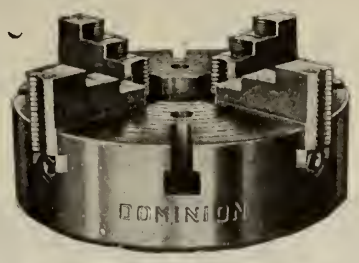
By ORVILLE N. STONE, Asst. Chief Engineer, The Van Dorn & Dutton Co., Cleveland, Ohio

The large scale commercial production of non-metallic gearing of the present day is the result of a vast amount of experimental work which has been done in the past by the foremost gear manufacturers in attempting to produce high speed gearing where quietness is a prime consideration. The initial material placed on the market for this class of work was rawhide. In recent years, numerous other fibre materials, such as Bakelite, Fabroil, Egyptian Fibre, Celeron, and many others have been placed on the market as a substitute for rawhide, and although these fibre materials ordinarily are not as strong as rawhide, still from the standpoint of economy and for many purposes where the gears are subjected to small stresses, fibre is considered by many manufacturers as ideal material.

Rawhide gear material consists of the green packer hides cured separately, followed by a special treatment which eliminates much of the animal material, leaving the fibre, and reducing the thickness of the hide to about one-sixteenth inch. Hides treated in this manner are then blanked to the desired size, ranging from two to forty inches in diameter, depending on the size of the gear wanted. These discs are then dipped in high quality glue and are then placed between blocks by piling them up to make blanks of the required thickness, after which hydraulic pressure is applied to squeeze out surplus glue and the assembled blanks are then thoroughly dried.

Rawhide, while not quite as durable as steel, is used in preference for peripheral velocities of from 1,700 to 2,000 feet per minute and more. This material is as strong as cast iron at high speeds, although weak in comparison in a static test, inasmuch as impact is absorbed due to the cushioning effect of the teeth gears and pinions made of rawhide are in general practice furnished with side plates of bronze, having teeth cut through the side plates, thus increasing the load capacity from 10 to 25 per cent., dependent on the grade of bronze and the thickness of the plates. Gearing made of rawhide should not be subjected to a temperature greater than 225° Fahr. Higher temperatures dry out the material and proper storage must be maintained, as dried-out rawhide caannot be revived. When not in use rawhide gearing should be coated with shellac and stored in a cool place. When in use the life of such gearing is increased by the use of a lubricant consisting of a thin mixture of lard oil and graphite, which in turn coats the tooth face with a metallic film, thus protecting the rawhide. Mineral oils should never be used as a lubricant for this material.

In the application of rawhide gears general practice is to make the smaller member of the mating pair of rawhide. The number of teeth should be 15 to 18 wherever possible.



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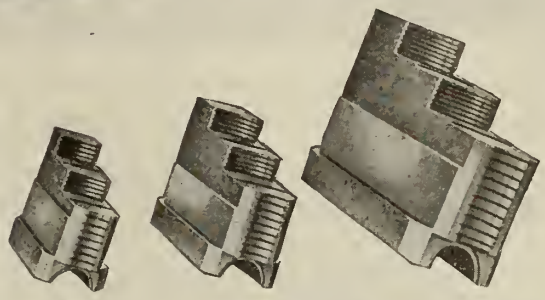

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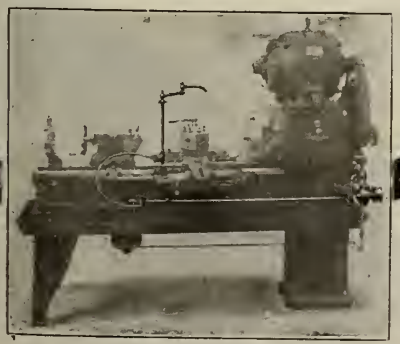

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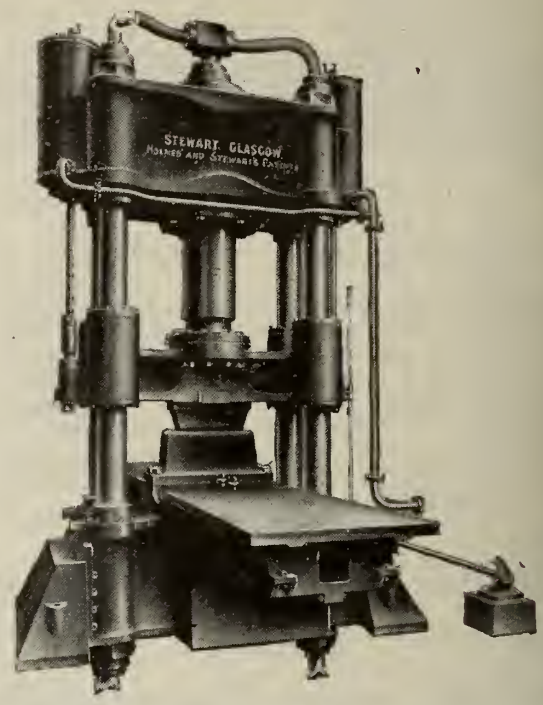

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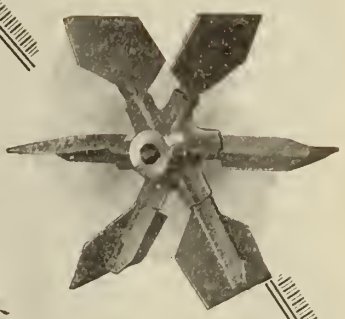

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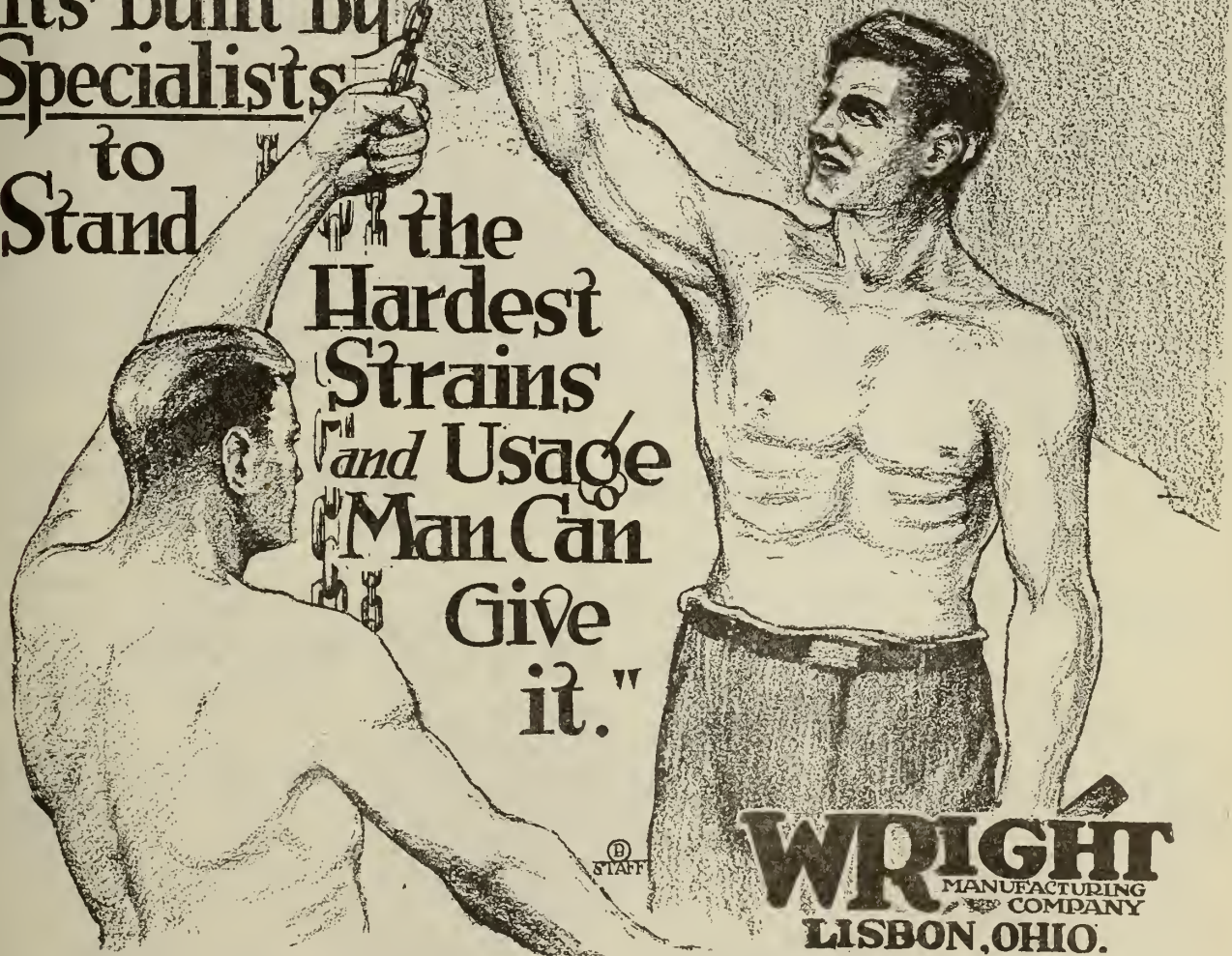

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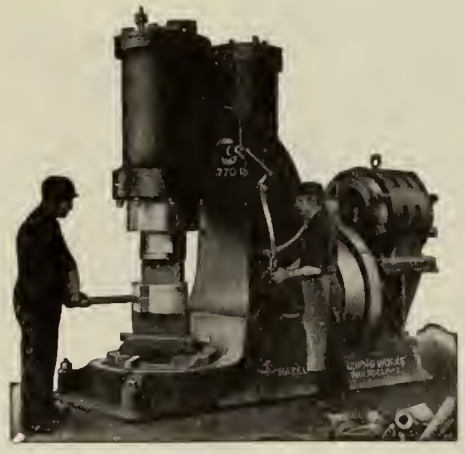

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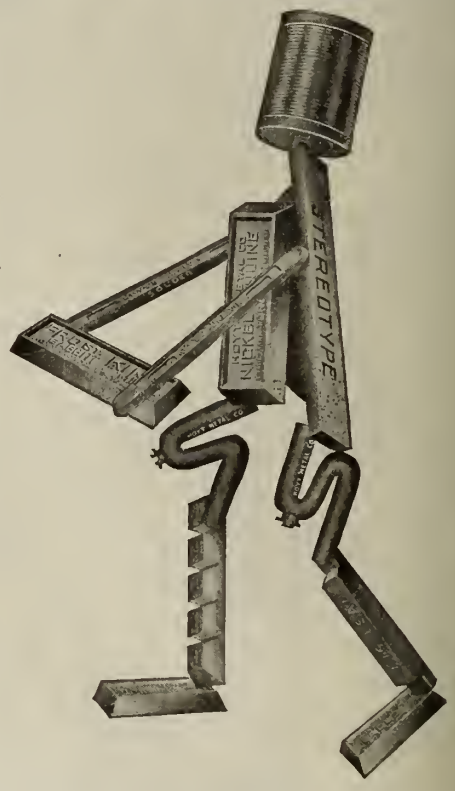

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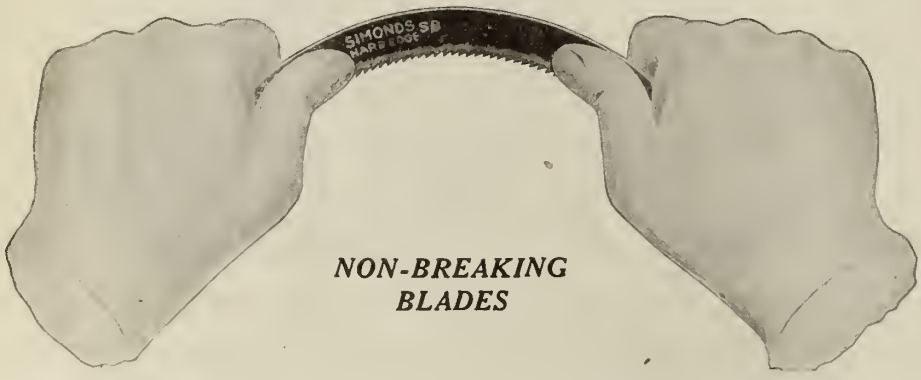

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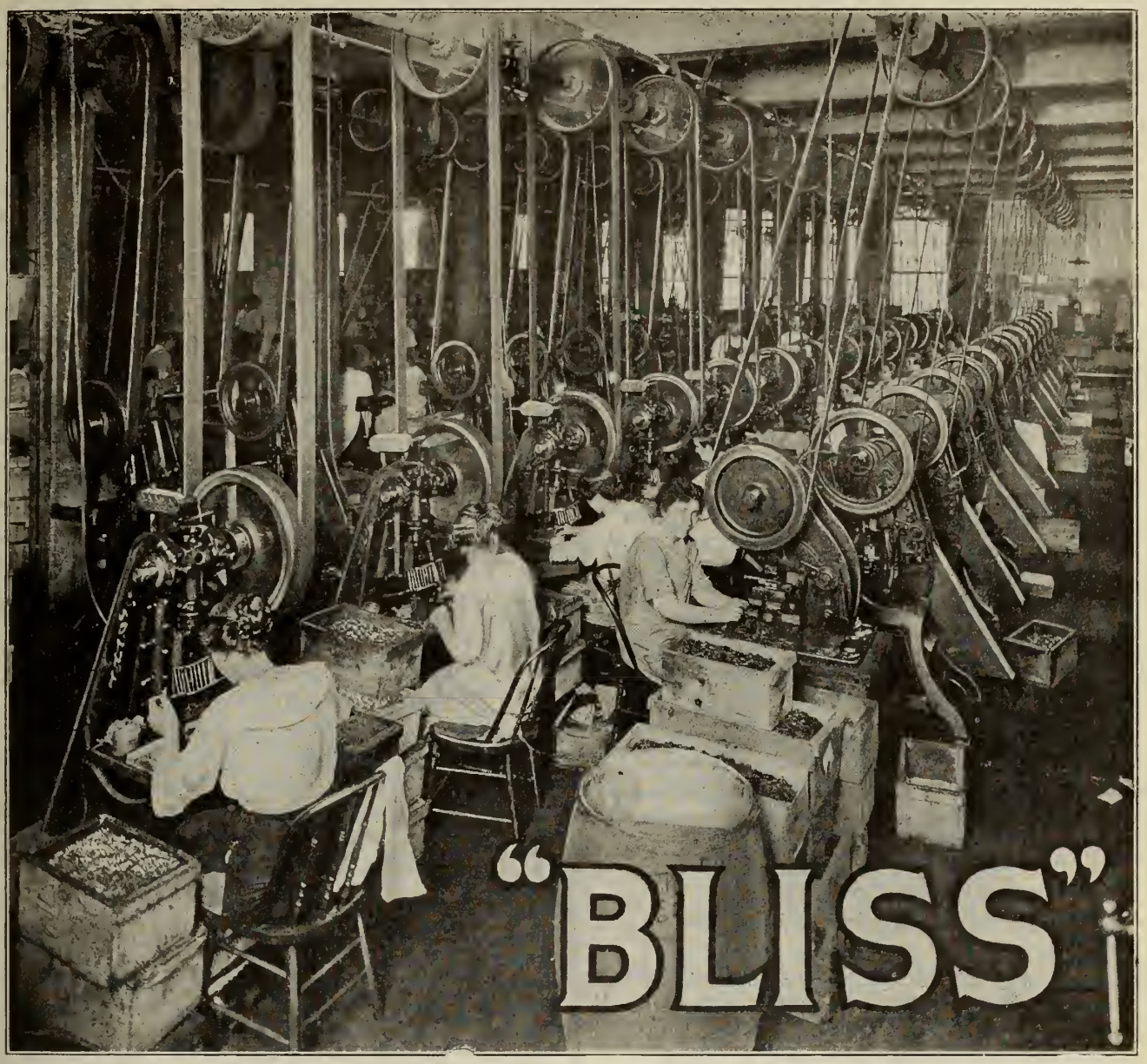

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Women Are Making Good

is so many industrial fields to-day that this picture is interesting. It shows three rows of "BLISS" Presses (41 in all) in the plant of The Arrow Electric Company of Hartford, Conn. The girl operators are making electric light fixture parts of brass, steel and copper, the presses bending them into various required shapes.

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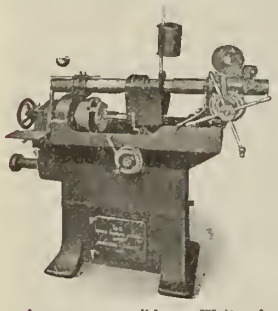

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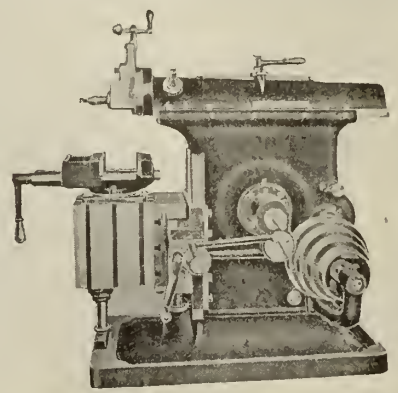

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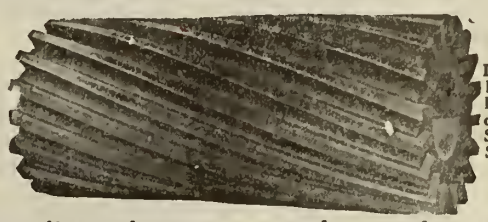

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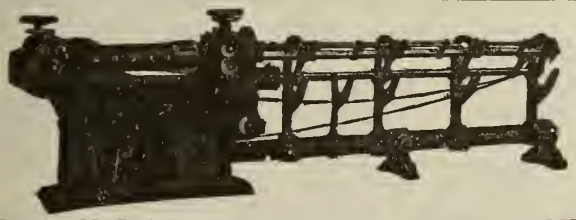

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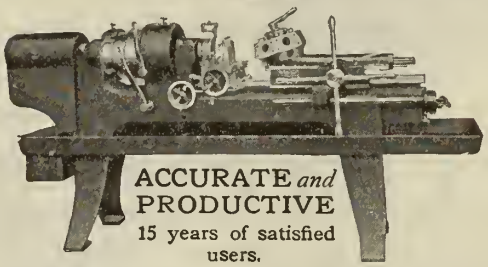

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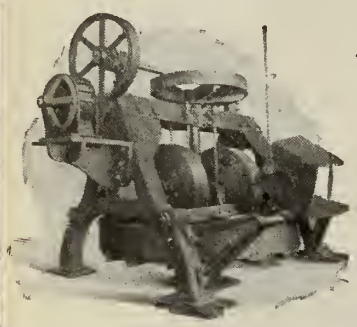

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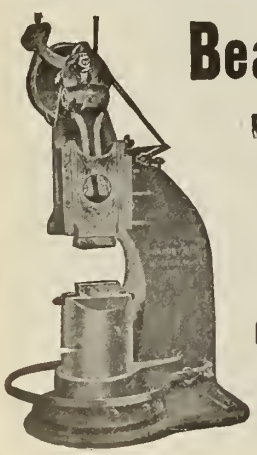

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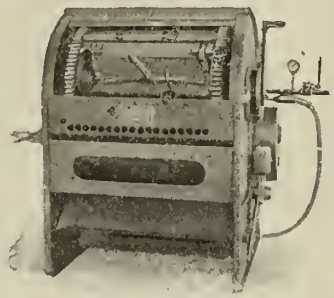

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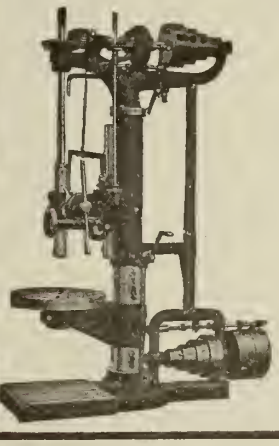

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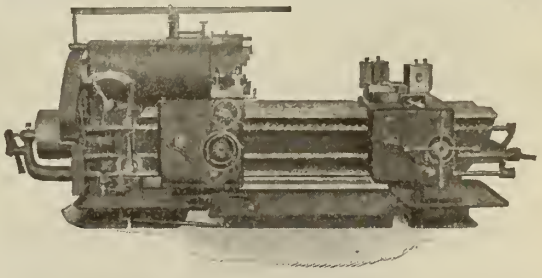

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See Compressors.

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MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
St Lawrence Welding Co, Ltd , Montreal

BUCKETS, ELEVATOR
Can. Link-Belt Co., Toronto, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
...ence Welding Co. Ltd., Montreal

BUCKETS, CLAM SHELL, CRAB, DUMP
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Ltd, Walkerville.
St Lawrence Welding Co, Ltd., Montreal

BULLDOZERS
Bertram & Sons Co., John, Dundas.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy. Co., A. R., Toronto, Ont.
Williams, White & Co., Moline, Ill.

BURNERS, OIL AND NATURAL GAS
Northern Crane Works, Ltd., Walkerville.
W. S. Rockwell Co., New York, N.Y.

BURRS, IRON AND COPPER
Parmenter & Bulloch Co., Gananoque,.

BUSHINGS, BRONZE
Morrow Screw & Nut Co., John, Ingersoll.
St Lawrence Welding Co, Ltd., Montreal

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R.I.
Pangborn Corporation, Hagerstown, Md.

CABINETS, SAND BLAST
Pangborn Corporation, Hagerstown, Md.

CABLE, ELECTRIC
International Machinery & Supply Co., Ltd., Montreal, Que.

CABLES, TRANSMISSION AND TELEPHONES
Northern Electric Co., Ltd., Montreal.

CALKS, BOOT
Lufkin Rule Co., of Can., Windsor, Ont.

CANNERS' MACHINERY
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Can.

CANNERS' CONVEYORS
Can. Link-Belt Co., Toronto, Ont.

CARBIDE
Union Carbide Co., of Canada, Limited, Weland, nt.

CARBONIZING BOXES
Can. Driver-Harris Co., Ltd., Walkerville
Kaetie Foundry, Galt, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
Swedish Crucible Steel Co., Windsor.

CARRIERS, PNEUMATIC TUBE
James & Glassco, Montreal.

CARS, INDUSTRIAL
Can. Blower & Forge Co., Kitchener, Ont
Can. Fairbanks-Morse Co., Ltd, Montreal
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
St Lawrence Welding Co, Ltd., Montreal

CASES, FILING
Economy Drawing Table Co., Adrian, Mich.

CASTINGS, ALUMINUM, BRASS BRONZE, COPPER, AND GUN METAL
Algoma Steel Corp., Sault Ste. Marie.
Franklin Mfg. Co., Syracuse, N.Y.
Canada Metal Co., Ltd., Toronto, Ont.

CASTINGS, DIE CAST
Canada Metal Co., Ltd., Toronto, Ont.
Franklin Mfg. Co., Syracuse, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Tallman Brass & Metals Ltd., Hamilton, Ont.

CASTINGS, STEEL—ALL KINDS
Can. Elec. Steel Castings, Aurora, Ont.
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Electric Steel & Metals Co., Welland.
Mesta Machine Co., Pittsburgh, Pa.

CASTINGS, ELECTRIC AND ALLOY STEEL
Can. Elec. Castings Co. Ltd., Orillia, Ont
Dominion Foundries & Steel Ltd., Hamilton, Ont.

CARRIERS COUPLING BOLTS
John Morrow Screw & Nut Co., Ingersoll
Alexander Fleck Ltd., Ottawa.
Greenleafs Ltd., Belleville, Ont.
St. Lawrence Welding Co., Montreal.
Tallman Brass & Metal Co., Hamilton.

CASTINGS, BENCH LEG.
Brown & Sharpe Mfg. Co., Providence, R.I.

CASTINGS, BRASS AND IRON
Algoma Steel Corp., Sault Ste. Marie.
International Machinery and Supply Co., Ltd., Montreal, Que.

CASTINGS, BUILDING
Katie Foundry, Galt. Ont.

CASTINGS, GRAY IRON
Bernard Industrial Co., A., Fortierville, Q.
Brown & Sharpe Mfg. Co., Providence, R.I.
Brown, Boggs Co., Ltd., Hamilton.
Can. Elec. Castings Co, Ltd., Orillia, Ont
Alexander Fleck, Ltd., Ottawa.
Gardner & Son, Robt., Montreal.
Hull Iron & Steel Foundries, Ltd., Hull
International Malleable Iron Co., Guelph
Kennedy & Sons, Ltd., Wm., Owen Sound.
Katie Foundry, Ltd., Galt, Ont.
Hamilton Co., Wm., Peterboro.

CASTINGS, PLUMBERS'
Katie Foundry, Galt, Ont.

CASTINGS, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville

CASTINGS, HARDWARE
Katie Foundry, Galt, Ont.

CASTINGS, STEEL CHROME AND MANGANESE STEEL
Thos. Davidson Mfg. Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hull Iron & Steel Foundries, Ltd., Hull.
Kennedy & Sons, Ltd, Owen Sound.

CASTINGS, MALLEABLE
International Malleable Iron Co., Guelph

CASTINGS, NICKEL STEEL
Hull Iron & Steel Foundries, Ltd., Hull.

CEMENT, ELASTIC, IRON AND FURNACE
Warminton Co., J. N., Montreal.

CEMENT MACHINERY
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Gardner, Robt., & Son. Montreal.

CEMENT HANDLING MACHINERY
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CEMENT TOOLS
Atkins & Co., E. C., Hamilton, Ont.

CENTERING MACHINES
Victoria Foundry Co., Ottawa, Ont.

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Bertram & Sons Co., John, Dundas.
Butterfield & Co., Inc., Rock Island, Que.
Gardner, Robt. & Son, Montreal.
Hurlburt, Rogers Mch. Co., South Sudbury, Mass.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co., of Canada, Galt, Ont.

CHAIN, WELDED COIL
Morris Crane & Hoist Co., Herbert, Niagara Falls. Ont.

CHAIN BLOCKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford Chain Block & Mfg. Co., Phila., Pa.
Garlock-Walker Machy. Co., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & HoistCo., Herbert, Niagara Falls, Ont.
Oliver Engineering Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Jones & Glassco, Montreal, Que.

CHAINS, AGRICULTURAL
Morse Chain Co., Ithaca, New York.

CHAINS, AUTOMOBILE ENGINE
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.

CHAINS, BICYCLE, DRIVE AND BLOCK
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAINS, FOR ELEVATORS AND CONVEYORS
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Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAINS, POWER TRANSMISSION
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, New York.
Glasgow, N.S.

CHAINS, SPROCKET WHEEL
Can. Link-Belt Co., Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAIN DRIVES
Can. Link-Belt Co., Toronto, Ont.
Coventry Chain Co., Coventry, England.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHASERS
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Taylor, J. A. M., 518 Stair Bldg., Toronto, Ont.

CHEMISTS
Toronto Testing Lab'tory, Ltd., Toronto

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Garvin Machine Co., New York.

CHUCKS, CENTERING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKS, COLLET, AIR
Elliott & Whitehall Mach. & Tool Co. Galt, Ont.
Smalley-General Co., Inc., Bay City, Mich.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Aikenhead Hardware Co., Toronto, Ont.
Almond Mfg. Co., Ashburnham, Mass.
Bertram & Sons Co., John, Dundas.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt., & Son, Montreal.
Garlock-Walker Mach'y Co., Toronto.
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Chicago, Ill.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Jacobs Mfg. Co., Hartford, Conn.
Ker & Goodwin Machine Co., Ltd., Knight Metal Products, Toronto.
Modern Tool Co., Erie, Pa.
Rice Lewis & Son, Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, AUTOMATIC AND KEYLESS
Aikenhead Hardware Co., Toronto, Ont
Can. Blower & Forge Co., Kitchener.

CHUCKS, FRICTION AND TAP
Victor Tool Co., Waynesboro, Pa.

CHUCKS, MACHINE MILLING
Hoggson & Pettis Mfg. Co., New Haven Conn.

CHUCKS, MAGNETIC
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

CHUCKS, RING WHEEL
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.

CHUCKS, WHEEL, CAR
Hoggson & Pettis Mfg. Co., New Haven Conn.

CHUCKING MACHINES
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Windsor, Vt.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Wood Turret Mach. Co., Brazil, Ind.
Williams Mchy Co., A. R., Toronto, Ont.

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Williams, & Co., J. H., Brooklyn, N.Y.

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Oakley Chemical Co., New York, N.Y.

CLEANING COMPOUND
Oakley Chemical Co., New York.

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Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Inc., Chicago, Ill.

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Bernard Industrial Co., A., Fortierville, Q
Can. Link-Belt Co., Toronto, Ont.
Carlyle Johnson Mach. Co., Manchester, Conn.
Positive Clutch & Pulley Wks., Aurora, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.

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Canadian Mead-Morrison Co., Limited, Montreal, Que.

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Brown Hoisting Machinery Co., Cleveland, Ohio.
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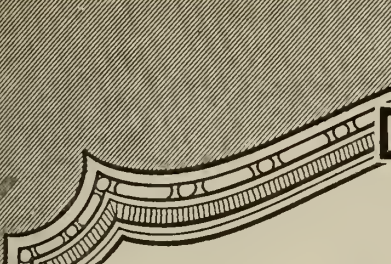
Can. Link-Belt Co., Toronto, Ont.
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Nova Scotia Steel & Coal Co., New



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Giant American rolling mills now supply all the steel, and mile after mile is run off from enormous coils in the polishing process.

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Sturtevant Co., B. F., Galt, Ont.

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Hardinge Bros., Inc., Chicago, Ill.

COMPOSITION INGOT
Canada Metal Co., Toronto, Ont.

COMPOUNDS, CUTTING AND GRINDING, DRAWING, STAMPING
Oakley Chemical Co., New York, N.Y.

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Curtis Pneumatic Machy. Co., St. Louis.
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Garlock-Walker Machy. Co., Toronto.
MacGovern & Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Superior Machinery Co., London, Ont.
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Smalley-General Co., Inc., Bay City, Mich.

CONDUITS
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Canada Found's & Forgings, Ltd., Welland, Ont.

CONTRACTORS' HOISTS
Canadian Mead-Morrison Co., Limited, Montreal, Que.

CONTRACT WORK
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CONVERTERS, ROTARY
MacGovern & Co., Montreal, Que.
Can. Link-Belt Co., Toronto, Ont.
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CONVEYORS—McCASLIN GRAVITY BUCKET
Canadian Mead-Morrison Co., Limited, Montreal, Que.

COOLERS, WITH DRINKING FOUNTAINS
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Ford-Smith Machine Co., Hamilton, Ont.
Foster Machine Co., Elkhart, Ind.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
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Can. Link-Belt Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

COUPLINGS, RAPID HOSE
Int. Machinery & Supply Co., Ltd., Montreal, Que.

COILING MACHINERY, WIRE AND SPRING
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Gardner, Robt. & Son, Montreal.
Independent Pneumatic Tool Co., Chicago

CRANES, LOCOMOTIVE
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Northern Crane Works, Walkerville.

CRANES, OVERHEAD, HAND AND ELECTRIC
Volta Manufacturing Co., Welland, Ont.

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COVERS, OIL HOLE
Can. Winkley Co., Ltd., Windsor, Ont.

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Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.

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MacKinnon Steel Co., Sherbrooke, Que.

CRANES, JIB
Brown Hoisting Machinery Co., Cleveland, Ohio.

CRANES, LOCOMOTIVE
Brown Hoisting Machinery Co., Cleveland, Ohio.

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Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
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Northern Crane Works, Walkerville.
Petrie, Ltd., H. W., Toronto.

CRANES, PILLAR
Brown Hoisting Machinery Co., Cleveland, Ohio.

CRANES, TRAVELLING, ELECTRIC AND HAND POWER
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Dominion Bridge Co., Montreal.
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Lyman Tube & Supply Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Niles-Bement-Pond Co., New York.
Northern Crane Works, Walkerville.
Oliver Engineering Co., Montreal.

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Williams & Co., J. H., Brooklyn, N.Y.

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Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Graton & Knight Mfg. Co., Worcester, Mass.

CRUSHERS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Elec. Steel & Metals, Welland, Ont.

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Can. Blower & Forge Co., Kitchener.
Northern Crane Works, Walkerville.

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Volta Manufacturing Co., Welland, Ont.

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See Bolt Cutters.

CUTTERS, GEARS
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Fellows Gear Shaper Co., Springfield, Vt.

CUTTERS, FLUE
Cleveland Pneumatic Tool Co., Toronto.

CUTTER HEADS
Oliver Machinery Co. Grand Rapids, Mich

CUTTERS, PIPE (See Pipe Cutters)

CUTTERS, MILLING
Becker Milling Mach. Co., Boston, Mass.
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Butterfield & Co., Rock Island, Que.
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Ingersoll Mache, Co., Ingersoll, Ont.
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Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
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Greenfield Tap & Die Corp., Greenfield, Mass
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Hall & Sons, John H., Brantford, Ont.
Kennedy & Sons, Wm., Owen Sound.
Lyman Tube & Supply Co., Montreal, Que.
Niles-Bement-Pond Co., New York, N.Y.
Prest-O-Lite Co., Inc., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
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Davis-Bournonville Co., Jersey City, N.J.
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Smalley General Co., Inc., Bay City, Mich

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Hepburn Co., Ltd., J. T., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont

DERRICK HOISTS
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Furniss, Clarke & Co., Montreal, Que.
Joyce-Koebel Co., Inc., New York City.
Wheel Trueing Tool Co., Detroit.
Petrie, Ltd., H. W., Toronto.

DIAMONDS, CARBON AND BORTZ
Wheel Trueing Tool Co., Detroit.

DIAMONDS, BLACK AND ROUGH
Joyce, Koebel & Co., Inc., New York.
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Tallman Brass & Metals Ltd., Hamilton, Ont.

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Hoggson & Pettis Mfg. Co., New Haven, Conn.

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Wells Bros. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.

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Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt. & Son, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Jones & Lamson, Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.
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Modern Tool Co., Erie, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Rickert-Shafer Co., Erie, Pa.
Stoll Co., Inc., D. H., Buffalo, N.Y.
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Wells Brothers of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

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Crescent Mche. Co., Ltd., Montreal, P.Q.
Elliott & Whitehall, Galt, Ont.

DIES, PIPE THREADING
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Crescent Mche. Co., Ltd., Montreal, P.Q.
Landis Machine Co., Waynesboro, Pa.

DIES, THREADING
Butterfield & Co., Inc., Rock Island, Que.
Crescent Machine Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

DIE SINKERS
Becker Milling Machine Co., Boston
Garvin Machine Co., New York.
Jackson Machine Tool Co, Jackson, Mich.
Kimber & Hillier Mfg., Co., St. Catharines, Ont.
Pratt & Whitney Co., Dundas, Ont.
Walcott Lathe Co., Jackson, Mich

DIES FOR MACHINES
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Rock Island, Que.
Firth & Sons, Thos., Montreal, Que.
Landis Machine Co., Waynesboro, Pa.
Wells Brothers Co. of Canada, Galt.

DIE HEADS
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Canada, Galt, Ont.

DIES, SELF-OPENING
Geometric Tool Co., New Haven.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Wells Brothers Co. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.

DIE FILING MACHINES
Oliver Mach. Co., Grand Rapids, Mich.

DIE STEEL, HOT AND COLD WORK
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Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.
Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.

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Wells Bros. Co. of Can., Galt, Ont.

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Brown, Boggs & Co., Hamilton, Canada
Globe Engineering Co., Hamilton, Ont.
Stoll Co., D. H., Buffalo, N.Y.

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A. B. Jardine & Co., Ltd., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
National-Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros., Co., of Can., Galt, Ont

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Swedish Steel & Importing Co., Montreal.

DIRECT CONNECTED UNITS
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Butterfield & Co., Rock Island, Que.
Can. Blower & Forge Co., Kitchener.
A. B. Jardine & Co., Hespeler, Ont.
Pratt & Whitney Co., Dundas, Ont.
Sturtevant Co., B. F., Galt, Ont.

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DRAWING OFFICE SUPPLIES
Hughes, Owens Co., Ltd., Montreal, Que.

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Can. Desmond-Stephan Mfg. Co., Hamilton
Dominion Abrasive Co., Ltd., Mimico, Ont.
Petrie, Ltd., H. W., Toronto.
Wheel Trueing Tool Co., Windsor, Ont.

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Barber Mchy. Co., Ltd., Toronto, Ont.
W. F. & John Barnes Co., Rockford.
Can. Blower & Forge Co., Kitchener.
Canada Machinery Corp., Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
U. S. Mach. Tool Co., Cincinnati, Ohio.
A. R. Williams Machinery Co., Toronto.

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Kayser-Ellison & Co., Ltd., Montreal.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
Marshall, Son & Bunney, Toronto.
Swedish Steel & Importing Co., Ltd., Montreal.

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Barnes, W. F. & John, Co., Rockford, Ill.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bilton Mach. Tool Co., Bridgeport, Conn
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Silver Mfg. Co., Salem, Ohio.

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Bilton Mach. Tool Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Mach. Co., Toronto.
Garvin Machine Co., New York.
Hoefer Mfg. Co., Freeport, Ill.
Henry & Wright Mfg. Co., Hartford, Conn
A. B. Jardine & Co., Hespeler, Ont.
Landis Tool Co., Waynesboro, Pa.
Nat. Automatic Tool Co., Richmond, Ind.
Niles-Bement-Pond Co., New York.
Rockford Drilling Mach Co., Rockford, Ill

The City of ST. JOHNS QUEBEC

A City of unparalleled industrial advantages

ST. JOHNS is a nerve centre of the network of railways connecting central and Western Canada with the Maritime Provinces, also the Eastern States. Consequently it commands a lower freight rate and cheaper coal supply than any other centrally located manufacturing city.

Directly connected by rail with the docks at Montreal, only 27 miles distant, St. Johns enjoys the advantages of export trade. The city is peculiarly suitable for the American manufacturer locating in Canada having direct connections by water with New York, the St. Lawrence and Great Lakes, and the Eastern seaboard of the United States.

An abundant supply of skilled and unskilled labor is always available. The city is, in fact, recognized as the cheapest labor market in Canada. Low rents and taxes and the general low cost of living have always made St. Johns remarkably free from labor troubles.

Cheap and abundant power is developed at Chambly, eleven miles north-east of St. Johns.

Already an industrial centre, St. Johns is rapidly expanding and now offers unparalleled inducements to encourage the establishment of new industries.

The secretary of the City Council will be pleased to answer any enquiry on St. Johns and will supply complete and accurate information on any phase of the industrial situation as it affects the city.

For more specific information write

The Secretary, City Council

ST. JOHNS, QUEBEC, CAN.

If interested tear out this page and place with letters to be answered.

DRILLING MACHINES, RADIAL AND TURRET
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Garlock-Walker Machinery Co., Toronto.
Henry & Wright Mfg. Co., Hartford,
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Williams Mchy Co., A. R., Toronto, Ont.

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Geo. F. Foss Mch. & S'ply Co., Montreal
Garlock-Walker Mach. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
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Canada Mach. Corp., Galt, Ont.
Garvin Machine Co., New York.
Ford-Smith Machine Co., Hamilton, Ont.
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R. McDougall Co., Galt.
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Rockford Drilling Mach. Co., Rockford, Ill
Niles-Bement-Pond Co., New York.
Oliver Mfg. Co., Salem, Ohio.
U. S. Ordnance, Toronto, Ont.
A. R. Williams Machinery Co., Toronto.

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Rice Lewis & Son, Toronto, Ont.
Oliver Mfg. Co., Salem, Ohio.

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W. F. & John Barnes Co., Rockford, Ill
Can. Blower & Forge Co., Kitchener.
Can. Fairbanks-Morse Co., Montreal.
Geo. F. Foss Mch. & S'ply Co., Montreal
Garlock-Walker Machinery Co., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

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Aikenhead Hardware Co., Toronto, Ont.
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Cleveland Twist Drill Co., Cleveland.
Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto.
Rice Lewis & Son, Toronto, Ont.
Wilt Twist Drill Co., of Can., Walkerville

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Can. Blower & Forge Co., Kitchener.
Cleveland Twist Drill Co., Cleveland.
Geo. F. Foss Mch. & S'ply Co., Montreal
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.
Whitman & Barnes Mfg. Co., Akron, O.
Wilkinson & Kompass, Hamilton, Ont.
Wilt Twist Drill Co. of Can., Walkerville

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Butterfield & Co., Inc., Rock Island, Que.
Marshall, Son & Bunney, Toronto.
John Morrow Screw & Nut Co., Ingersoll

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Cincinnati Electrical Tool Co., Cincinnati
Geo. F. Foss Mch. & S'ply Co., Montreal
Haskins Co., R. C., Chicago, Ill.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Pilot Steel & Tool Co., Montreal, Que.
Prest-O-Lite Co., Inc., Toronto, Ont.
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A. R. Williams Mach. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

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Samuel Osborne, Ltd., Montreal, P.Q.

DRILLS, EMERY
Garlock-Walker Mach. Co., Toronto, Ont.

DRILLS, HIGH SPEED TWIST
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Armstrong-Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Canadian Fairbanks-Morse Co., Montreal
H. A. Drury Co., Montreal.
Geo. F. Foss Mch. & S'ply Co. Montreal
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
W. F. & John Barnes Co., Rockford, Ill
Osborne, Samuel, Montreal, P.Q.
Plewes, Ltd., Winnipeg, Man.
Pratt & Whitney Co., Dundas, Ont.
Petrie, H. W. Toronto.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Taylor J. A. M., Stair Bldg., Toronto.
Wilt Twist Drill Co. of Can., Walkerville
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

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Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

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Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co, New York.
Williams Mchy Co, Ltd., A. R., Montreal
Greenfield Tap & Die Corp., Greenfield, Mass.

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Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.

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Armstrong Bros. Tool Co., Chicago, Ill.
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cincinnati Electrical Tool Co., Cincinnati.
Cleveland Twist Drill Co., Cleveland.
Garlock-Walker Mchy. Co., Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilt Twist Drill Co. of Can., Walkerville.

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Globe Engineering Co.

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The Foss Mchy. & Supply Co., Montreal.
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Morse Twist Drill & Mch. Co., New Bedford, Mass.
Wilt Twist Drill Co. of Can., Walkerville.

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W. S. Rockwell Co., New York, N.Y.

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Volta Manufacturing Co., Welland, Ont.

DUMP CARS
Canadian Fairbanks-Morse Co., Montreal.
MacKinnon Steel Co., Sherbrooke, Que.
St Lawrence Welding Co, Ltd., Montreal

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DUST HANDLING EQUIPMENT
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Sturtevant Co., B. F., Galt, Ont.

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Sturtevant Co., B. F., Galt, Ont.

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Lancashire Dynamo & Motor Co., Ltd., Toronto.
MacGovern & Co., Montreal, Que.
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Lyman Tube & Supply Co., Montreal, Que.
Northern Electric Co., Ltd., Montreal Que

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Electric Furnace Construction Co., Philadelpria, Pa.
Hamilton & Hansell, Inc., New York City
Volta Manufacturing Co., Welland, Ont.

ELECTRIC FURNACE REGULATORS, WINCHES, ROOF COOLERS AND ELECTRODE HOLDERS
Volta Manufacturing Co., Welland, Ont.

ELECTRICAL RESISTANCE MATERIALS, NICHROME, KROMORE, CHROMAX, CLIMAX, NICKEL, SILVER, ADVANCE.
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Volta Manufacturing Co., Welland, Ont.

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Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
Sturtevant Co., B. F., Galt, Ont.
Volta Manufacturing Co., Welland, Ont.

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Goad Engineering Co., Toronto, Ont.

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Canada Wire & Iron Goods Co., Hamilton

ELEVATOR WEIGHTS
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Curtis Pneumatic Machy. Co., St. Louis.

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Ford-Smith Machine Co., Hamilton, Ont.

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Atkins & Co., E. C., Hamilton, Ont.
H. H. Barton & Son Co, Philadelphia, Pa
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Atkins & Co., E. C., Hamilton, Ont.
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Brantford Emery Wheel Co., Brantford, Canada.
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Canada Emery Wheels Co., Hamilton.
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Ford-Smith Mach. Co., Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Wilkinson & Kompass, Hamilton, Ont.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.

ENAMELWARE
Crane, Ltd., Montreal, Que.

EMERY WHEEL DRESSINGS
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Wheel Trueing Tool Co., Windsor Ont.

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ENGINEERS
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MacGovern & Co., Montreal, Que.
Sturtevant Co., B. F., Galt, Ont.

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Petrie, Ltd., H. W., Toronto.

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Ker & Goodwin Machine Co., Ltd., Brantford, Ont.

ENGINES, HEAVY OIL, DIESEL TYPE
Dom. Steel Products Co., Ltd., Brantford

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Sturtevant Co., B. F., Galt, Ont.

ESCUTCHEON PINS
Parmenter & Bulloch, Gananoque, Ont.

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Canadian Fairbanks-Morse Co., Montreal.
Sturtevant Co., B. F., Galt, Ont.

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Pangborn Corporation, Hagerstown, Md.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
St Lawrence Welding Co, Ltd., Montreal

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Can. Foundries & Forgings, Ltd., Welland, Ont.

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Strong, Kennard & Nutt Co., Cleveland.
Willson & Co., Inc., T. A., Reading, Pa.

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Page Steel & Wire Co., Adrian, Mich.

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FACTORY SITES
City of St. Johns, Quebec.

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Sturtevant Co., B. F., Galt, Ont.
Sheldons, Ltd., Galt, Ont.

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Page Steel & Wire Co., New York, N.Y.

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Page Steel & Wire Co., Adrian, Mich.

FERRO-TUNGSTEN
Vanadium-Alloys Steel Co., Pittsburgh, Pa

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Atkins & Co., Wm., Sheffield, Eng.
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Morrow Screw & Nut Co., J., Ingersoll, Ont
Marshall, Son & Bunney, Toronto, Ont.
Nicholson File Co., Port Hope, Ont.
Rice Lewis & Son, Toronto, Ont.
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Whitman & Barnes Mfg. Co., Akron, O.
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General Combustion Co., Ltd., Montreal. Que.

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Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Toronto Tool Co., Toronto, Ont.

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Rice Lewis & Son, Toronto, Ont.
Sturtevant Co., B. F., Galt, Ont.
U. S. Ordnance, Toronto, Ont.

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FORGINGS
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Can. Found. & Forgings, Ltd., Welland
Nova Scotia Steel & Coal Co., New Glasgow, N.S.

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Steel Co. of Canada, Ltd., St. Catharines
Victoria Foundry Co., Ottawa.
Williams & Co., J. H., Brooklyn, N.Y.

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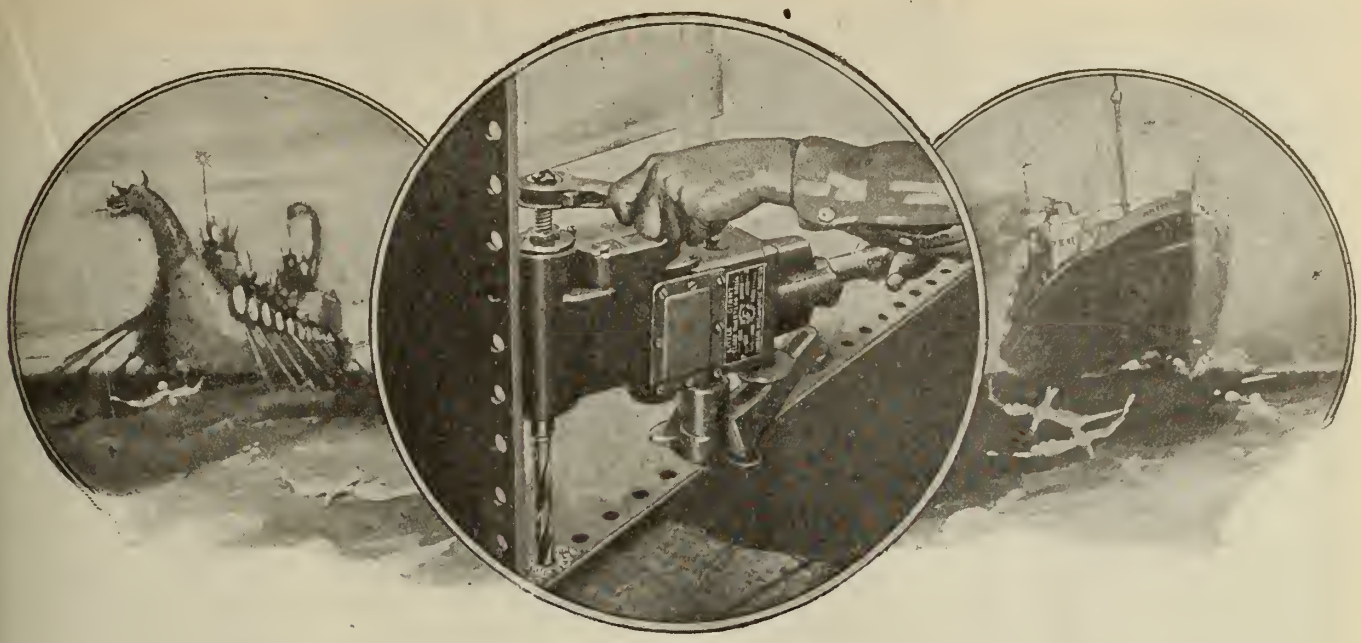
Brown, Boggs Co., Ltd., Hamilton, Ont
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machy. Co., Toronto, Ont
National Machy. Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
Chicago Flexible Shaft Co., Chicago, Ill



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P-46 H

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Armstrong-Whitworth of Can., Montreal.
Can. Found. & Forgings, Ltd., Welland.
Williams & Co., J. H., Brooklyn, N.Y.

FORMING
Brown & Sharpe Mfg. Co., Providence, R.I.

FOUNTAINS, DRINKING
Puro Sanitary Drinking. Fountain Co. Haydenville, Mass.

FRICTION LEATHERS
Graton & Knight Mfg. Co., Montreal.

FRICTION SURFACE BELTING
Can. Consolidated Rubber Co., Montreal.

FUEL OIL SYSTEMS
Bowser Co., Ltd., S. F., Toronto, Ont.
St Lawrence Welding Co, Ltd., Montreal

FURNACES, ANNEALING, CASE HARDENING AND TEMPERING
Bellevue Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I.
Chicago Flexible Shaft Co., Chicago, Ill.
Gen. Combustion Co, Can., Ltd, Montreal
Mechanical Eng'r'g Co., Three Rivers, Q.
W. S. Rockwell Co., New York, N.Y.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.

FURNACES, BLAST
Bellevue Industrial Furnace Co., Detroit.
Chicago Flexible Shaft Co., Chicago, Ill.
W. S. Rockwell Co., New York, N.Y.
Toronto Iron Works, Ltd., Toronto.

FURNACES — BRASS MELTING
General Combustion Co., Ltd., Montreal.

FURNACES — CRUCIBLE
Chicago Flexible Shaft Co., Chicago, Ill.

FURNACES, ELECTRIC
Electric Furnace Construction Co., Philadelphia, Pa.
Hamilton & Hansell, Inc., New York City

FURNACES, FORGING
Chicago Flexible Shaft Co., Chicago, Ill.
Gen. Combustion Co. of Can., Ltd., Montreal.
W. S. Rockwell Co., New York, N.Y.

FURNACES — HIGH-SPEED STEEL
Chicago Flexible Shaft Co., Chicago, Ill.

FUSE BOXES, STEEL
Dom. Forge & Stamp. Co., Walkerville.

FUSE PLUGS AND FUSES
Northern Electric Co., Ltd., Montreal Que

GALVANIZING FLUX
British Smelting & Refining Co., Ltd. Montreal, Que.

GANG PLANER TOOLS
Armstrong Bros. Tool Co., Chicago.

GAS AND STEAM ENGINES
Mesta Machine Co., Pittsburgh, Pa.

GASKETS, LEATHER, ETC.
Graton & Knight Mfg. Co., Montreal.

GASOLINE METERS
Bowser Co., Ltd., S. F., Toronto, Ont.

GASOLINE TANKS
Bowser Co., Ltd., S. F., Toronto, Ont.
St. Lawrence Welding Co., Montreal Que

GASOLINE PUMPS, SELF-MEASURING
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.

GAUGES
Crescent Mach. Co., Ltd., Montreal, P.Q.
Elliott & Whitehall Mach. & Tool Co. Galt, Ont.

GAUGE BLOCKS
Wilton Tool & Mfg. Co., Boston 20, Mass.

GAUGERS, CALIPERS
Williams & Co., J. H., Brooklyn, N.Y.

GAUGES, MERCURY COLUMN, DRAFT
Taylor Instrument Co., Rochester, N.Y.

GAUGES, HYDRAULIC
Taylor Instrument Co., Rochester, N.Y.

GAUGES, MANUFACTURERS, LIMIT, THREAD
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Can., Galt, Ont.
Wilton Tool & Mfg. Co., Boston 20, Mass.

GAUGES, SNAP, THREAD AND CYLINDRICAL
C. E. Johanson, Inc., Toronto, Ont.
Wilton Tool & Mfg. Co., Boston 20, Mass.

GAUGES, THREAD
Wilton Tool & Mfg. Co., Boston 20, Mass.

GAUGES, VACUUM AND PRESSURE
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Rochester, N.Y.

GAUGES, STANDARD
Brown Engineering Corp., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Crescent Mchy. Co., Ltd., Montreal, Que.
Garvin Machine Co., New York.
C. E. Johanson, Inc., Toronto, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Hartford, Conn.
Taylor, J. A. M., 518 Stair Bldg., Toronto
Toronto Tool Works, Toronto, Ont.
Wells Brothers Co. of Canada, Galt, Ont.
Wilton Tool & Mfg. Co., Boston 20, Mass.

GEAR BLANKS
Can. Steel Foundries, Ltd., Montreal.
Dom. Found. & Steel, Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Williams & Co., J. H., Brooklyn, N.Y.

GEAR BLANKS, CAST
Katie Foundry, Galt, Ont.

GEAR BLANKS, RAWHIDE
Lyman Tube & Supply Co., Montreal, Que.

GEAR BOXES, REDUCTION
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEAR SHAPERS AND CUTTERS
Fellows Gear & Shaper Co., Springfield, V.

GEAR-CUTTING MACHINERY
Bilton Mach. Tool Co., Bridgeport, Conn.
Fellows Gear & Shaper Co., Springfield, V.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
A. R. Williams Machy. Co., Toronto.

GEAR-TESTING MACHINE
Gisholt Machine Co., Madison, Wis.

GEARS, CHAIN
Morse Chain Co., Ithaca, New York.
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, COMPENSATING
Morse Chain Co., Ithaca, New York.
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, CUT, MORTISE, ANGLE, WORM
Can. Link-Belt Co., Toronto, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Dominion Bridge Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Elliott & Whitehall, Galt, Ont.
Gardner, Robt., & Son, Montreal.
Hamilton Gear & Machine Co., Toronto.
Hull Iron & Steel Found., Ltd., Hull, Q.
Jones & Glassco, Montreal.
Wm. Kennedy & Sons, Ltd., Owen Sound, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia
Victoria Foundry Co., Ottawa.

GEARS, RAWHIDE
Gardner, Robt., & Son, Montreal.
Grant Gear Works, Boston, Mass.
Hamilton Gear & Machine Co., Toronto.
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia.
A. R. Williams Machy. Co., Toronto.

GENERATORS, GEAR
Fellows Gear & Shaper Co., Springfield, V

GEARS, SILENT CHAIN
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, SPRING
Morse Chain Co., Ithaca, New York.

GEARS, SPUN, BENCH, SPIRAL
Brown & Sharpe Mfg. Co., Providence, R.I.

GENERAL MACHINE WORK
Elliott & Whitehall, Galt, Ont.
St Lawrence Welding Co, Ltd., Montreal

GENERATORS AND CONVERTORS
Northern Elec. Co., Ltd., Montreal, P.Q.

GENERATORS, MOTOR
MacGovern & Co., Montreal.
Northern Elec. Co., Ltd., Montreal, P.Q.
Sturtevant Co., B. F., Galt, Ont.
U. S. Ordnance, Toronto, Ont.

GENERATORS, STEAM TURBO
Can. Link-Belt Co., Ltd., Toronto, Ont.

GILDING
Brown's Copper and Brass Rolling Mills, New Toronto.

GLOVES, ASBESTOS, ACID PROOF, WATERPROOF, ETC.
Strong, Kennard & Nutt Co., Cleveland.

GLUE HEATERS
Oliver Machinery Co., Grand Rapids, Mich

GLASSES, SAFETY
Strong, Kennard & Nutt Co., Cleveland.
Willson & Co., Inc., T. A., Reading, Pa.

GRAPHITE
Aikenhead Hardware, Ltd., Toronto.
Rice Lewis & Son, Toronto.

GOGGLES
Consolidated Optical Co., Toronto.
Standard Optical Co., Geneva, N.Y.
Strong, Kennard & Nutt Co., Cleveland.
Welding & Supplies Co., Montreal.

GRAB BUCKETS—CLAMSHELL and ORANGE PEEL
Canadian Mead-Morrison Co., Limited, Montreal, Que.

GRAVITY CARRIERS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

GREASE CUPS, PRESSED STEEL, BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES (See Lubricants)

GRINDERS, AUTOMATIC KNIFE
Canada Machinery Corp., Galt, Ont.
Foss Mchry. & S'ply Co., G. F., Montreal
Garlock-Walker Machinery Co., Toronto.

GRINDERS, BENCH
Superior Machinery Co., London, Ont.

GRINDERS, CENTRE COLUMN, PEDESTAL AND BENCH
Can. Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Haskins & Co., R. C., Chicago, Ill.
Wisconsin Electric Co., Inc., Racine, Wis.
Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto.
Katie Foundry, Galt, Ont.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford.
Niles-Bement-Pond Co., New York, N.Y.
Perfect Machine Co., Galt, Ont.
United States Elec. Tool Co., Cincinnati.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, CUTTER
Brown & Sharpe Mfg. Co., Providence, R.I
Cincinnati Milling Mach. Co., Cincinnati.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Globe Engineering Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield, M.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Norton Co., Worcester, Mass.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, DIE AND CHASER
Haskins & Co., R. C., Chicago, Ill.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
National-Acme Co., Cleveland, Ohio.

GRINDERS, DISK
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., E. C., Hamilton, Ont.
Ford-Smith Mach. Co., Hamilton.
Gardner Machine Co., Beloit, Wis.
Heald Machine Co., Worcester, Mass.

GRINDERS, FLEXIBLE CASTING
Manhattan Machine & Tool Co., Grand Rapids, Mich.

GRINDERS, DRILL
Aikenhead Hardware Co., Toronto.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield,
Petrie, Ltd., H. W., Toronto.
United States Elec. Tool Co., Cincinnati.
Wells Bros. of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, CYLINDER, INTERNAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I
Foss Mchy. & S'ply Co., G. F., Montreal.
Greenfield Machine Co., Greenfield, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, PORTABLE, ELECTRIC HAND, TOOL POST, FLOOR AND BENCH
Baird Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Ford-Smith Mach. Co., Hamilton, Ont.
Haskins & Co., R. C., Chicago, Ill.
Grant Mfg. & Mach. Co., Bridgeport, Conn
Garlock-Walker Machinery Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Independent Pneumatic Tool Co., Chicago
Petrie, Ltd., H. W., Toronto.
United States Elec. Tool Co., Cincinnati
Wisconsin Electric Co., Inc., Racine, Wis.
Williams Mchy Co., A. R., Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.

GRINDERS, MANUFACTURING
Barber Mchy. Co., Ltd., Toronto, Ont.
Universal Grinding Mach. Co., Fitchburg, Mass.

GRINDERS, HOLE, HOLE AND AND DEEP HOLE
Barber Mchy. Co., Ltd., Toronto, Ont.
Bryant Chucking Grinder Co., Springfield, Vermont.
Heald Machine Co., Worcester, Mass.

GRINDERS, PLAIN CYLINDRICAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Fitchburg Grinding Mach. Co., Fitchburg, Mass.

GRINDERS, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal.
Cleveland Pneumatic Tool Co., Toronto.
Garlock-Walker Machinery Co., Toronto.
Heald Machine Co., Worcester, Mass.
Independent Pneumatic Tool Co., Chicago
MacGovern & Co., Montreal, Que.

GRINDERS, PROFILE
Cleveland Milling Machine Co., Cleveland.

GRINDERS, ROTARY SURFACE
Brown & Sharpe Mfg. Co., Providence, R.I.
Bristol Machine Tool Co., Bristol, Conn.
Manhattan Machine & Tool Co., Grand Rapids, Mich.

GRINDERS, TOOL AND HOLDER
Armstrong Bros. Tool Co., Chicago.
W. F. & John Barnes Co., Rockford, Ill.
Blount & Co., J. G., Everet, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I
Ford-Smith Machine Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield.
National-Acme Co., Cleveland, Ohio.
Tabor Mfg. Co., Philadelphia, Pa.
Wells Bros. of Canada, Galt, Ont.

GRINDERS, UNIVERSAL, PLAIN
Barber Mchy. Co., Ltd., Toronto, Ont.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Modern Tool Co., Erie, Pa.
Norton Co., Worcester, Mass.
Williams Mchy Co, Ltd., A. R., Montreal

GRINDERS, VERTICAL, SURFACE
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Co., Montreal.
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Norton Co., Worcester, Mass.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDING DISCS
Atkins & Co., E. C., Hamilton, Ont.
Wausau Abrasives Co., Chicago, Ill.

GRINDING AND POLISHING MACHINES, PORTABLE, PNEUMATIC AND SPRING FRAME
Can. Fairbanks-Morse Co., Montreal.
Cincinnati Elec. Tool Co., Cincinnati, O.
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal.
Garvin Machine Co., New York.
Garlock-Walker Machy. Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Haskins & Co., R. C., Chicago, Ill.
Hall & Sons, John H., Brantford, Ont.
Niles-Bement-Pond Co., New York, N.Y.
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Wisconsin Electric Co., Racine, Wis.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDING MACHINES, CAR WHEEL, CUTTER, CYLINDRICAL, CRANKSHAFT
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I
Norton Co., Worcester, Mass.

GRINDING WHEELS
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Brantford Emery Wheel Co., Brantford.
Can. Fairbanks-Morse Co., Montreal.
Carborundum Co., Niagara Falls, N.Y.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Mchy. & S'ply Co. G. F., Montreal.
Norton Co., Worcester, Mass.

GRINDING WHEEL DRESSER
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.

GUARDS, WINDOW AND MACHINE
Canada Machinery Corp., Galt, Ont.
Canada Wire & Iron Goods Co., Hamilton
Dennis Wire & Iron Works, London, Ont.
B. Greening Wire Co., Hamilton, Ont
Page Steel & Wire Co., Adrian, Mich.
St Lawrence Welding Co, Ltd., Montreal
Strong, Kennard & Nutt Co., Cleveland.

GUTTERS AND SKYLIGHTS
H. H. Robertson, Ltd., Sarnia, Ont.

HACK SAW BLADES
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Boker & Co., Inc., H., Montreal, Que.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Wks., Buffalo.
Ford-Smith Machine Co., Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Plewes, Ltd., Winnipeg, Man.
Pilot Steel & Tool Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Racine Tool & Machine Co., Racine, Wis.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
L. S. Starrett Co., Athol, Mass.
Standard Machy. & Supplies, Montreal.
Victor Saw Works, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.
Williams Mchy Co., A. R., Toronto, Ont.

HANDLES, BALANCE, CRANK AND MACHINE
Williams & Co., J. H., Brooklyn, N.Y.

HANGERS, SHAFT
Can. Link-Belt Co., Ltd., Toronto, Ont.

HACK SAW FRAMES
Aikenhead Hardware Co., Toronto.
Atkins & Co., E. C., Hamilton, Ont.
Can. Fairbanks-Morse Co., Montreal.
Ford-Smith Machine Co., Hamilton, Ont.
Garvin Machine Co., New York City.
Victor Saw Works, Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.

HACK SAWS, POWER
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Wks., Buffalo.
Foss Mchy. & S'ply Co., G. F., Montreal.
Ford-Smith Machine Co., Hamilton.
Perfect Machine Co., Galt, Ont.
Starrett Co., L. S., Athol, Mass.
Victor Saw Works, Hamilton, Ont.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

HAMMERS, FORGING
Nazel Eng. & Mach. Wks., Philadelphia.

HAMMERS, ELECTRIC
Haskins & Co., R. C., Chicago, Ill.

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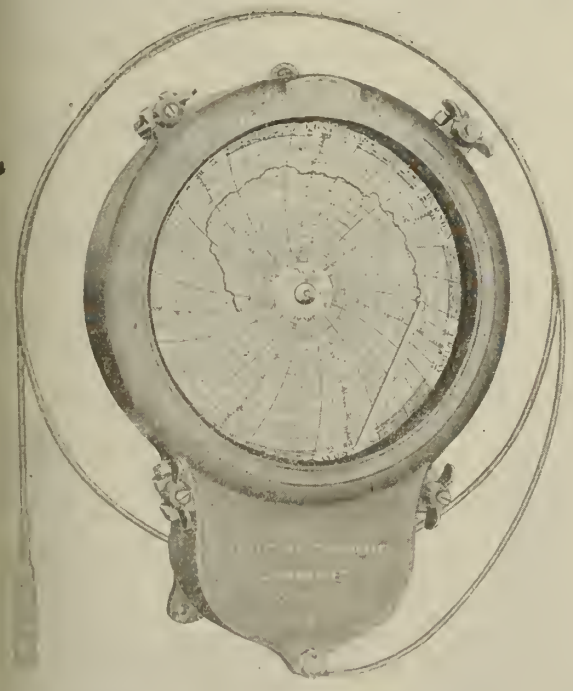

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HAMMERS (DROP), MOTOR AND BELT DRIVEN
Beaudry & Co., Boston, Mass.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton.
Can. Billings & Spencer, Ltd., Welland.
Canada Machinery Corp., Galt, Ont.
High Speed Hammer Co., Rochester, N.Y.
Jardine & Co., A. B., Hespeler, Ont.
Niles-Bement-Pond Co., New York, N.Y.
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
United Hammer Co., Boston, Mass.
Williams Mchy Co, Ltd., A. R., Montreal

HAMMERS, HELVE POWER
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
West Tire Setter Co., Rochester, N.Y.
Williams Mchy Co, Ltd., A. R., Montreal

HAMMERS, CHIPPING, CAULKING, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Nazel Eng. & Mach. Wks., Philadelphia.

HAMMERS, MARKING
Matthews & Co., Jas. H., Pittsburgh, Pa.

HAMMERS, NAIL MACHINE
Rice Lewis & Son, Toronto, Ont.
United Hammer Co., Boston, Mass.

HAMMERS, POWER
Nazel Eng. & Mach. Wks., Philadelphia.

HAMMERS, STEAM
Canada Machinery Corp., Galt, Ont.
Niles-Bement-Pond Co., New York.

HAND PLANERS
Oliver Mchry. Co., Grand Rapids, Mich.

HAND PLANING AND JOINTING MACHINERY
Oliver Engineering Co., Montreal, P.Q.

HAND LEATHERS OR PADS
Graton & Knight Mfg. Co., Montreal.

HANGERS
Brown & Sharpe Mfg. Co., Providence, R.I.

HANGERS, SHAFT
Algoma Steel Corp., Sault Ste. Marie.
Chapman Double Ball Bearing Co., Toronto.
Gray Ball Bearing Co., Ltd., Toronto.
Baird Machine Co., Bridgeport, Conn.
Can. S K F Co., Toronto, Ont.
Gardner & Son, Robt., Montreal.
Jones & Glassco, Montreal.
Williams Mchy Co, Ltd., A. R., Montreal

HARDNESS TESTING INSTRUMENTS
Shore Instrument & Mfg. Co., New York.

HEAD, AUXILIARY
Hoefer Mfg. Co., Freeport, Ill.

HEATING AND VENTILATING ENGINEERS
Can. Blower & Forge Co., Kitchener, Ont.
Sheldons, Ltd., Galt, Ontario.
Sturtevant Co., B. F., Galt, Ont.

HEAT TREATMENT OF STEEL
Gray Ball Bearing Co., Ltd., Toronto.

HEAT GAUGES, HARDENING AND ANNEALING
Shore Instrument & Mfg. Co., New York

HELMETS, SANDBLAST, AMMONIA
Strong, Kennard & Nutt Co., Cleveland

HIGH SPEED STEEL
See Steel.

HINGE MACHINERY
Baird Machine Co., Bridgeport, Conn.

HINGES
Butterfield & Co., Inc., Rock Island, Que.
London Bolt & Hinge Wks., London, Ont.

HOBS
Greenfield Tap & Die Co., Greenfield, Mass
Pratt & Whitney Co., Dundas, Ont.
Taylor, J. A. M., 318 Stair Bldg., Toronto
Wells Bros. of Canada, Galt, Ont.

HOISTING MACHINERY
Canadian Mead-Morrison Co., Limited, Montreal, Que.

HOISTS, AIR
Can. Ingersoll-Rand Co., Ltd., Sherbrooke
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

HOISTS, CHAIN AND PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Ford Chain Block & Mfg., Philadelphia.
Independent Pneumatic Tool Co., Chicago
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.
Williams Mchy Co, Ltd., A. R., Montreal

HOISTS, ELEC., STATIONARY, MONO RAIL
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
A. Leatty & Sons, Ltd., Welland, Can.
Oliver Engineering Co., Montreal.
Volta Mfg. Co., Welland, Ont.

HOISTS, ELECTRICAL
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Montreal, Que.
Electric Steels & Metals Ltd., Welland.
Kennedy & Sons, Owen Sound, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

HOLDERS, STEEL DIE FOR MARKING
Matthews & Co., Jas. H., Pittsburgh, Pa.

HOLDERS, ELECTRIC
Electric Steels & Metals, Ltd., Welland

HOOKS, BELT LACING
Clipper Belt Lacer Co., Grand Rapids.

HOPPERS
MacKinnon Steel Co., Ltd., Sherbrooke.
Dominion Bridge Co., Montreal, Que.
William Hamilton Co., Peterboro, Ont.
Toronto Iron Works, Ltd., Toronto, Ont.

HOSE, FIRE PROTECTION
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal

HOSE, PNEUMATIC
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Gutta Percha & Rubber, Ltd., Toronto.
Independent Pneumatic Tool Co., Chicago.
Quaker City Rubber Co., Philadelphia, Pa.
Wells Bros. Co. of Canada, Galt, Ont.

HOSE, ALL KINDS
Goodyear Tire & Rubber Co., of Canada, Ltd., Toronto.
Gutta Percha & Rubber, Ltd., Toronto.
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.

HOSE, SAND BLAST
Pangborn Corporation, Hagerstown, Md.
Goodyear Tire & Rubber Co. of Can., Ltd. Toronto
Quaker City Rubber Co., Philadelphia, Pa.
Intern'l. Machine Tool Co., Indianapolis.

HOSE, STEAM, SUCTION AND WATER
Gutta Percha & Rubber, Ltd., Toronto.
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.

HUMIDIFIERS
Sturtevant Co., B. F., Galt, Ont.

HYDRAULIC ACCUMULATORS
Dom. Steel Products Co., Ltd., Brantford.

HYDRAULIC MACHINERY
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Machinery Co., Toronto.
Dom. Steel Products Co., Ltd., Brantford.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
West Tire Setter Co., Rochester, N.Y.
Victoria Foundry Co., Ottawa.

HYDRAULIC TURBINES
Que.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,

HYDROMETERS, HYGROMETERS, HYGRODNIKS
Taylor Instrument Co., Rochester, N.Y.

INDICATORS, SPEED
Athenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol, Mass.

INDEX CENTRES
Brown & Sharpe Mfg. Co., Providence, R.I.
Dickow, Fred. C., Chicago, Ill.
Ford-Smith Machine Co., Hamilton, Ont.
Garvin Machine Co., New York.
Petrie, Ltd., H. W., Toronto.

INDICATING INSTRUMENTS
Taylor Instrument Co., Rochester, N.Y.

INDICATING SCALES
Can. Kron Scale Co., Montreal.

INDUSTRIAL SITES
City of St. Johns, Quebec.

INGOTS, BRASS, BRONZE, GUN METAL, PHOSPHOR
Thomas Moore & Son, Montreal.

INGOTS, FORGING AND ROLLING
Electric Steel & Metals Co., Welland.

INSULATING COMPOUNDS
Robertson Co., Ltd., H. H., Sarnia, Ont.

INSTRUMENTS, ENGINEERING
Consolidated Optical Co., Toronto.

IRON ORE
Hanna & Co., M. A. Cleveland, O.

IRON, WROUGHT, ROLLED, PIG
Swedish Steel & Impt. Co., Ltd., Montreal

JACKS
Athenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Globe Engineering Co.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Norton, A. O., Coaticook, Que.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.

JACKS, PIT AND TRACK
Canadian Fairbanks-Morse Co., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Northern Crane Works, Walkerville.

JAWS, FACE PLATE
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford.
Skinner Chuck Co., New Britain, Conn.

JOINTERS
Gray Ball Bearing Co., Ltd., Toronto.

JIGS, TOOLS, ETC.
Brown Engineering Corp., Toronto.
Crescent Mach. Co., Ltd., Montreal, P.Q.
Elliott & Whitehall Mach. & Tool Co., Galt.
Goshorn Machine Co., Madison, Wis.
Globe Engineering Co., Ltd., Hamilton.
Horner & Wilson, Hamilton, Ont.
Jones & Lamson, Springfield, Vt.
Toronto Tool Co., Toronto, Ont.

JOURNAL WEDGES
Canada Foundries & Forgings, Welland.
Dominion Foundries & Steel Ltd., Hamilton, Ont.

KEY SEATERS
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Morton Mfg. Co., Muskegon Heights, M.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.

KEYS, MACHINE
Whitney Mfg. Co., Hartford, Conn.
Williams & Co., J. H., Brooklyn, N.Y.

KILNS
Can. Blower & Forge Co., Kitchener, Ont.
General Combustion Co., Ltd., Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Sturtevant Co., B. F., Galt, Ont.

KNIVES, MACHINE
Atkins & Co., E. C., Hamilton, Ont.

KNIFE GRINDERS
Gray Ball Bearing Co., Ltd., Toronto.

LABELS AND TAGS
Matthews & Co., Jas. H., Pittsburgh, Pa.

LABORATORIES, INSPECTION AND TESTING (see Chemists)

LADLES, FOUNDRY
Northern Crane Works, Walkerville.

LACING MACHINES
Clipper Belt Lacer Co., Grand Rapids, M.

LAG SCREW GIMLET POINTERS
National Machy. Co., Tiffin, Ohio.

LATH
Robertson, Ltd., H. H., Sarnia, Ont.

LATHES, CHUCKING
Acme Machine Tool Co., Cincinnati, Ohio.
Petrie, Ltd., H. W., Toronto.
Wood Turret Machine Co., Brazil, Ind.

LATHE CHUCKS (See Chucks)

LATHE DOGS AND ATTACHMENTS
Armstrong Bros. Tool Co., Chicago.
Hendey Machine Co., Torrington, Conn.
Williams & Co., J. H., Brooklyn, N.Y.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.
Wood Turret Machine Co., Brazil, Ind.

LATHES, AXLE
Barber Mchy. Co., Ltd., Toronto, Ont.
Betts Mach. Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.

LATHES, BORING
Barber Mchy. Co., Ltd., Toronto, Ont.
Bridgeford Mach. Tool Works, Rochester.
Canada Machinery Corp., Galt, Ont.
Ledge & Shipley, Cincinnati, O.
Petrie, Ltd., H. W., Toronto.

LATHES, PRECISION, BENCH
W. F. & John Barnes Co., Rockford.
J. G. Blount & Co., Everett, Mass.
Canadian Fairbanks-Morse Co., Montreal.
Geo. F. Foss Machy. & Supply Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Hardinge Bros., Chicago, Ill.
Pratt & Whitney Co., Dundas, Ont.
Seneca Falls Mfg Co., Seneca Falls, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

LATHES, BRASS
Acme Machine Tool Co., Cincinnati, Ohio.
Hardinge Bros., Chicago, Ill.
Wood Turret Machine Co., Brazil, Ind.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

LATHES, ENGINE
Acme Machine Tool Co., Cincinnati, Ohio.
Barber Mchy. Co., Ltd., Toronto, Ont.
John Bertram & Sons Co., Dundas.
Canada Mach'y Corp., Galt, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cleco Machine Tool Co., Cincinnati, Ohio.
G. F. Foss Mchy. & S'ply Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis
Kennedy & Sons, Wm., Owen Sound, Ont.
Lehman Mach. Co., St. Louis, Mo.
R. McDougall Co., Galt.
Niles-Bement-Pond Co., New York.
Perfect Machine Co., Galt, Ont.
Rae Mach. Tool Co., Ramilton.
Smalley-General Co., Inc., Bay City, Mich.
Standard Equipment & Tool Wks. Montreal, P.Q.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Sidney Tool Co., Sidney, Ohio.
U. S. Ordnance, Toronto, Ont.
Wabcott Lathe Co., Jackson, Mich.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.
A. R. Williams Machy. Co., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.
Worcester Lathe Co., Worcester, Mass.

LATHES, FOOT POWER
Seneca Falls Mfg. Co., Seneca Falls, N.Y.

LATHES, HORIZONTAL
Intern'l. Mchy. Supplies Ltd., Montreal.
Wood Turret Machine Co., Brazil, Ind.

LATHES, JOURNAL TRUEING
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.

LATHE MANDRELS, HARDENED AND GROUND
Elliott & Whitehall, Galt, Ont.

LATHES, PATTERNMAKERS'
J. G. Blount Co., Everett, Mass.
Can. Machinery Corp., Galt.
Wood Turret Machine Co., Brazil, Ind.
G. F. Foss Mchy. & S'ply Co., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.

LATHES, POLISHING
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

LATHES, SCREW CUTTING
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas, Ont.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Cleco Machine Tool Co., Cincinnati, O.
Foss Mchy. & S'ply Co., G. F., Montreal.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Toronto, Ont.
Hardinge Bros., Inc., Chicago, Ill.
Hepburn Ltd., John T., Toronto, Ont.
Lehman Machine Co., St. Louis, Mo.
Niles-Bement-Pond Co., New York.
Rae Mach. Tool Co., Ramilton.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
U. S. Ordnance, Toronto, Ont.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.
Williams Machy. Co., A. R., Toronto.
Wood Turret Machine Co., Brazil, Ind.
Worcester Lathe Co., Worcester, Mass.

LATHES, SPINNING
Bliss Co., E. W., Brooklyn, N.Y.

LATHES, TOOL ROOM
Barber Mchy. Co., Ltd., Toronto, Ont.
Cleco Machine & Tool Co., Cincinnati, O.
Canada Machinery Corporation, Galt, Ont.
Knight Metal Products, Toronto.
Lehman Machine Co., St. Louis, Mo.
Rae Mach. Tool Co., Ramilton.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Worcester Lathe Co., Worcester, Mass.

LATHES, QUICK CHANGE
Lehman Machine Co., St. Louis, Mo.

LATHE SAWS
Atkins & Co., E. C., Hamilton, Ont.

LATHES, TURRET
Hardinge Bros., Chicago, Ill.
Acme Machine Tool Co., Cincinnati, Ohio

LEAD, PIG AND BAR
British Smelting & Refining Co., Ltd., Montreal, Que.

LEAD BURNING
St. Lawrence Welding Co., Montreal.

LEAD BURNING OUTFITS
Turner Brass Works, Sycamore, Ill.

LEATHER STRAPPING
Graton & Knight Mfg. Co., Worcester, M.

LENSES FOR GOGGLES
Standard Optical Co., Geneva, N.Y.

LETTERS AND FIGURES, METAL
Hagaman & Pettis Mfg. Co., New Haven, Conn.

LEVELS
Hughes, Owens Co., Ltd., Montreal, Que.

LIDS, SCREW TOP AND HINGE
Can. Winkley Co., Ltd., Windsor, Ont.

LINK BELTING
See Belting, Chain.

LIFT TRUCKS
Can. Kron Scale Co., Montreal.

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LOCKERS, STEEL WARDROBE AND STEEL MATERIAL
Canada Wire & Iron Gds. Co., Hamilton.
Dennis Wire & Iron Works, London, Ont.

LUBRICANTS
Cataract Refining & Mfg. Co., Toronto.
Swan & Finch, Inc., New York.

LUBRICANTS, CUTTING AND GRINDING, DRAWING, STAMPING
Oakley Chemical Co., New York, N.Y.

LUBRICATING, OIL FILTERING AND CIRCULATING SYSTEMS
Bowser Co., Ltd., S. F., Toronto, Ont.

LUBRICATORS
Trabern Pump Co., Rockford, Ill.

LUMBERMEN'S TOOLS
Thos. Pink Co., Ltd., Pembroke, Ont.

MACHINE COUNTER WEIGHTS
Katie Foundry, Galt, Ont.

MACHINE TOOLS
Barber Mach. Co., F. F., Toronto, Ont.
Knight Metal Products, Toronto.
Rae Mach. Tool Co., Ramilton.

MACHINERY, CORNER AND BENDING
Peck, Stow & Wilcox, Southington, Conn.

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ause they not only do poor work,
ut waste valuable time—which
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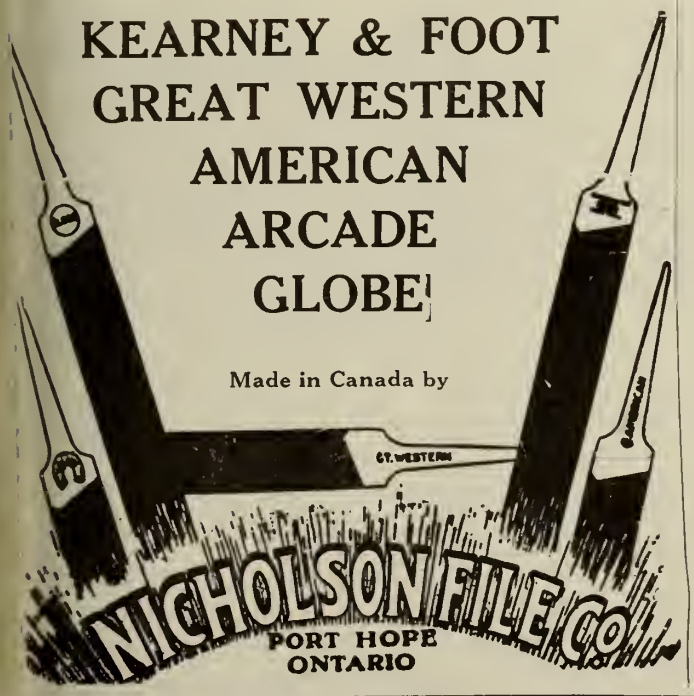
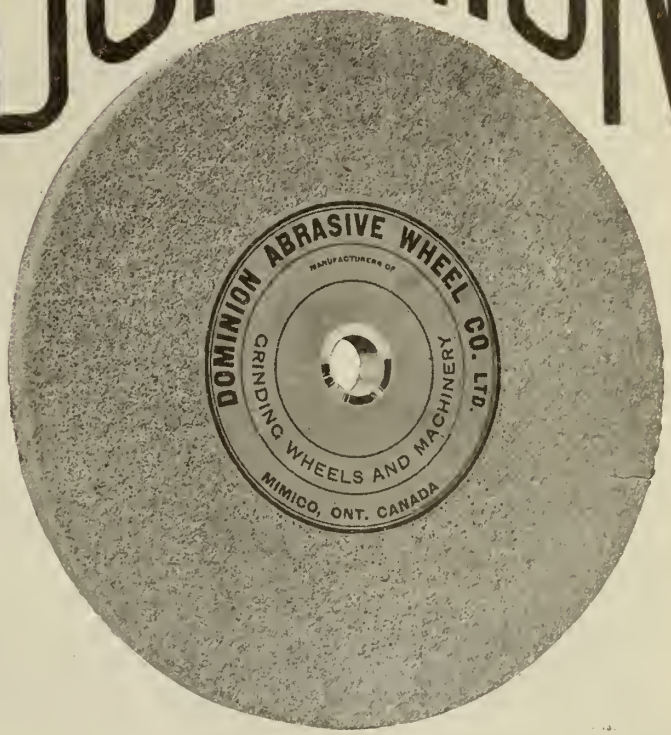


DOMINION



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A Western Canada dealer who makes a specialty of supplying abrasive wheels to the blacksmith trade was asked to handle Dominion Wheels. He replied: "Our experience with Canadian wheels has been unsatisfactory." When it was explained that Dominion Wheels are now made under a new arrangement whereby it is possible to maintain a high standard of QUALITY, he agreed to take a dozen Dominion Wheels on trial. What were the results?—This dealer (name on request) NOW ORDERS DOMINION WHEELS IN HUNDRED LOTS.

Give Dominion Wheels a trial and be convinced that their QUALITY is equal to the best imported makes.

DOMINION ABRASIVE WHEEL CO., Ltd.
MIMICO, ONTARIO

Made in Canada in Every Particular

Equal in Quality to Best Imported Wheels

If interested tear out this page and place with letters to be answered

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Archibald & Co., Chas. P., Montreal.
Barber Mchy. Co., Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Elliott & Whitehall, Galt, Ont.
Williams Machy. Co., A. R., Toronto.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.

MACHINERY GUARDS (See Guards)

MACHINERY SUPPLIES
Crescent Machine Co., Ltd., Montreal.
Globe Engineering Wks., Hamilton, Ont.
Knight Metal Products, Toronto.

MACHINERY, SPECIAL
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Crescent Machinery Co., Ltd., Montreal, Que.
Globe Engineering Co., Ltd., Hamilton
Hoggson & Pettis Mfg. Co., New Haven, Conn.

MACHINISTS' TOOLS
Atkins & Co., E. C., Hamilton, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.

MAGNETIC BRAKES FOR ELECTRIC MOTORS
Volta Mfg. Co., Welland, Ont.

MANDRELS
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.

MARKING DEVICES
Pritchard-Andrews Co. of Can., Ottawa.
Matthews & Co., Jas. H., Pittsburgh, Pa.

MARKING MACHINERY
Brown, Boggs Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal
Perrin, Wm. R., Toronto.
Petrie, Ltd., H. W., Toronto.

MASKS, WELDING, SMOKE, FUME, GAS, ETC.
Strong, Kennard & Nutt Co., Cleveland

MATERIALS, HANDLING PLANTS
Canadian Mead-Morrison Co., Limited, Montreal, Que.

MATS, RUBBER MATTING
Quaker City Rubber Co., Philadelphia, Pa
International Mchy. Sply., Ltd., Montreal

MEASURING MACHINES
Pratt & Whitney Co., Dundas, Ont.

MEASURES, REGISTERING
Bowser Co., Ltd., S. F., Toronto, Ont.

MEASURING TAPES AND RULES
Chesterman & Co., Jas., Sheffield, Eng.

MERCHANTS, IRON AND STEEL
Samuel Osborne (Can.), Ltd., Montreal.

METALLURGISTS
See Chemists.

METAL CLEANERS
Oakley Chemical Co., New York, N.Y.

METAL CUTTING MACHINES
Atkins & Co., E. C., Hamilton, Ont.
Lyman Tube & Supply Co., Montreal, Que.

METAL SAWS
See Saws.

METAL, ANTI-FRICTION
Thos. Moore & Son, Montreal.

METAL SAWS, POWER
E. C. Atkins & Co., Inc., Indianopils.
Hoefer Mfg. Co., Freeport, Ill.
Lyman Tube & Supply Co., Montreal, Que.

METALS
British Smelting & Refining Co., Ltd., Montreal, Que.
Brown's Copper & Brass Rolling Mills, New Toronto, Ont.
Canada Metal Co., Toronto, Ont.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal

METAL, STAMPINGS, SMALL
Can. Winkley Co., Ltd., Windsor, Ont.

METERS, OIL, GASOLINE, KEROSENE, ETC.
Bowser Co., Ltd., S. F., Toronto, Ont.
General Combustion Co., Ltd., Montreal, Que.

MICROMETERS
Almond Mfg. Co., Ashburnham, Mass.
Taylor, J. A. M., 318 Stair Bldg., Toronto.
Petrie, Ltd., H. W., Toronto.

MILLS, BRACE AND TUBE
Elec. Steel & Metals, Welland, Ont.

MILL SPECIALTIES
Atkins & Co., E. C., Hamilton, Ont.

MILLS, SAND
Frost Mfg. Co., Chicago, Ill.

MILL MACHINERY
Alexander Fleck, Ltd., Ottawa.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

MILLING ARBORS
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Kearney & Trecker Co., Milwaukee Wis.

MILLING ATTACHMENTS
Barber Mchy. Co., Ltd., Toronto, Ont.
Becker Milling Machine Co., Boston, Mass.
Bertram & Sons Co., John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence.
Canada Machinery Corp., Galt, Ont.
Cincinnati Milling Machine Co., Cincinnati
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal
Hardinge Bros., Inc., Chicago, Ill.
Hendey Mach. Co., Torrington, Conn.
Hinckley Machine Works, Hinckley, Wis.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

MILLING MACHINES, AUTOMATIC
Bilton Mach. Tool Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Betts Machine Co., Rochester, N.Y.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.

MILLING CUTTERS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Milling Machine Co., Cleveland.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Marshall, Son & Bunney, Toronto.
Petrie, Ltd., H. W., Toronto.
Wilt Twist Drill Co., Walkerville, Ont.

MILLING MACHINES, HAND
Bristol Machine Tool Co., Bristol, Conn.

MILLING MACHINES, THREAD
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Inc., Chicago, Ill.
Gray Ball Bearing Co., Ltd., Toronto.
United States Mach. Tool Co., Cincinnati.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Smalley Gen. Co., Inc., Bay City, U.S.A.
Standard Equipment & Tool Wks., Montreal, P.Q.

MILLING MACHINES, HORIZONTAL AND VERTICAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Becker Milling Machine Co., Boston, Mass
Bristol Machine Tool Co., Bristol, Conn.
Brown & Sharpe Mfg. Co., Providence.
Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
Gooley & Edlund, Cortland, N.Y.
Hardinge Bros., Inc., Chicago, Ill.
Kearney & Trecker Co., Milwaukee, Wis.
Knight Metal Products, Toronto.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Rockford Milling Mach. Co., Rockford, Ill
United States Mach. Tool Co., Cincinnati.
U. S. Ordnance, Toronto, Ont.
Whitney Mfg. Co., Hartford, Conn.
Williams Machy. Co., A. R., Toronto.

MILLING MACHINES, PLAIN, BENCH AND UNIVERSAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Becker Milling Machine Co, Boston, Mass.
Bilton Mach. Tool Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence.
Canada Machinery Corp., Galt, Ont.
Cleveland Milling Machine Co., Cleveland.
Cincinnati Milling Machine Co., Cincinnati
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
National Machy. Co., Tiffin, Ohio.
Gooley & Edlund, Inc., Cortland, N.Y.
Hardinge Bros., Inc., Chicago, Ill.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Knight Metal Products, Toronto.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.
U.S. Ordnance, Toronto, Ont.

MILLING MACHINES, PROFILE
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

MILLING TOOLS
Aikenhead Hardware Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence.
Ford-Smith Mach. Co., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

MINE CARS
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dominion Bridge Co., Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.

MINING MACHINERY
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Elec. Steel & Metals, Welland, Ont.
Petrie, Ltd. H. W., Toronto.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., A. R., Toronto, Ont

MIXERS, SAND
Frost Mfg. Co., Chicago, Ill.

MORTISING MACHINES
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
Gray Ball Bearing Co., Ltd., Toronto.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
MacGovern & Co., Montreal, Que.
Northern Elec. Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
U. S. Ordnance, Toronto, Ont.
Volta Mfg. Co., Welland, Ont.
Williams Mach'y Co., A. R., Toronto.

MOTOR SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

MOTORCYCLE FRAME AND FORK
The Dunbar Brothers Co., Bristol, Conn.

MOTORS, PNEUMATIC
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto.

MOULDS, RUBBER
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Hoggson & Pettis Mfg. Co., New Haven, Conn.

MULTIPLE INDEX CENTRES
Garvin Machine Co., New York.
Graton & Knight Mfg. Co., Worcester, M.

MULTI-DRILLING, MULTI-BORING, MULTI-TAPPING MACHINERY.
Nat. Automatic Tool Co., Richmond, Ind.

MUNICIPALITIES
City of St. John, Quebec.

NAIL SETS
Morrow Screw & Nut Co., J., Ingersoll, Ont

NAME PLATES, BRONZE, ETCHED AND STAMPED
Matthews & Co., Jas. H., Pittsburgh, Pa.
Turner Brass Works, Sycamore, Ill.

NICHROME CASTINGS
Can. Driver-Harris Co., Ltd., Walkerville.

NICKEL
Baker & Co., Inc., H., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.

NICKEL STEEL
See Steel.

NICKEL SILVER—SHEETS, ROLLS, PLATES and RODS
Brown's Copper and Brass Rolling Mills, New Toronto.

NIPPLE THREADING MACHINES
Hall & Sons, Ltd., John H., Brantford.
Landis Machine Co., Waynesboro, Pa.

NITROGEN
Carter Welding Co., Toronto, Ont.

NUTS, STEEL, CASTELLATED AND COLD PRESSED
Galt Machine Screw Co., Ltd., Galt, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Williams & Co., J. H., Brooklyn, N.Y.

NUTS, SEMI-FINISH AND FINISHED
Galt Machine Screw Co., Galt, Ont.
National-Acme Co., Cleveland, Ohio.
Wilkinson & Kompass, Hamilton.

NUT LOCKS
Edw. W. Robinson Co., Ltd., Montreal.

NUT BURRING AND NUT MACHINES (HOT)
National Machy. Co., Tiffin, Ohio.

NUT FACING AND BOLT SHAVING MACHINES
Garvin Machine Co., New York.
National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
Victor Tool Co., Waynesboro, Pa.

NUT TAPPERS
Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
Hall & Son, J. H., Brantford, Ont.
Jardine & Co., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.

OILERS
All-Way Oiler Mfg. Co., Toronto, Ont.

OIL SEPARATORS
Can. Fairbanks-Morse Co., Montreal.
St Lawrence Welding Co. Ltd., Montreal

OIL STONES
Aikenhead Hardware Co., Toronto, Ont.
Carborundum Co., Niagara Falls, N.Y.
Norton Co., Worcester, Mass.
Rice Lewis & Son, Toronto, Ont.

OIL STONE GRINDERS
Oliver Machy. Co., Grand Rapids, Mich.

OIL STORAGE SYSTEMS
Bowser Co., Ltd., S. F., Toronto, Ont.
St. Lawrence Welding Co., Ltd., Montreal.

OPENING DIE HEADS
Greenfield Tap & Die Corp, Greenfield.
Wells Bros. of Canada, Galt, Ont.

OPTICAL SUPPLIES
Consolidated Optical Co., Toronto, Ont.

ORE HANDLING EQUIPMENT
Brown Hoisting Machinery Co., Cleveland, Ohio.
Canadian Mead-Morrison Co., Limited, Montreal, Que.

OSCILLATING VALVE GRINDERS (PNEUMATIC)
Cleveland Pneumatic Tool Co. of Canada, Toronto

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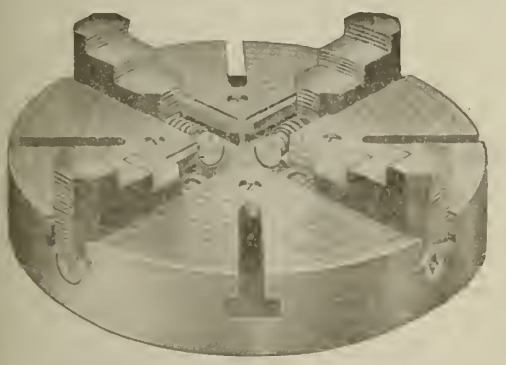

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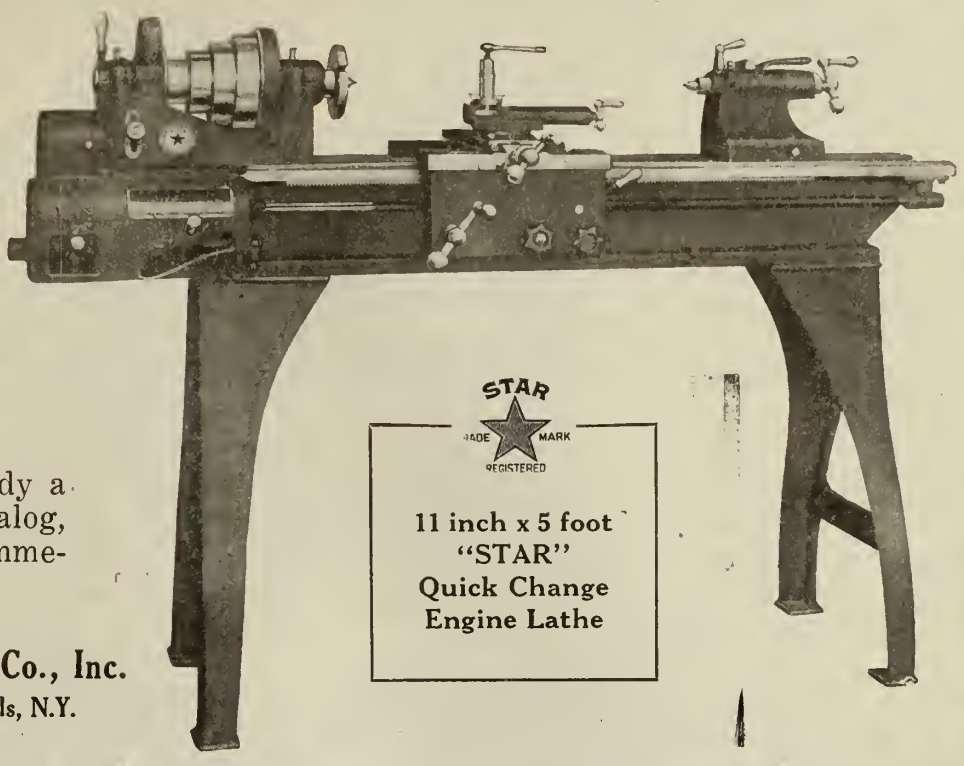

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366 W. Falls St., Seneca Falls, N.Y.

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TEETH cut on the nut giving DIRECT DRIVE and the hardened steel Pinion Bushings which prevent wear, insure long life.

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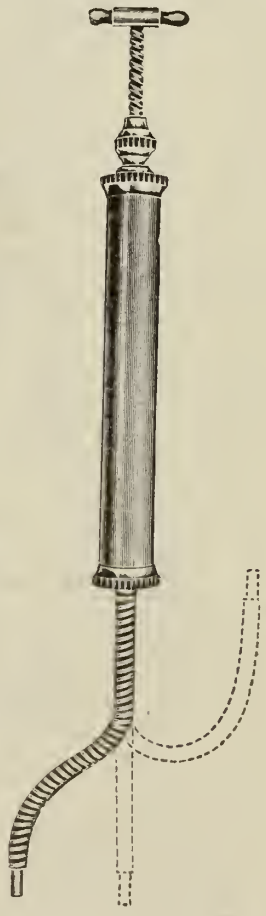
ALL-WAY Flexible Spout Grease and Oil Guns

Make it easy to refill the most out-of-the-way gear cases or transmission as the flexible spout can be bent to any desired angle. The Cleaning Device of the end of the **ALL-WAY"** spout reduces cleaning time and oil wastage to a minimum.

The **"ALL-WAY"** gun is especially useful and handy in filling lineshaft hanger reservoirs.

If your dealer cannot supply you, write us.

We also manufacture the well-known "ALL-WAY" Oil Can. Saves you 50% of your oil bill.



The All-Way Oiler Mfg. Co.
196 KING STREET WEST
TORONTO, ONT.

If interested tear out this page and place with letters to be answered

ROLLER CHAINS
Can. Link-Belt Co., Toronto.
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que

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Brown, Boggs Co., Ltd., Hamilton.
Can. Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto
Niles-Bement-Pond Co., New York.
Petrie Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo, O.

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Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

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ROOF COOLERS
Electric Steels & Metals, Ltd., Welland

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Mesta Machine Co., Pittsburgh, Pa.

ROLL LATHES
Mesta Machine Co., Pittsburgh, Pa.

ROLLS, BENDING, STRAIGHTENING
Manhattan Machine & Tool Co., Grand Rapids, Mich.

ROLLS, CRUSHING
Can. Link-Belt Co. Toronto.

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Hoggson & Pettis Mfg. Co., New Haven, Conn.

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Elliott & Whitehall, Galt, Ont.

RUBBER MILL DRIVES
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Dom. Steel Products Co., Ltd., Brantford
Can. Link-Belt Co., Toronto.

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Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

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Dominion Abrasive Co., Mimico, Ont.

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James Chesterman & Co., Ltd., Sheffield
Rice, Lewis & Son, Toronto.
L. S. Starrett Co., Athol, Mass.

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RULES, BOXWOOD, FOLDING
Lufkin Rule Co. of Can., Windsor.

RULES, BOARD AND LONG
Lufkin Rule Co. of Can., Windsor.

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Petrie, Ltd., H. W., Toronto.

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Frost Mfg. Co., Chicago, Ill.

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SAND BLAST SUPPLIES AND ACCESSORIES
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Lawrence Welding Co. Ltd., Montreal

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SAFETY APPLIANCE GOGGLES
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Frost Mfg. Co., Chicago, Ill.

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Hunter Saw & Machine Co., Pittsburgh.
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Plewes Ltd., Winnipeg, Man.
Simonds Mfg. Co., Fitchburgh, Mass.
Tabor Mfg. Co., Philadelphia, Pa.

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SAW GUARDS
Atkins & Co., E. C., Hamilton, Ont.

SAWS, METAL, HACK AND BAND
Atkins & Co., E. C., Hamilton, Ont.

SAWS, SILVER STEEL
E. C. Atkins & Co., Inc., Indianapolis

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Greenfield Tap & Die Corp., Greenfield.
Hunter Saw & Machine Co., Pittsburgh.
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Atkins & Co., E. C., Hamilton, Ont.
Elliott & Whitehall Machine and Tool Co., Galt, Ont.

SAWS — HIGH-SPEED FRICTION
Atkins & Co., E. C., Hamilton, Ont.

SAWS — PATTERN SHOP
Atkins & Co., E. C., Hamilton, Ont.

SAWS — SWING
Atkins & Co., E. C., Hamilton, Ont.

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Can. Kron Scale Co., Montreal, P.Q.
U. S. Ordnance, Toronto, Ont.

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Lufkin Rule Co. of Can., Windsor.

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Shore Instrument & Mfg. Co., New York.
U. S. Ordnance, Toronto, Ont.

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SCREW EXTRACTORS
Cleveland Twist Drill Co., Cleveland.

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Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Ltd., Toronto
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield.
A. B. Jardine & Co., Hespeler.
National Acme Co. Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
U. S. Ordnance, Toronto, Ont.
Warner & Swasey Co., Cleveland, O.
Wells Bros. of Can., Galt, Ont.
Wood Turret Mach. Co., Brazil, Ind.

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John Morrow Screw & Nut Co., Ingersoll.
National Acme Co., Montreal.
Rice Lewis & Son, Toronto.
Steel Co. of Canada, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.

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John Morrow Screw & Nut Co., Ingersoll.

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Brown & Sharpe Mfg. Co., Providence, R.I.

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Morse Twist Drill & Mach. Co., New Bedford, Mass.
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Wells Bros. of Can., Galt.
Wilkinson & Kompass, Hamilton.

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Garvin Machine Co., New York.
National Acme Co., Cleveland, O.
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Bristol Co., Waterbury, Conn.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wilkinson & Kompass, Hamilton.

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Jacobs Mfg. Co., Hartford, Conn.

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Geo. F. Fowe Mchy. & Sply. Co., Montreal
Robt. Gardner & Son, Montreal.
Garlock-Walker Mach'y. Co., Toronto.
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Rae Mach. Tool Co., Hamilton.
Standard Equipment & Tool Wks., Montreal.
U. S. Ordnance, Toronto, Ont.
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Knigh Metal Products, Toronto.

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Jones & Glasco, Montreal.
Niles-Bement-Pond Co., New York.
Can. Drawn Steel Co., Hamilton.
Peckovers, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas.
Rice, Lewis & Son, Toronto.
A. R. Williams Machy. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

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Rice, Lewis & Son, Toronto.

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Bertrams Ltd., Edinburgh, Scotland.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
A. B. Jardine & Co., Hespeler, Ont.
Long & Allstatter Co., Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo, O.

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Brown, Boggs Co, Ltd., Hamilton.
Can Blower & Forge Co, Kitchener.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Long & Allstatler, Hamilton, Ohio.
A. B. Jardine & Co., Hespeler, Ont.
National Machy. Co, Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
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Williams, White & Co., Moline, Ill.
Williams Mchy Co., A. R., Toronto, Ont.

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SHEARS, PNEUMATIC
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Peck, Stow & Wilcox Co., Southington, C.
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D. H. Stoll Co., Inc., Buffalo, N.Y.

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Kayser-Ellison & Co., Ltd., Montreal.

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SHEETS, NICKEL, RESIST. ALLOY
Can. Driver-Harris Co., Ltd., Walkerville.

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Dennis Wire & Iron Works, London.

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J. H. Williams & Co., Brooklyn, N.Y.

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Jones & Glassco, Montreal.

SLEDGES
Aikenhead Hardware Co., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont

SLEDGES, CAST IRON
Katie Foundry, Galt, Ont.

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Peck, Stow & Wilcox Co., Southington, Conn.

SLINGS, CHAINS
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

SLOTTERS
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
National-Acme Co., Cleveland, Ohio.
Niles-Bement-Pond Co., New York.

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Keystone Mfg. Co., Buffalo, N.Y.
Modern Tool Co., Erie, Pa.
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Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

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Katie Foundry, Galt, Ont.

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Brown, Boggs & Co., Hamilton, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.

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Aikenhead Hardware Co., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Tallman Brass & Metal Co., Hamilton.

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Jones & Glassco, Montreal.

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Can. Steel Foundries, Ltd., Montreal.
Cleveland Wire Spring Co., Cleveland.
Dunbar Bros. Co., Bristol, Conn.
Garlock-Walker Machinery Co., Toronto.

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Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram, John, & Sons Co., Dundas.
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada.
Brown Engineering Corp., Toronto, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
Globe Engineering Co., Ltd., Hamilton.
Gooley & Edlund, Inc., Courtland, N.Y.
John H. Hall & Sons, Brantford.
A. B. Jardine & Co., Hespeler, Ont.
Katie Foundry, Galt, Ont.
Ker & Goodwin Machine Co., Ltd., Brantford, Ont.
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Mesta Machine Co., Pittsburgh, Pa.
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Morse Chain Co., Ithaca, New York.

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Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que
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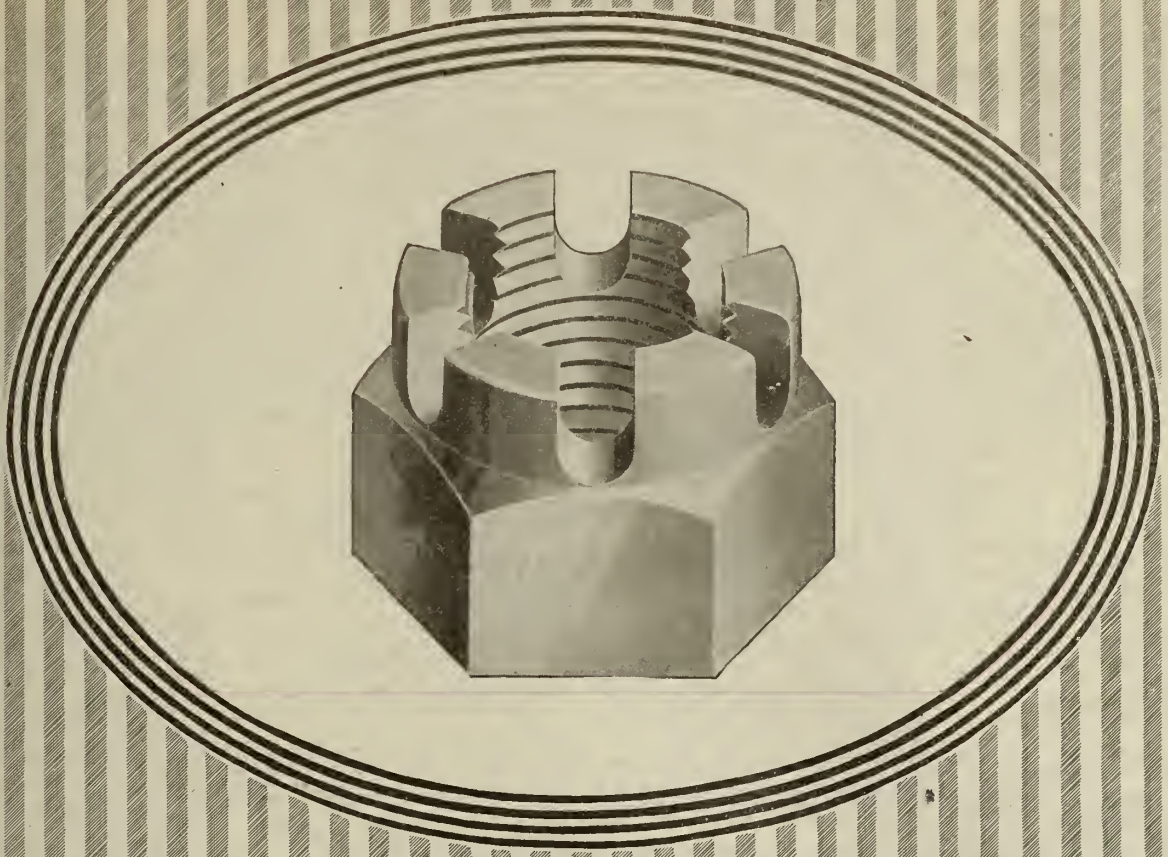
Can. Link Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Ltd., Montreal

SQUARES
Peck, Stow & Wilcox Co., Southington, Conn.



NAMCO Plain Semi-Finished Castellated NUTS

S.A.E., V., & U.S.S. Standard

SCREWS

V., U.S.S., & S.A.E. Cap Screws
V. & U.S.S., Set Screws

Special Screw Machine Product up to 2¼" diam.

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Montreal, P.Q.

De Courcelles G.T.R.R.

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SANDERS
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SAW BENCHES
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SAW GUARDS
Oliver Mach. Co., Grand Rapids, Mich.

SAWS SWING
Oliver Mach. Co., Grand Rapids, Mich.

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Wells Bros. of Can., Galt, Ont.

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Globe Engineering Co., Hamilton, Ont.
Homer & Wilson, Hamilton, Ont.

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Brown, Boggs, & Co., Hamilton, Can.
Canada Machinery Corp., Galt, Ont.

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STAMPS, STEEL ALPHABET, FIGURES
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Matthews, Jas. H & Co., Hartford, Conn.

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Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.

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Atkins & Co., Ltd., Wm., Sheffield, Eng.
Baines & David, Toronto.
Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Latrobe Electric Steel Co., Latrobe, Pa.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
Marshall, Son & Bunney, Toronto.
Peckovers, Ltd., Toronto, Ont.
Samuel Osborne (Can.), Ltd., Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.

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Norton, Ralph B., Agent, Montreal.
Atkins & Co., Ltd., Wm. Sheffield, Eng.
Marshall, Son & Bunney, Toronto.

STEEL CHROME NICKEL
Kayser-Ellison & Co., Ltd., Montreal.
Lyman Tube & Supply Co., Ltd., Montreal
Norton, Ralph B., Agent, Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.

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Davidson Mfg. Co., Ltd., Montreal, Que.
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Dom. Iron & Steel, Sydney, N.S.
Joliette Steel Co., Montreal, Que.
Kennedy & Sons, Wm., Owen Sound.
Electric Steel & Metals Co., Welland.
Nova Scotia Steel & Coal Co., Windsor.
Swedish Crucible Steel Co., Windsor.

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Can. Drawn Steel Co., Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co. Ltd., Montreal.
Union Drawn Steel Co., Hamilton, Ont.

STEEL FJAB
Lincoln Electric Co., of Canada, Ltd., Toronto, Ont.

STEEL, NICKEL
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Peckovers, Ltd., Toronto, Ont.

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Armstrong-Whitworth of Can., Montreal
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Wm. Atkins & Co., Sheffield, Eng.
Baker & Co., Inc., H., Montreal, Que.
Can. Fairbanks-Morse Co., Montreal
Deloro Smelting & Refining Co., Ltd. Toronto, Ont.
H. A. Drury Co., Ltd., Montreal.
Firth & Sons, Thos., Montreal, Que.
Hawbridge Bros. Co., Boston, Mass.
Illingworth Steel Co., J., New York.
Kayser Ellison & Co., Sheffield, Eng.
Latrobe Electric Steel Co., Latrobe, Pa.
Marshall, Son & Bunney, Toronto, Ont.
Osborne, Samuel, Montreal, P.Q.
Plewes, Ltd, Winnipeg, Man.
Pilot Steel & Tool Co., Montreal, Que.
Ralph B. Norton, Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co., Ltd., Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL, CHROME, MANGANESE
Joliette Steel Co., Montreal, Que.

STEEL, OPEN HEARTH
Illingworth Steel Co., John, New York.

STEEL PLATES
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Kayser-Ellison & Co., Ltd., Montreal.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.

STEEL, SPRING AND REINFORCING
Peckovers, Ltd., Toronto, Ont.

STEEL, STRUCTURAL
Algoma Steel Corp., Sault Ste. Marie
Dom. Iron & Steel Co., Sydney, N.S.
MacKinnon Steel Co., Sherbrooke, Que.
Peckovers, Ltd., Toronto, Ont.

STEEL, TOOL
Armstrong, Whitworth of Can., Montreal
Atkins & Co., Wm. Sheffield, Eng.
Baines & David, Toronto.
Can. Fairbanks-Morse Co., Montreal.
Drury Co., H. A., Montreal, Que.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.
Firth & Sons, Thos., Montreal, Que.
Hawbridge Bros. Co., Boston, Mass.
Kayser-Ellison & Co., Ltd., Montreal.
Lincoln Electric Co., of Canada, Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Ltd., Montreal
Marshall, Son & Bunney, Toronto, Ont.
Latrobe Electric Steel Co., Latrobe, Pa.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son Toronto, Ont.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL, VANADIUM
Wm. Atkins & Co., Ltd., Sheffield, Eng.
Armstrong, Whitworth of Can., Montreal.
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Drury, H. A., Co., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.
Wells Bros. of Can., Galt, Ont.

STEEL WELDING
Peckovers, Ltd., Toronto, Ont.

"STELLITE"
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.

STENCILS
Hoggson & Pettis Mfg. Co., New Haven, Conn.

STOCK RACKS FOR BARS, PIPING, ETC.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

STOCKS AND DIES
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros., of Can., Galt, Ont.

STOCKS, PIPE
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Wells Bros., Co., of Canada, Galt, Ont.

STONES, COMMUTATORS
Lyman Tube & Supply Co., Ltd., Montreal

STRAIGHTENING MACHINERY
Baird Machinery Co., Bridgeport, Conn.
Bertrams, Ltd., Edinburgh, Scotland.

STRAND
Dom. Steel Products Co., Ltd., Brantford.
Page Steel & Wire Co., Adrian, Mich.

STRIP STEEL
Peckovers, Ltd., Toronto, Ont.

SURFACE PLATES
Brown & Sharpe Mfg. Co., Providence, R.I.

STRUCTURAL STEEL WORKS
William Hamilton Co., Peterboro, Ont.

SUPPLIES, RUBBER MFRS.
Hoggson & Pettis Mfg. Co., New Haven, Conn.

SWITCHBOARDS
Northern Electric Co., Ltd., Montreal Que

SWITCHES, RAILWAY
Can. Steel Foundries, Ltd., Montreal.

TABLES, DRAWING
Economy Drawing Table Co., Adrian, Mich.

TABLES, SAND-BLAST
Panghorn Corporation, Hagerstown, Md.

TAPPING MACHINES (PNEUMATIC)
Cleveland Pneumatic Tool Co., Toronto.

TANKS, AIR, EXPANSION
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, GASOLINE, KEROSENE AND OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. John Wood Mfg. Co., Ltd., Toronto
Dominion Bridge Co., Montreal, Que.
Dom. Forge & Stamping Co., Walkerville.
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
U. S. Ordnance, Toronto, Ont.

TANKS, LEAD LINED
Can. Hanson Van Winkle Co., Ltd.,

TANKS, LUBRICATING, OIL STORAGE
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, PNEUMATIC AND CLOSET
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, RUBBER CEMENT
Bowser Co., Ltd., S. F., Toronto, Ont.
St Lawrence Welding Co, Ltd., Montreal

TANKS, STEEL, WATER PRESSURE
Bowser Co., Ltd., S. F., Toronto, Ont.
Dominion Bridge Co., Montreal, Quebec.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal, Que.
Toronto Iron Works, Ltd, Toronto.

TANK WAGONS
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal.
Toronto Iron Works, Ltd., Toronto.

TANKS, WELDED
Can. John Wood Mfg. Co., Ltd., Toronto
Can. Hanson Van Winkle Co., Ltd., Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.

TANKS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
William Hamilton Co., Peterboro, Ont.

TAPER PINS
Galt Machine Screw Co., Ltd., Galt, Ont.

TAPES, MEASURING
James Chesterman & Co., Ltd., Sheffield, Eng.
Rice Lewis & Son, Toronto, Ont.

TAPPING MACHINES AND ATTACHMENTS
Bertram, John & Sons Co., Dundas.
Canada Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garvin Machine Co., New York.
The Geometric Tool Co., New Haven.
J. H. Hall & Sons, Brantford, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchy Machine & Tool Co., Detroit.
Niles-Bement-Pond Co., New York.
Rickerd-Shafer Co., Erie, Pa.
National-Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto.
L. S. Starrett Co., Athol, Mass.
Whitney Mfg. Co., Hartford, Conn.

TAPES, MEASURING, STEEL AND WOVEN
Lufkin Rule Co. of Can., Windsor, Ont.

TAPES, POCKET
Lufkin Rule Co. of Can., Windsor, Ont.

TAPS, ADJUSTABLE
Butterfield & Co., Rock Island, Que.
Geometric Tool Co., New Haven.
Ingersoll Mach. Co., Ingersoll, Ont.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Pilot Steel & Tool Co., Montreal, Que.
Victor Tool Co., Waynesboro, Po.

TAPS, GUN, HAND, BOILER
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, MACHINE RELIEVED
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, MACHINE SCREW
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, PIPE
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Mach. Co., Ingersoll, Ont.
Marshall, Son & Bunney, Toronto.
Wells Bros. of Can., Galt, Ont.

TAPS, SPECIAL
Elliott & Whitehall, Galt, Ont.

TAPS, STAYBOLT, TAPPER
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

TAPS, DIES AND WRENCHES
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Foss Mchy. & Sply. Co., G. F., Montreal,
Geometric Tool Co., New Haven.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Mach. Co., Ingersoll, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Morse Twist Drill & Mchy. Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Rice Lewis & Son, Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Taylor, J. A. M., 318 Stair Bldg., Toronto.
U. S. Ordnance, Toronto, Ont.
Wells Bros. of Canada, Galt, Ont.

TAP EXTRACTORS
Walton Co., The, Hartford, Conn.

TENSILE MACHINES, STORAGE
U. S. Ordnance, Toronto, Ont.

THERMOMETERS, INDUSTRIAL ENGRAVED TEMPERATURE AND PRESSURE
Taylor Instrument Co., Rochester, N.Y.

THERMOMETERS, RECORDING AND INDEX
Bristol Co., Waterbury, Conn., U.S.A.
Taylor Instrument Co., Rochester, N.Y.
U. S. Ordnance, Toronto, Ont.

TESTING INSTRUMENTS, METALLURGICAL
Shore Instrument & Mfg. Co., New York.

TENOVERS
Oliver Machy. Co., Grand Rapids, Mich.

TESTING LABORATORIES
Toronto Testing Laboratory, Toronto.

THREAD-CUTTING MACHINES
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Mach. Co., Ltd., Toronto
Geometric Tool Co., New Haven.
Jardine & Co., Ltd., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National-Acme Co., Cleveland, Ohio.
National Machy. Co., Tiffin, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt, Ont.

THREAD GAUGES
Wilton Mfg. Co., Boston, Mass.

THREADING TOOLS
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Greenfield
Landis Machine Co., Waynesboro, Pa.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. of Canada, Galt, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

THREADING MACHINES FOR BOLTS, NUTS AND PIPES
Greenfield Tap & Die Corp., Greenfield
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt, Ont.

THREAD MILLING MACHINES
Taft-Pierce Mfg. Co., New York, N.Y.
Gray Ball Bearing Co., Ltd., Toronto.
Smalley-General Co., Bay City, Mich.

THUMB SCREWS AND NUTS
See Screws.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.

TIGHTENERS, BELT
Hoggson & Pettis Mfg. Co., New Haven Conn.

TIN—PIG AND BAR
British Smelting & Refining Co., Ltd. Montreal, Que.

TINSMITHS' TOOLS
Brown, Boggs & Co., Hamilton, Can.
Petrie, Ltd., H. W., Toronto.

TIRE BENDERS
Jardine & Co., Ltd., A. B., Hespeler.

TIRE SETTING MACHINES, HYDRAULIC
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Perrin, Ltd., William R., Toronto.
West Tire Setter Co., Rochester, N.Y.

TOOL CASES
Rice Lewis & Son, Toronto, Ont.

TOOL HOLDERS
Aikenhead Hardware Co., Toronto, Ont.
Armstrong Bros. Tool Co., Chicago.
Cleveland Twist Drill Co., Cleveland.
Deloro Smelting & Refining Co., Ltd Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

TOOL MAKERS
Samuel Osborne (Can.), Ltd., Montreal

TOOL POSTS, LATHE
Armstrong Bros. Tool Co., Chicago.
Williams & Co., J. H., Brooklyn, N.Y.

TOOL ROOM PARTITIONS
Canada Wire & Iron Goods Co., Hamilton

TOOLS, BLACKSMITHS'
A. B. Jardine & Co., Ltd., Hespeler, Ont
Rice Lewis & Son Toronto, Ont.

TOOLS, ADJUSTABLE BORING
Kelly Reamer Co., Cleveland, O.
Petrie, Ltd., H. W., Toronto.

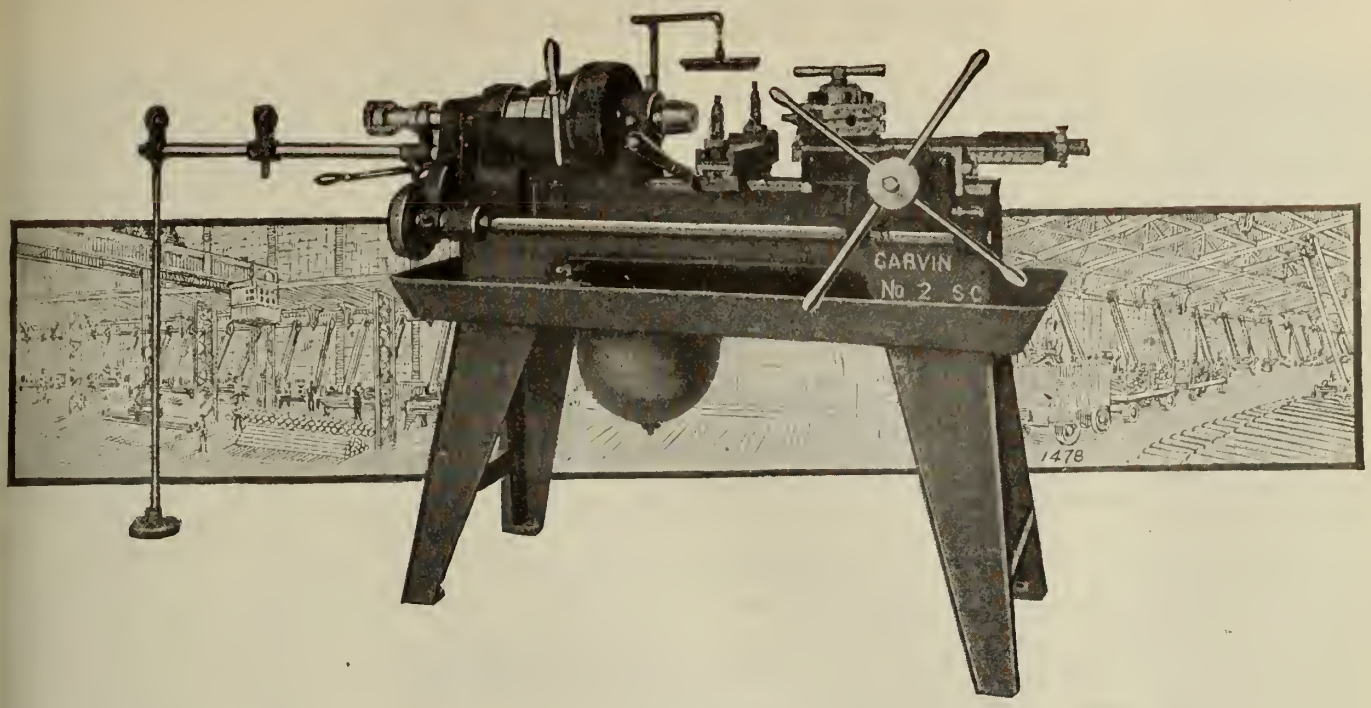
TOOLS, ELECTRIC
Independent Pneumatic Tool Co., Chicago
Williams Machy. Co., A. R., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.
U. S. Electrical Tool Co., Cincinnati, O.

TOOLS, FORMING
Davidson Tool Mfg. Co., New York, N.Y.
Deloro Smelting & Refining Co., Ltd Toronto, Ont.

TOOLS, LUMBERING
Thos. Pink & Co., Pembroke, Ont.

TOOLS, LATHE, PLANER, SLOTTER
Armstrong Bros. Tool Co., Chicago.
Gisholt Machine Co., Madison, Wis.
Williams & Co., J. H., Brooklyn, N.Y.

TOOLS, SCREW MACHINE
Foster Machine Tool Co., Elkhart, Ind.



A Garvin Screw Machine will be a valuable addition to your shop equipment

You can well afford to make rather than buy screw parts. The equipment is simple and the investment moderate.

The advanced design of the latest model Garvin Screw Machines combines advantageous features that place them in a class by themselves. Not only will they turn out screw parts at low cost when new, but are so sturdy that they maintain this unusual efficiency after other similar tools have needed rebuilding and elaborate repairs.

These Screw Machines are built in a full range of sizes, but all are alike in the high quality of their workmanship.

Garvin design has proven in actual service that screw machine turrets and slide cross need not be cumbersome to afford perfect rigidity. Slides are fitted with plug stops, capable of fine adjustment. Turrets rotate easily and are positively halted by a solid plug—no strain on the index lock bolt. Large diameter spindles permit the automatic feed to handle extra diameter stock. Turret has one clear through hole to pass long rods for one position.

Materials throughout could be no more carefully chosen. All wearing parts are of tool steel or drop forgings with heavy duty wearing surfaces hardened or ground.

Look at it any way you will, a Garvin Screw Machine is one of the best plant equipment investments you could make.

Screw Machines are but one of the Garvin products. All are described in the 340-page "Garvin Catalogue." Ask your dealer or address

The GARVIN MACHINE COMPANY, Spring & Varick Streets, New York, N.Y.

GARVIN

BUILDER OF BETTER MACHINE TOOLS

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If interested tear out this page and place with letters to be answered

TOOLS, SPECIAL
Crescent Machinery Co., Ltd., Montreal, Que.
Globe Engineering Co., Ltd., Hamilton.
Hoggson & Pettis Mfg. Co., New Haven, Conn.

TORCHES, BLOW
Int. Mach. & Supply Co., Ltd., Montreal.

TORCHES, STEEL
Armstrong, Whitworth of Can., Montreal.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

TORCHES, GASOLINE, KEROSENE AND ALCOHOL
Turner Brass Works, Sycamore, Ill.

TRACK SYSTEMS
Brown Hoisting Machinery Co., Cleveland, Ohio.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Brown Hoisting Machinery Co., Cleveland, Ohio.
Brown Hoisting Machinery Co., Cleveland, Ohio.

TRANSFORMERS
Can. General Electric Co., Toronto, Ont
MacGovern & Co., Montreal, Que.
Northern Electric Co., Ltd., Montreal.
U. S. Ordnance, Toronto, Ont.

TRANSITS
Hughes, Owens Co., Ltd., Montreal, Que.

TRANSMISSION CHAIN
Lyman Tube & Supply Co., Ltd., Montreal
Morris Chain Co., Ithaca, New York.

TRANSMISSION MACHINERY
American Pulley Co., Philadelphia, Pa.
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Coventry Chain Co., Coventry, England.
Hamilton Gear & Machine Co., Toronto.
Jones & Glassco, Montreal.
Kennedy & Sons, Wm., Owen Sound, Ont.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Machinery Co., A. R., Toronto.

TRANSMISSION ROPE
Jones & Glassco, Montreal, Que.
MacKinnon Steel Co., Ltd., Sherbrooke.

TRANSMISSION TOWERS
Curtis Pneumatic Machy. Co., St. Louis.
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Northern Crane Works, Walkerville.
Tallman Brass & Metal Co., Hamilton.

TROLLEYS
Brown Hoisting Machinery Co., Cleveland, Ohio.
Lyman Tube & Supply Co., Ltd., Montreal
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

TRUCKS, FACTORY, FREIGHT, ETC
Canada Machinery Corp., Galt, Ont.
Chapman Double Ball Bearing, Toronto.
Cowan Truck Co., Holyoke, Mass.
Holyoke Truck Co., Holyoke, Mass.
MacKinnon Steel Co., Sherbrooke, Que.
Rice Lewis & Son, Toronto, Ont.
U. S. Ordnance, Toronto, Ont.

TRUCKS, ELECTRIC
Cowan Truck Co., Holyoke, Mass.
Good Engineering Co., Toronto, Ont.

TRUCKS, FLOOR
Cowan Truck Co., Holyoke, Mass.
Holyoke Truck Co., Holyoke, Mass.
U. S. Ordnance, Toronto, Ont.

TRUCKS, HAND
Can. Kron Scale Co., Montreal, P.Q.
Cowan Truck Co., Holyoke, Mass.

TRUCKS, LUMBER AND KILN
Holyoke Truck Co., Holyoke, Mass.
Swedish Steel & Importing Co., Montreal
Northern Crane Works, Walkerville.

TRUCKS, LIFT, ELEVATING & TRANSFER
Cowan Truck Co., Holyoke, Mass.
Holyoke Truck Co., Holyoke, Mass.

TUBES, BOILER
Lyman Tube & Supply Co., Montreal, Que

TUBING, SEAMLESS, BRASS AND COPPER
Lyman Tube & Supply Co., Montreal, Que.
Standard Tube & Fence Co., Woodstock.
Tallman Brass & Metal Co., Hamilton.

TUBING COILERS, FLEXIBLE METAL
Almond Mfg. Co., Ashburnham, Mass.

TUBING, FLEXIBLE METALLIC
Lyman Tube & Supply Co., Montreal, Que.

TUBING, SEAMLESS STEEL
Lyman Tube & Supply Co., Montreal, Que.

TUBING, WELDED STEEL
Lyman Tube & Supply Co., Montreal, Que.

TURRET MACHINES, LATHES
Acme Mach. Tool Co., Cincinnati, Ohio.
Brown & Sharpe Mfg. Co., Providence.
Gardock-Walker Machinery Co., Toronto.
Greenfield Tap & Die Corp., Greenfield
Hardinge Bros., Chicago, Ill.
Oliver Machy. Co., Grand Rapids, Mich.
Pratt & Whitney, Hartford, Conn.
Petrie, Ltd., H. W., Toronto.
Steinle Turret Mach. Co., Madison, Wis.
Warner & Swasey Co., The, Cleveland, O

TURBO GENERATOR UNITS
MacGovern & Co., Montreal, Que.
Warner & Swasey, Cleveland, O.
Garvin Machine Co., New York.

TURNBUCKLES
Canada Fdrs. & Forg. Ltd., Welland.
Morrow Screw & Nut Co., Ingersoll, Ont.
Rice Lewis & Son, Toronto, Ont.

TURNTABLES
Can. Link-Belt Co., Toronto, Ont.
Dom. Bridge Co., Ltd., Montreal, P.Q
Elec. Steel & Metals, Welland, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

TWIST DRILLS
Butterfield & Co., Inc., Rock Island, Que.

UPSETTING AND BENDING MACHINERY
Bertram & Sons Co., John, Dundas.
Brown, Boggs Co., Ltd., Hamilton, Can.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Machinery Co., Toronto.
Jardine & Co., A. B., Hespeler, Ont.
National Machy. Co., Tiffin, O.
Canada Machinery Corp., Galt, Ont.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.

VALVE LEATHERS
Graton & Knight Mfg. Co., Montreal.

VALVES, MIXING
Crane, Ltd., Montreal, Que.

VALVES (IRON) STANDARD AND EXTRA HEAVY
Crane, Ltd., Montreal, Que.

VALVE GRINDERS (PNEUMATIC)
Cleveland Pneumatic Tool Co., Toronto.

VALVES, REDUCING, REGULATING
St Lawrence Welding Co, Ltd., Montreal

VALVES, HYDRAULIC
Metalwood Mfg. Co., Detroit, Mich.
St Lawrence Welding Co, Ltd., Montreal

VALVES, RUBBER PUMP
International Mach. Spls., Ltd., Montreal
Quaker City Rubber Co., Philadelphia

VENTILATORS
H. H. Robertson, Lt., Sarnia, Ont.

VENTILATING APPARATUS
Brantford Oven & Rack Co., Brantford.
Can. Blower & Forge Co., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
Williams Machy. Co., A. R., Toronto.

VISE STANDS, PORTABLE
Williams & Co., J. H., Brooklyn, N.Y.

VISES, BENCH
Aikenhead Hardware Co., Toronto, Ont.
Becker Milling Machine Co., Boston, Mass.
Foss Machy. & Sply. Co., G. F., Montreal.
Petrie, Ltd., H. W., Toronto.
Superior Machinery Co., London, Ont.
U. S. Ordnance, Toronto, Ont.

VISES, DRILL
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Superior Machinery Co., London, Ont.

VISES, PIPE
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Rock Island, Que.
Marshall, Son & Bunney, Toronto.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.
Wells Bros. Co. of Canada, Galt, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

VISES, MILLING MACHINE
Brown & Sharpe Mfg. Co., Providence, R.I.
Superior Machinery Co., London, Ont.

VISES, PLANER AND SHAPER
Aikenhead Hardware Co., Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Petrie, Ltd., H. W., Toronto.
Superior Machinery Co., London, Ont.

VOLMETERS & AMMETERS
Northern Electric Co., Ltd., Montreal Que

WASHER MACHINES
National Machy. Co., Tiffin, Ohio.

WASHERS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Barnes, Wallace, Co., Bristol, Conn.
Graton & Knight Mfg. Co., Worcester.
Kayser-Ellison & Co., Ltd., Montreal.
London Bolt & Hinge Wks., London, Ont.
Marshall, Son & Bunney, Toronto.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Norton, Ralph B., Agent, Montreal.
Peckovers, Ltd., Toronto.
Steel Co. of Canada, Ltd., Hamilton, Ont.

WASTE
Wilkinson & Kompass Hamilton, Ont.
Wood Turret Machine Co., Brazil, Ind.

WASTE CLEANER AND OIL RECLAIMER
Oakley Chemical Co., New York, N.Y.

WATER-INTAKE SCREENS
Can. Link-Belt Co., Toronto, Ont.

WATER TOWERS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Toronto Iron Works, Ltd., Toronto.
St Lawrence Welding Co, Ltd., Montreal

WATER WHEELS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

WELDED TANKS
Can. John Wood Co., Toronto, Ont.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.

WELDERS, ELECTRIC, SPOT AND BUTT
Knight Metal Products, Toronto.

WELDERS, ELECTRIC ARC
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.

WELDING, WIRE
Page Steel & Wire Co., Adrian, Mich.

WELDING, ELECTRIC, SPOT, BUTT, ETC.
Globe Engineering Co., Hamilton, Ont.
St. Lawrence Welding Co., Montreal.
Welding & Supplies Co., Montreal, Que.
Tabor Mfg. Co., Philadelphia, Pa.

WELDING MASKS
Davis-Bournonville Co., Toronto, Ont.
Strong, Kennard & Nutt Co., Cleveland.

WELDING GOGGLES
Davis-Bournonville Co., Toronto, Ont.
St Lawrence Welding Co, Ltd., Montreal
Strong, Kennard & Nutt Co., Cleveland.
Willson Goggles Inc., Reading, Pa.

WELDING RODS AND WIRE
Davis-Bournonville Co., Toronto, Ont.
Page Steel & Wire Co., Adrian, Mich.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
St Lawrence Welding Co, Ltd., Montreal
Welding & Supplies Co., Montreal, Que.

WELDING SUPPLIES
Davis-Bournonville Co., Toronto, Ont.
Lincoln Electric Co. of Canada, Limited, Toronto, Ont.
Nat. Electro Products Ltd., Toronto, Ont.
St Lawrence Welding Co, Ltd., Montreal
Union Carbide Co., Toronto, Ont.

WELDLESS BOILER TUBES
Furniss, Clarke & Co., Montreal, Que.

WHEELS, BALL BEARING
Lyman Tube & Supply Co., Montreal, Que

WHEELS, CAR, STEEL
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Elec. Steel & Metals, Welland, Ont.

WHEELS, SPROCKET AND TRACTION
Can. Link-Belt Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.

WHEELS, TURBINE, WATER
Elec. Steel & Metals, Welland, Ont.

WHEELS, PRESSED STEEL
American Pulley Co., Philadelphia, Pa.

WHEEL TRUEING TOOLS
Petrie, Ltd., H. W., Toronto.
Wheel Trueing Tool Co., Windsor, Ont.

WINCHES
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Hall & Sons, John H., Brantford.
Kennedy & Son, Wm., Owen Sound, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.

WINCHES, MOTOR TRUCK
Canadian Mead-Morrison Co., Limited, Montreal, Que.

WINCHES, POWER DRIVEN
Canadian Mead-Morrison Co., Limited, Montreal, Que.

WIRE, CAST STEEL AND MUSIC
Kayser-Ellison & Co., Ltd., Montreal.
Norton, Ralph B., Agent, Montreal.

WIRE COILING AND POINTING MACHINERY
Baird Machine Co., Bridgeport, Conn.
Shuster Co., F. B., New Haven, Conn.

WIRING MACHINES
Quickwork Co., St. Marys, Ohio.

WRENCHES, PIPE, POWER
Peck, Stow & Wilcox Co., Southington.

WIRE GUARDS
B. Greening Wire Co. Hamilton, Ont.

WIRE CLOTH AND PERFORATED METALS
Canada Wire & Iron Goods, Hamilton.
Page Steel & Wire Co., New York, N.Y.

WIRE FENCING

WIRE, COPPER, CLAD STEEL

WIRE, LINK FABRIC
Page Steel & Wire Co., Adrian, Mich.

WIRE FORMING AND STAMPING MACHINERY
Baird Machine Co., Bridgeport, Conn.
Brown, Boggs Co., Ltd., Hamilton, Can.
Shuster Co., F. B., New Haven, Conn.

WIRE GUARDS
Can. Wire & Iron Goods Co., Hamilton, Ont.

WIRE NAILS
Page Steel & Wire Co., New York, N.Y.
Parmenter & Bulloch Co., Gananoque.
Steel Co. of Canada, Ltd., Hamilton, Ont.

WIRE ROPE
B. Greening Wire Co. Hamilton, Ont.
Can. Wire & Iron Goods Co., Hamilton, Ont.
Samuel Osborne, Ltd., Montreal, P.Q.

WIRE NAIL MACHINERY
National Machy. Co., Tiffin, Ohio.
Page Steel & Wire Co., New York, N.Y.

WIRE, SPARK PLUG, MANGANESE NICKEL, COPPER NICKEL, MONEL METAL
Can. Driver-Harris Co., Ltd., Walkerville.

WIRE SPRING
Page Steel & Wire Co., Adrian, Mich.

WIRE STEEL, BRASS, COPPER
Page Steel & Wire Co., New York.
Steel Co. of Canada, Ltd., Hamilton, Ont.

WIRE, TELEPHONE, TELEGRAPH, GALVANIZED AND ELECTRICAL
Page Steel & Wire Co., Adrian, Mich.

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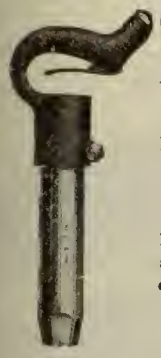

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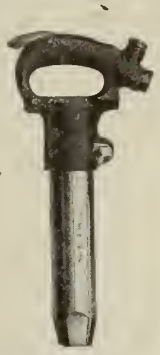

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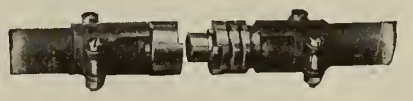

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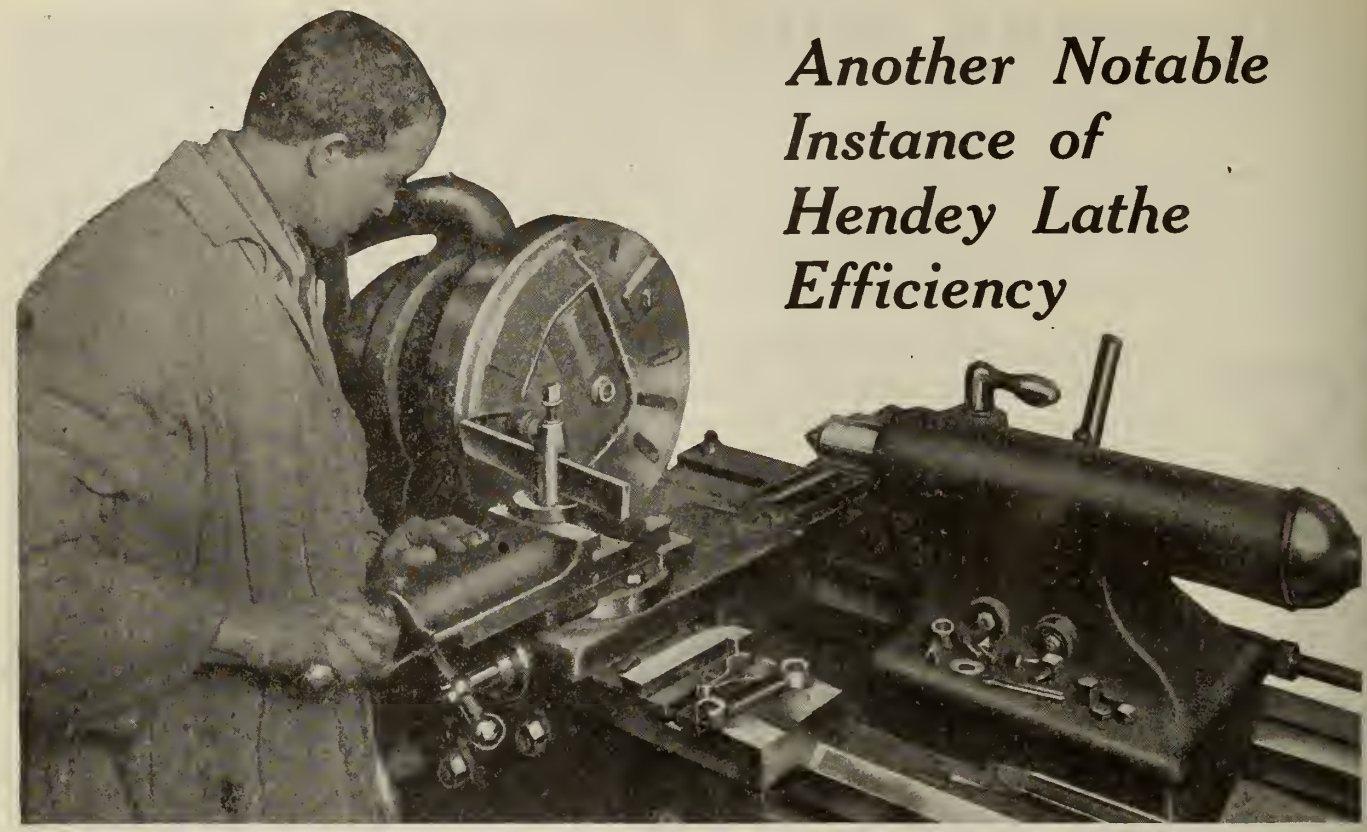

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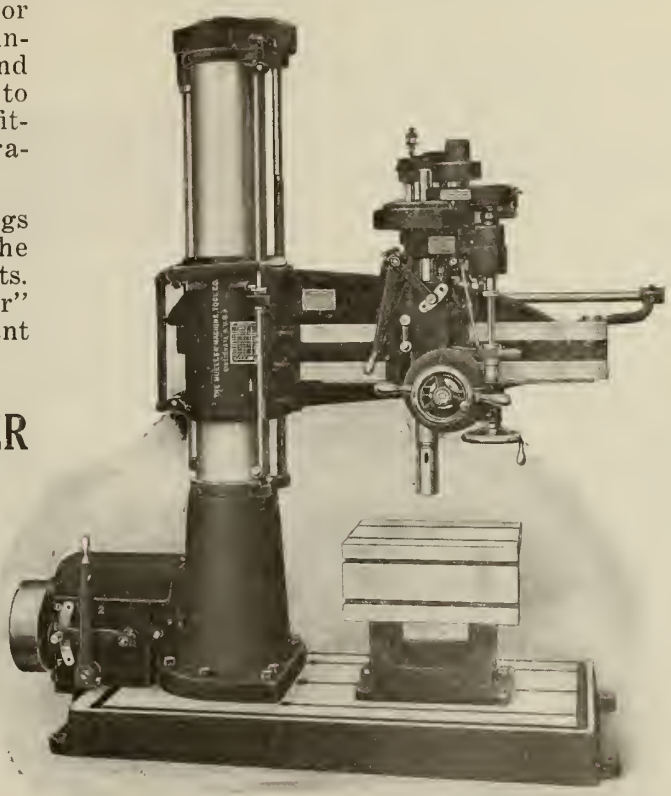

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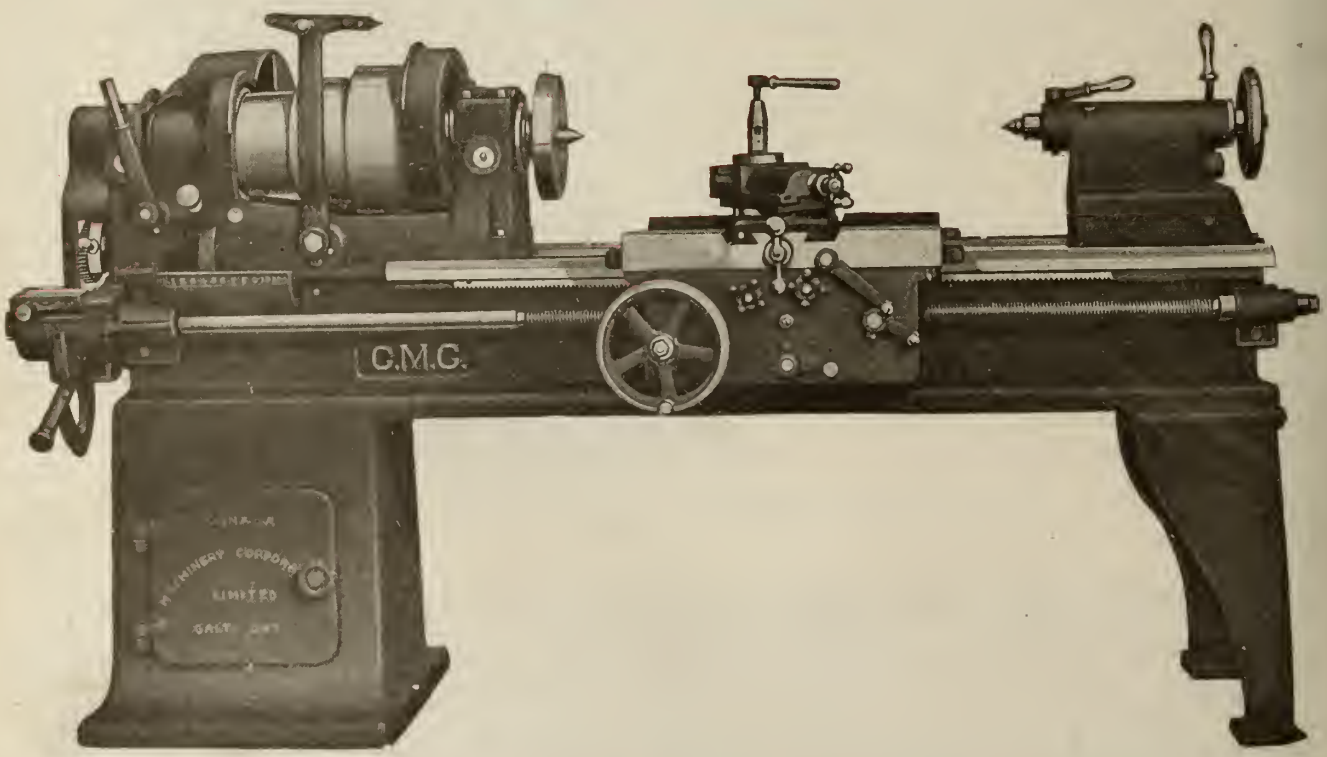

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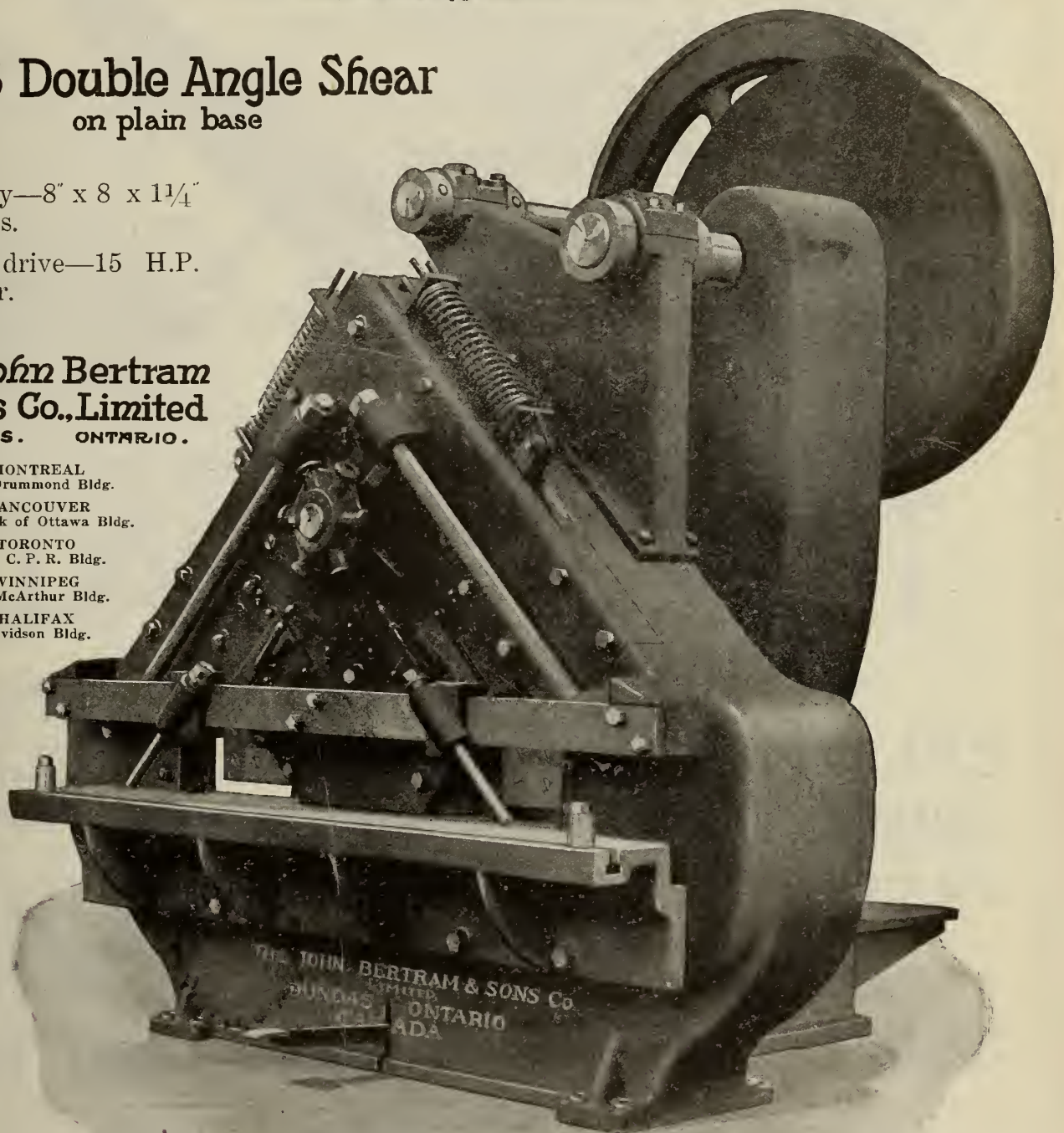

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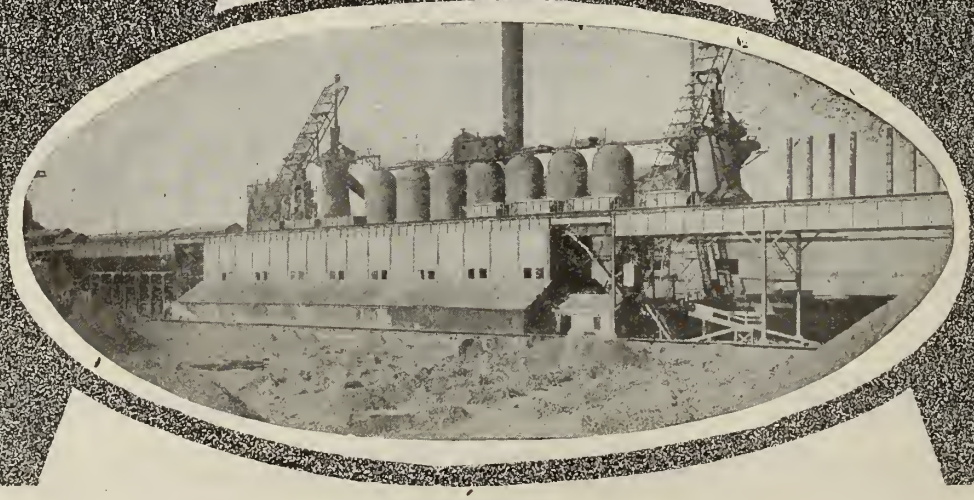

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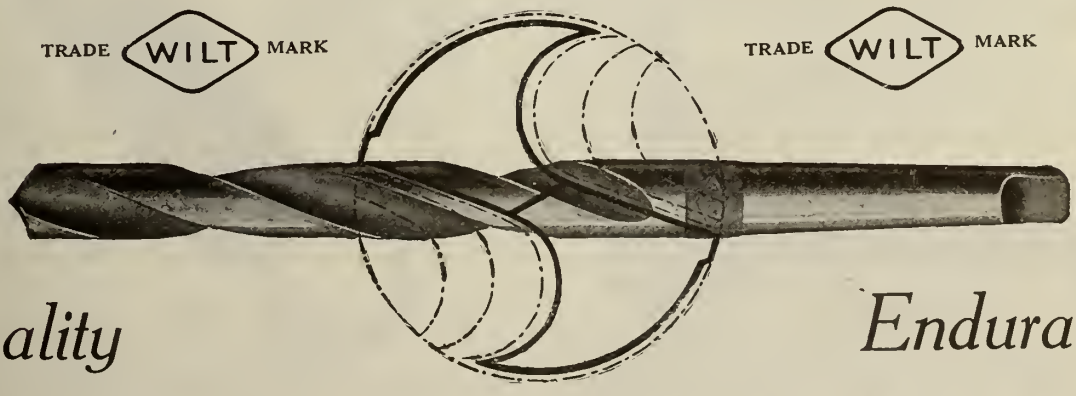

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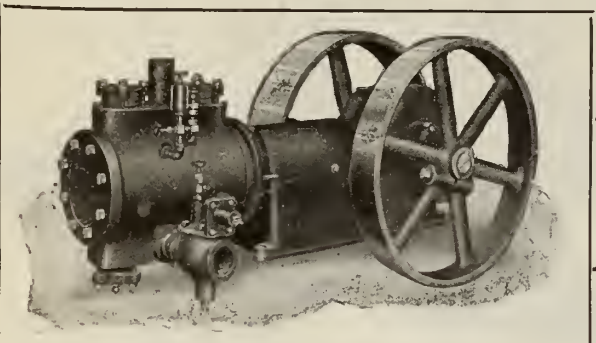

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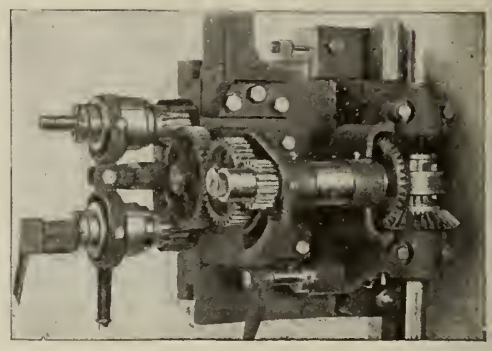
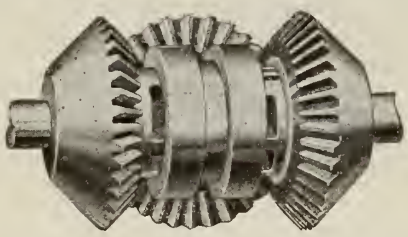


Here is a typical Johnson installation—the Colburn Boring Mill with three Johnson Clutches shown, and three more on the other end of the cross rail. For neatness and simplicity this arrangement is worthy of notice, but its real value appears in the smooth and convenient control of operations that it gives.



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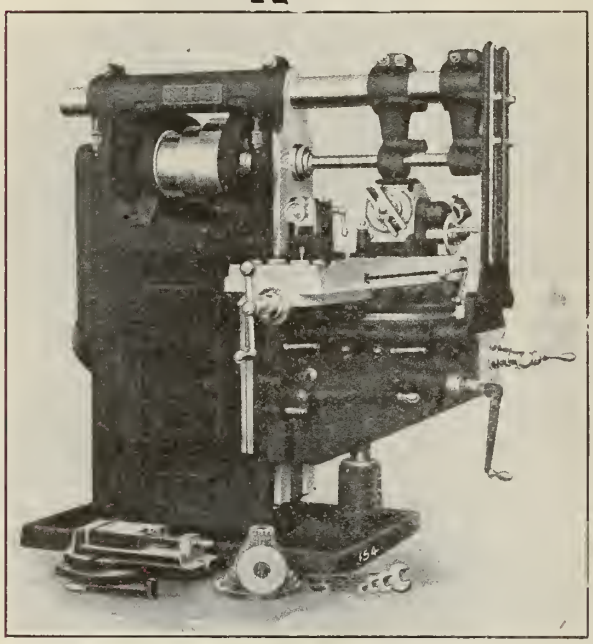

Ford-Smith Machine Tools comprise a large, thorough, efficient modern range of Milling Machines and Grinding equipment.
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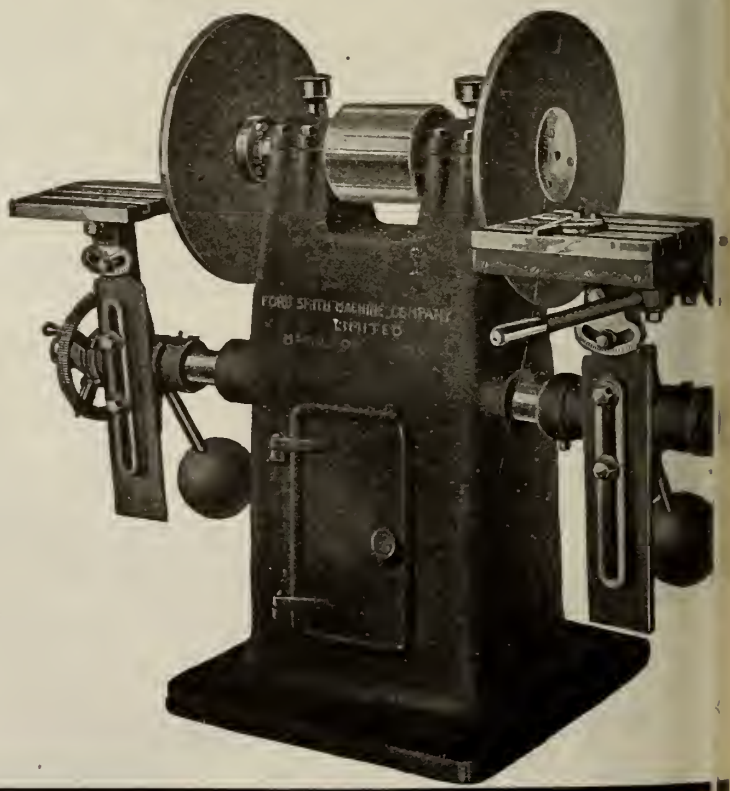

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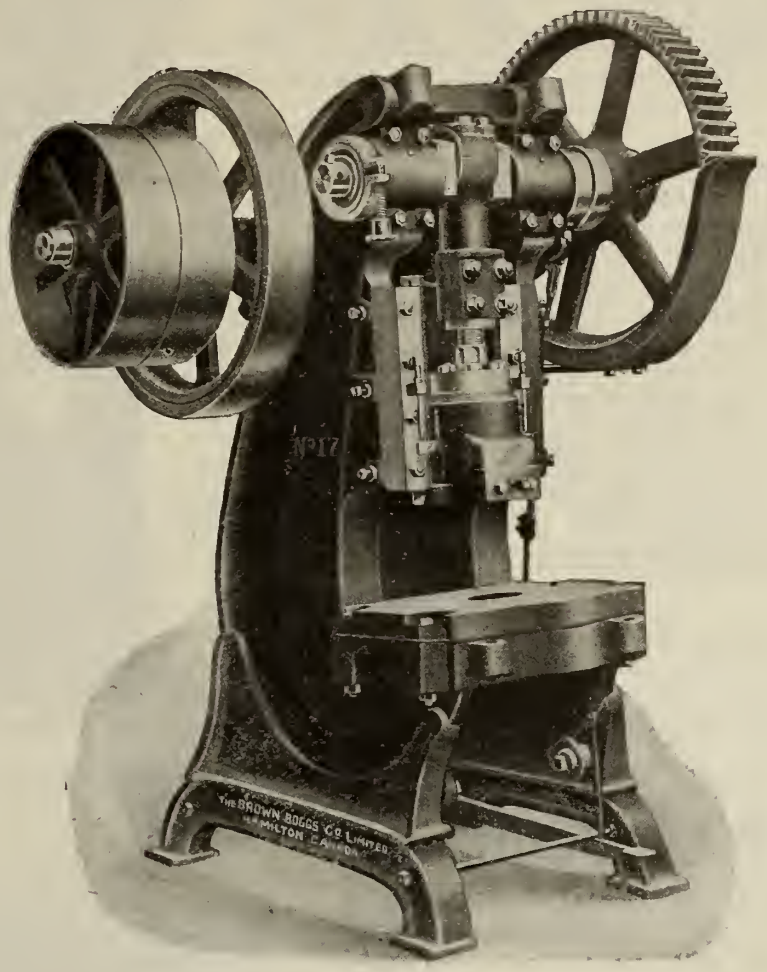

No. 17 Geared Inclinable Press

We have recently redesigned our line of Inclinable Power Presses, adding several new features that increase their efficiency and add life to the dies used in them.

The pitman connection is of the ball type made from **High Carbon Steel** carefully heat treated so as to give the maximum **Service.**

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Manufacturers of Sheet Metal Working Machinery, Presses, Shears, Rolls, etc.

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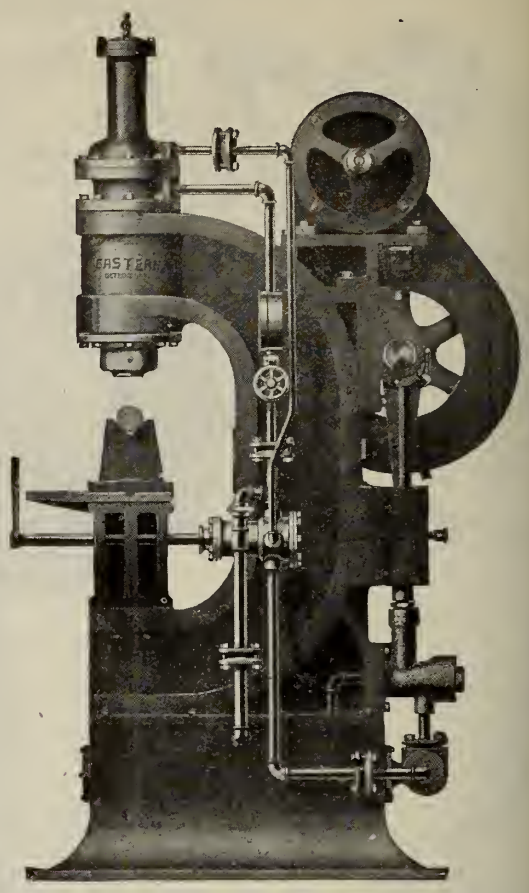

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Length of Ram Travel .....6 in.
Depth of Throat .....10 in.
Length of Table .....8 ft.
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Table to Ram .....10 to 14 in.

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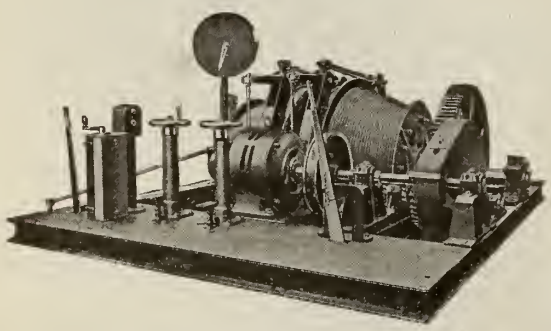

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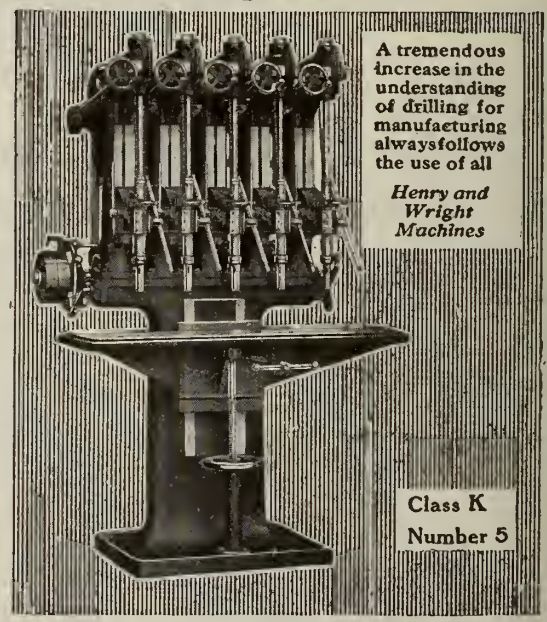
A tremendous increase in the understanding of drilling for manufacturing always follows the use of all
Henry and Wright Machines
Class K
Number 5

The Henry & Wright Mfg. Co.
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Crucible
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Open Hearth Steel
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"ARGO" BRAND *HIGH-SPEED* STEEL

The John Illingworth Steel Co.
1856
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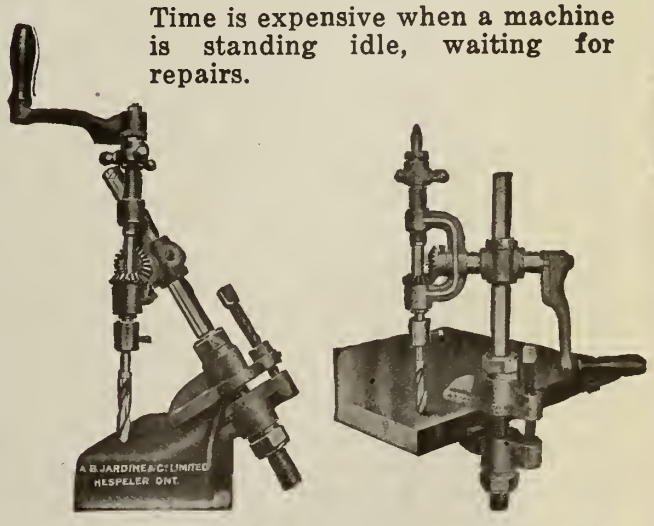
Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.



On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

Weight, 40 lbs. Price, $26.50 net.
Sold by all Machinery and Supply Houses

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HESPELER, ONTARIO

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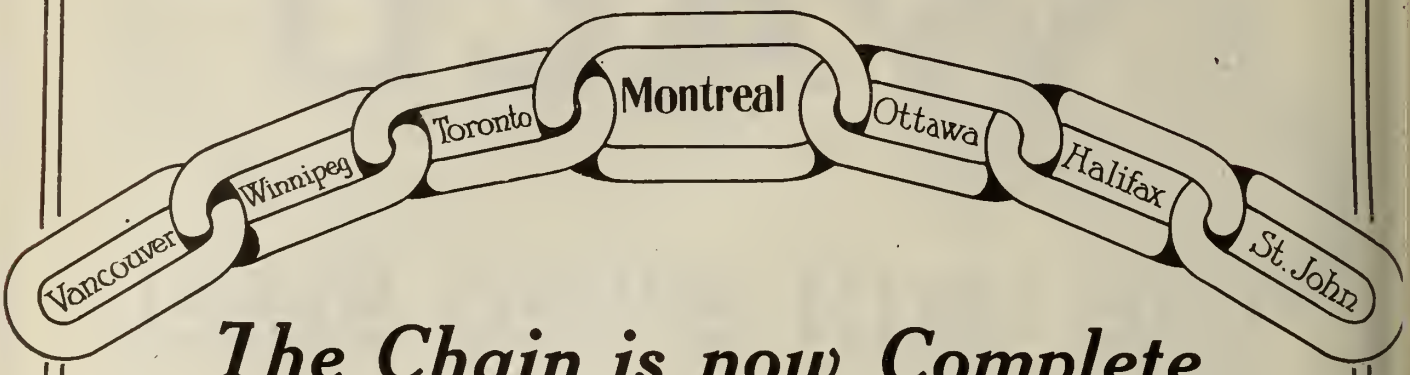

The Chain is now Complete

The history of the A. R. Williams Machinery Co., Limited, is of special interest to the machinery trade throughout Canada.

The A. R. Williams Machinery Co. was first opened at Toronto. As the firm grew it became necessary to open a branch in Winnipeg and later others in Vancouver, St. John, Halifax and Ottawa. Thus a chain of offices and warehouses was formed, extending from coast to coast—with the exception of Montreal.

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Boilers
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Woodworking Machinery
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Transmission
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Each week we will give to the readers of "Canadian Machinery" some additional facts with regard to A. R. Williams Service. They will interest you.

Have you received your copy of our **Nation-wide** Catalogue? If not, better let us send you a copy right away.

The A. R. Williams Machinery & Supply Company, Limited

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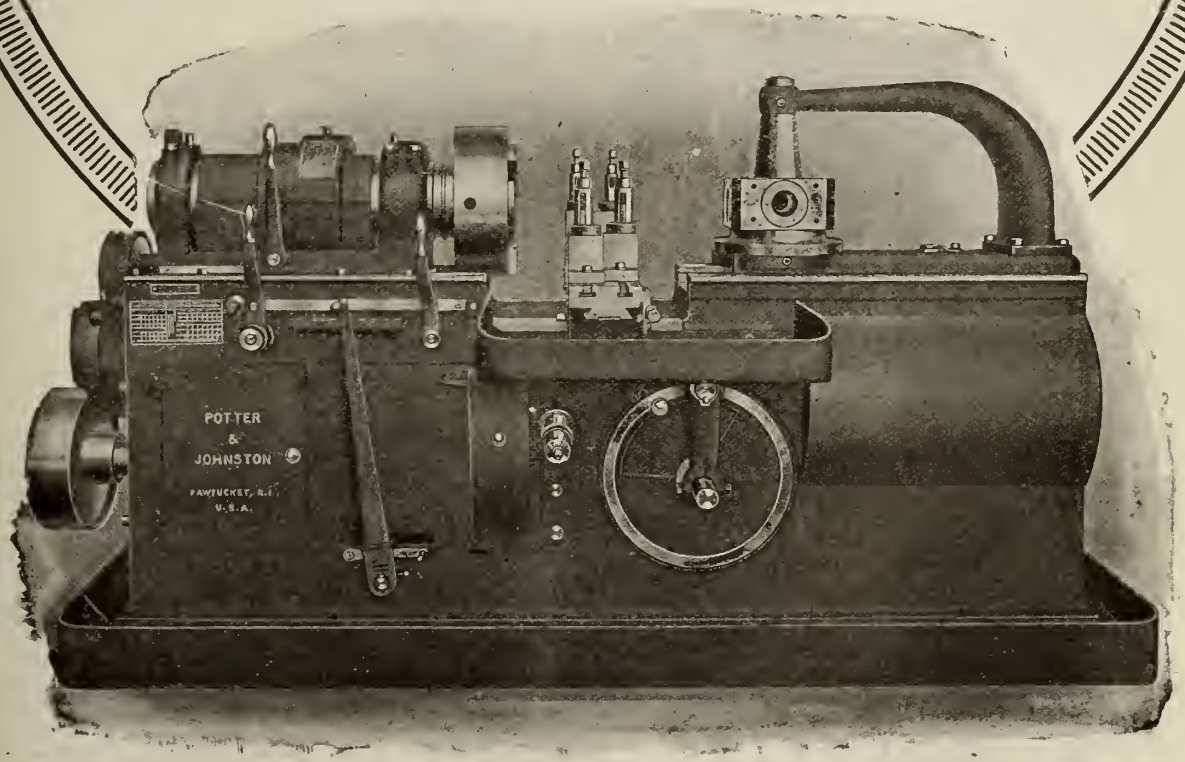
"Do it Automatically"

The Automatics reduce to a minimum your greatest single item of expense—the pay-roll. They enable you to figure your exact production on any job before even making a test run. *Write for the facts.*



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Works and Warehouses: Galt, Canada

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V., U.S.S. and S.A.E. Cap Screws
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S.A.E. Plain and Castellated Nuts
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SPECIAL

Screw machine product up to 2¼ inches diameter to customers' specifications.

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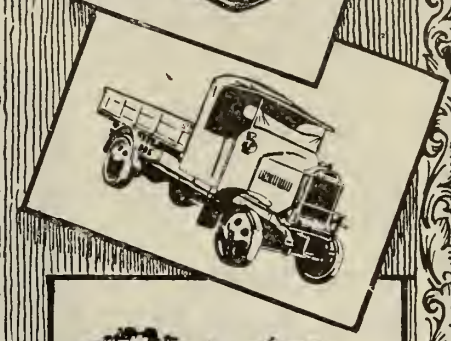
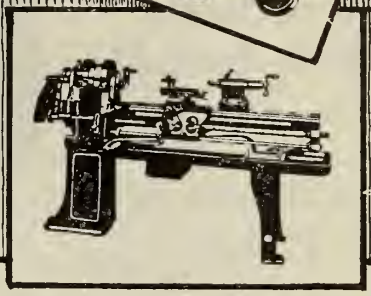
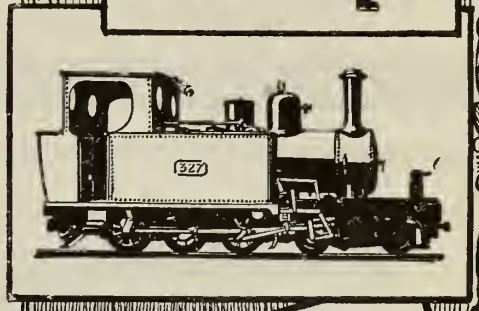
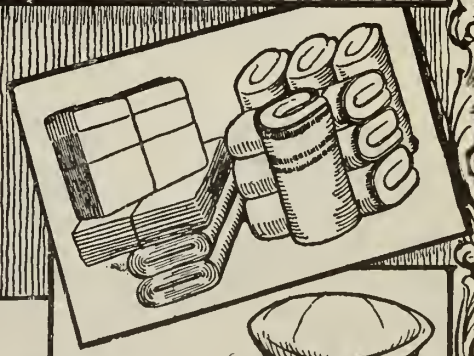

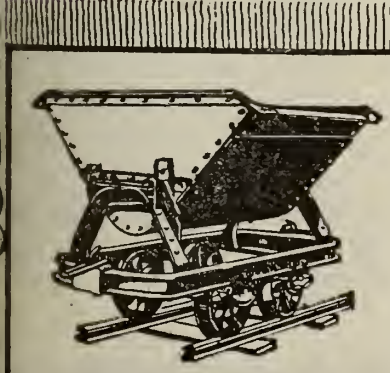
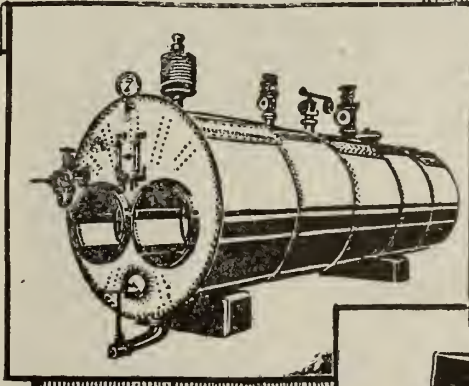

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Every Commercial Purpose

We are the only company in Canada producing steel ingots by the "HARMET" Liquid Process, a process that makes these ingots vastly superior to the ordinary kind, improving the physical properties and reducing the waste of ingot.

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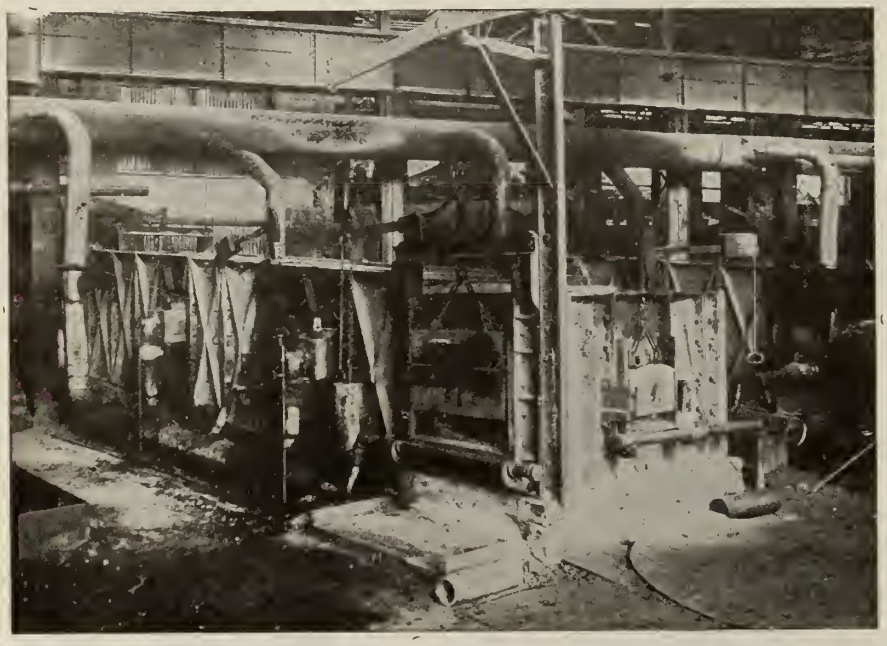
Steel Ingots
by the
HARMET
Liquid Process

Another MECOL Furnace

demonstrated its superior features point by point to a group of men whose years of experience in the heat-treatment of metals made them appreciative judges.



We refer to the "Mecol" Furnace shown in this illustration, installed at the Pointe St. Charles Works of the Canadian Steel Foundries, Limited.

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And it is built to last.

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Grinds within .0004 in. of absolute Accuracy

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SUCCESSORS TO C. G. GARRIGUS MACH. CO.
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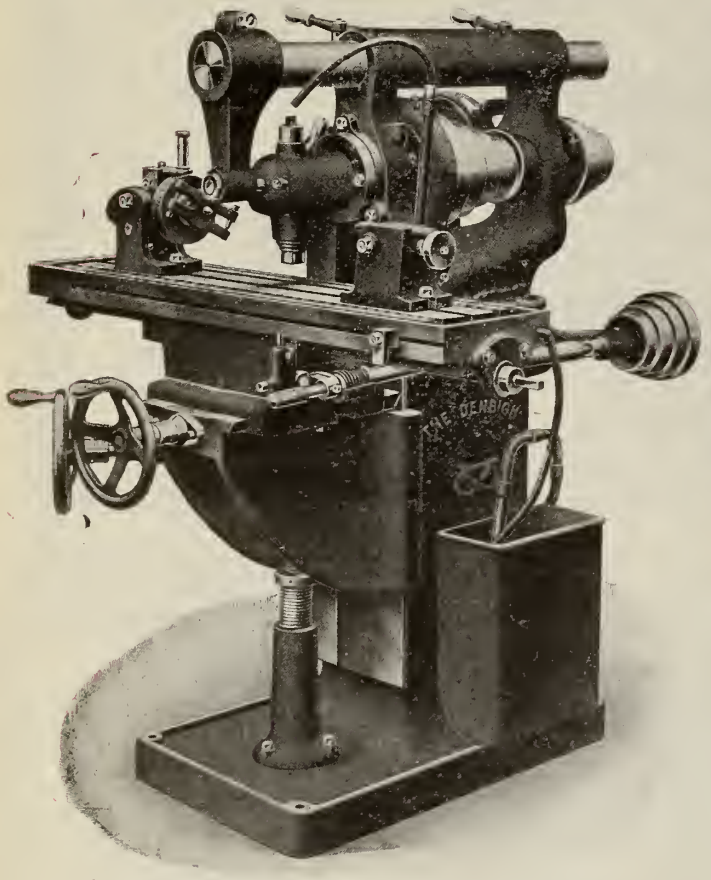
The DENBIGH Famous MANUFACTURING MILLERS



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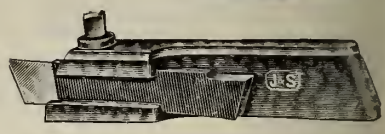
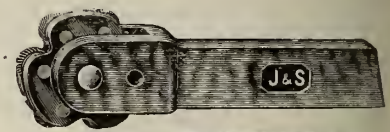
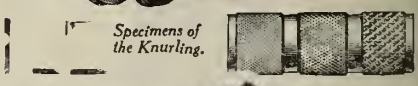
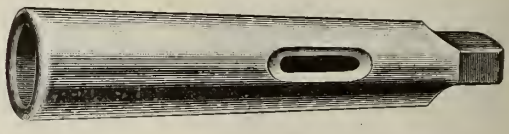






Specimens of the Knurling.

and many other standard tools



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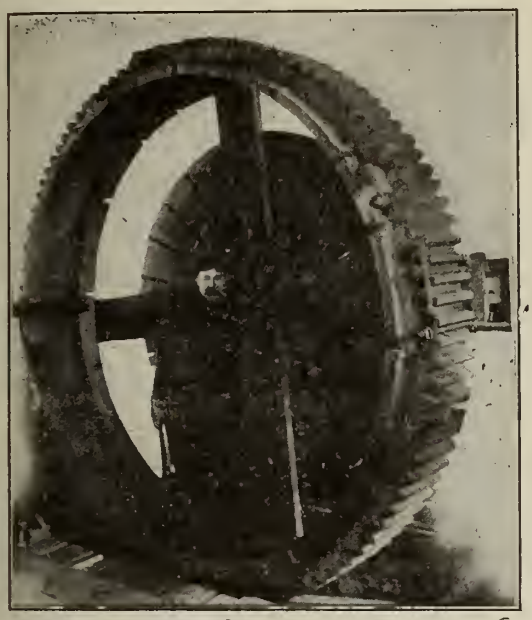

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Blast Furnaces, Rolling Mills
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MADE TO ANY ANALYSIS

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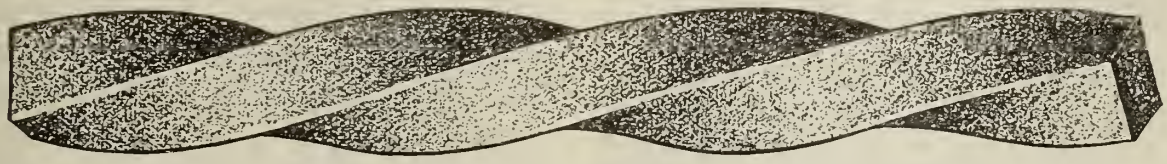
OF EVERY DESCRIPTION



ROUND
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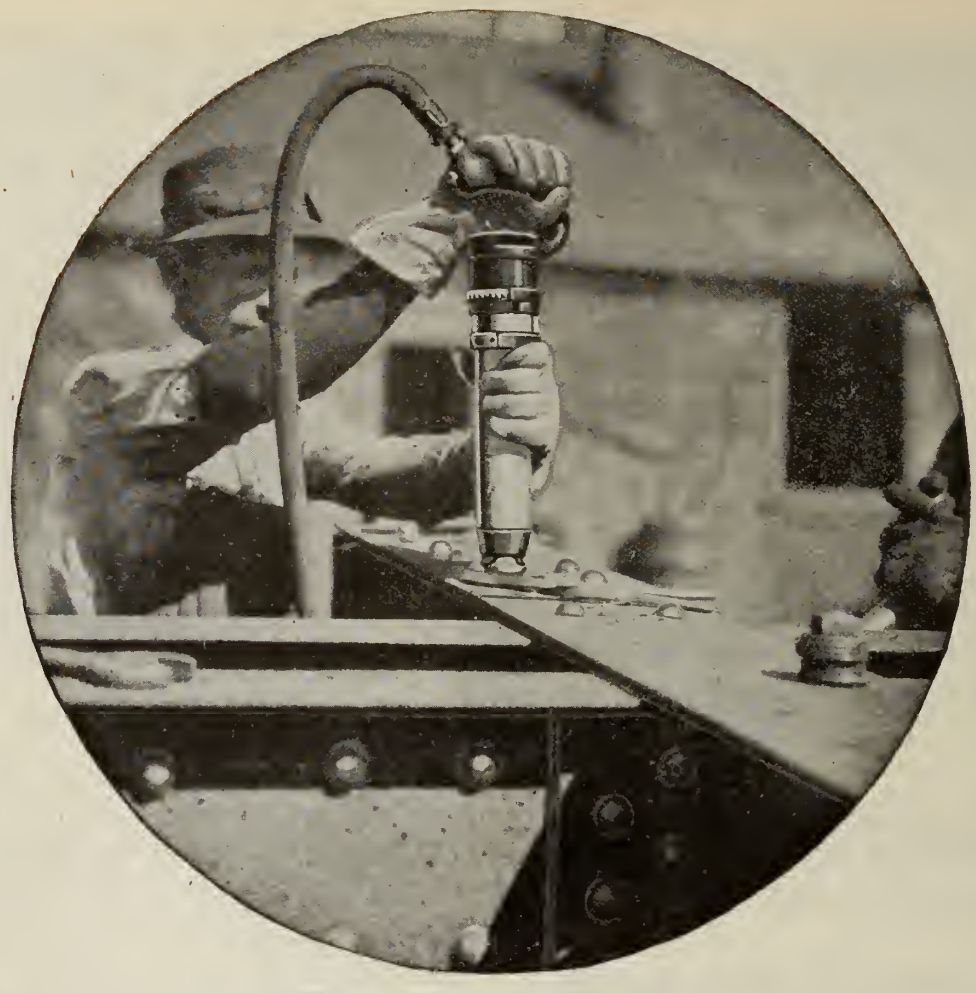

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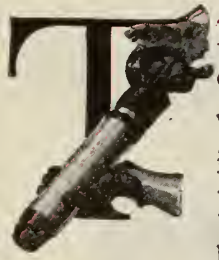

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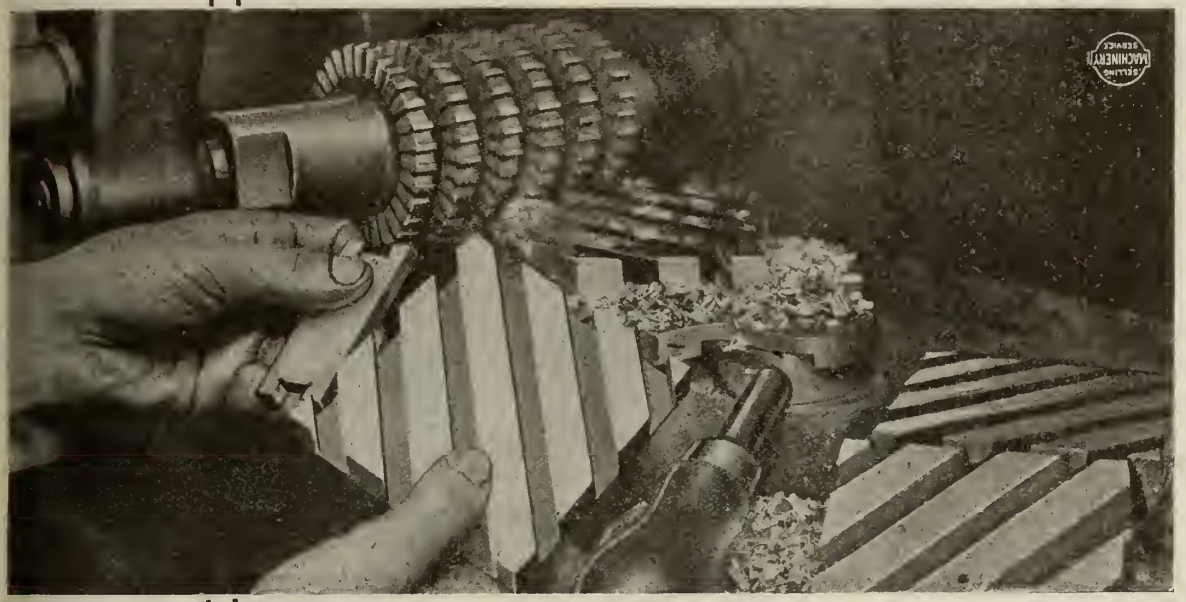

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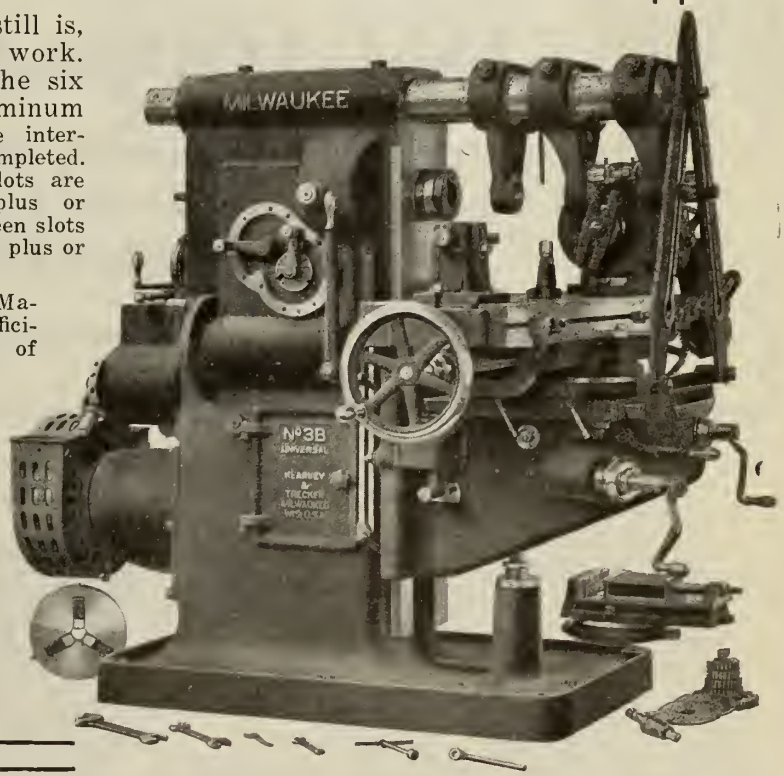

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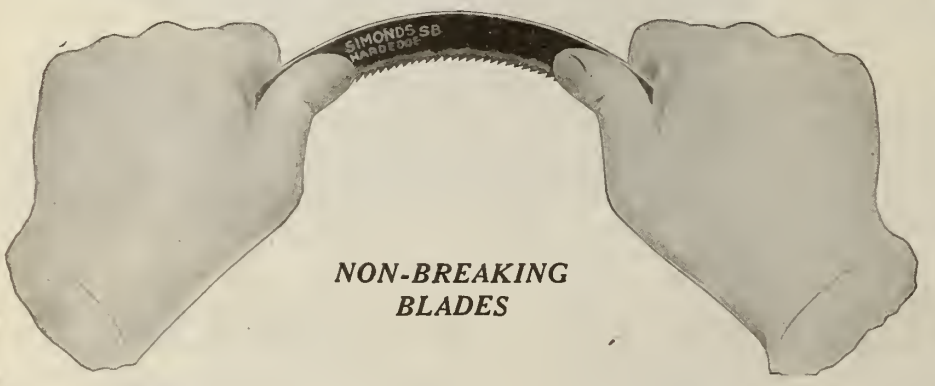

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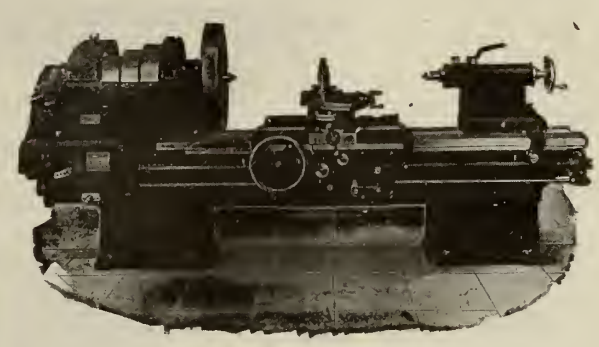

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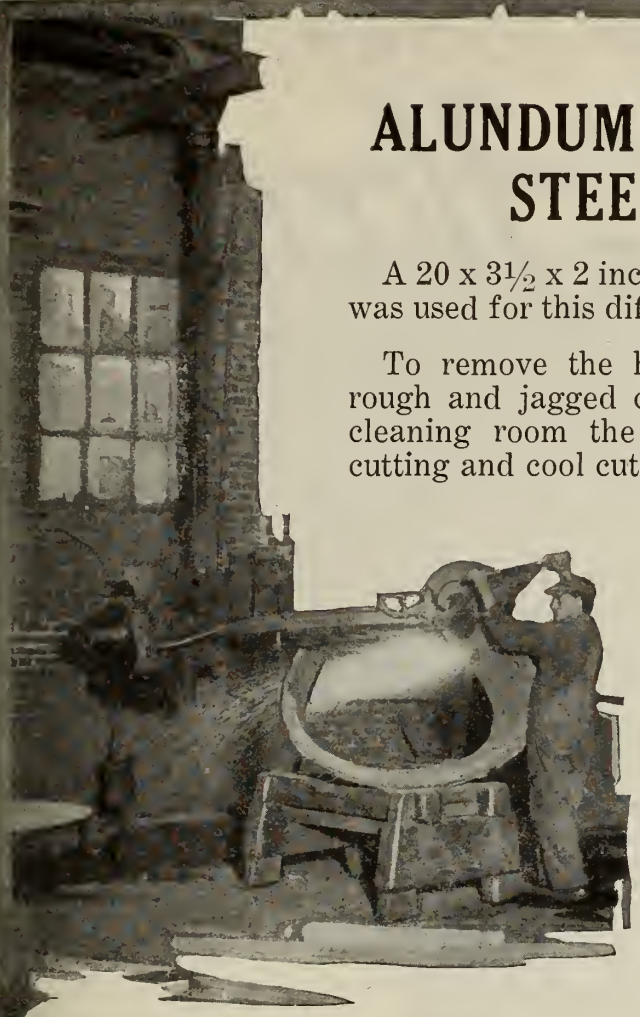

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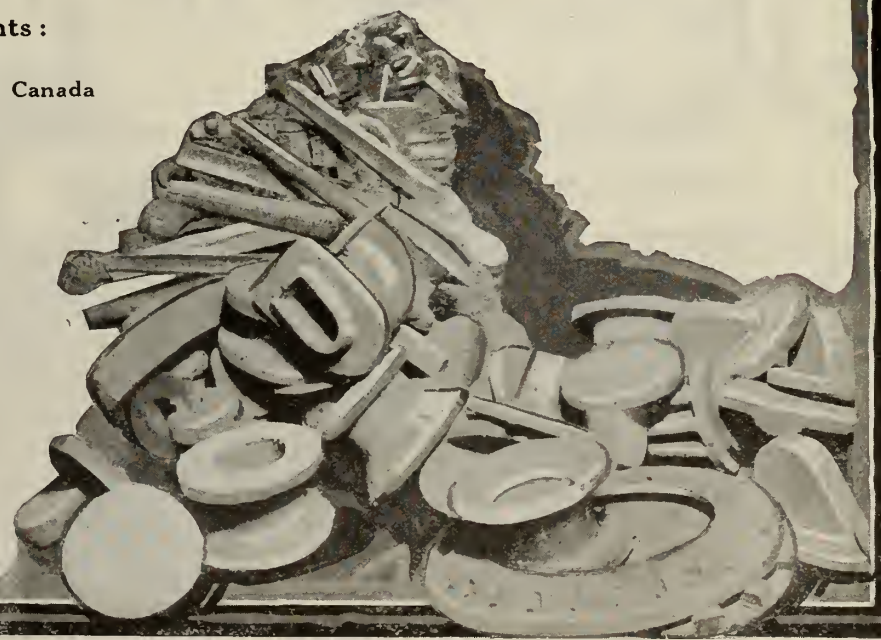

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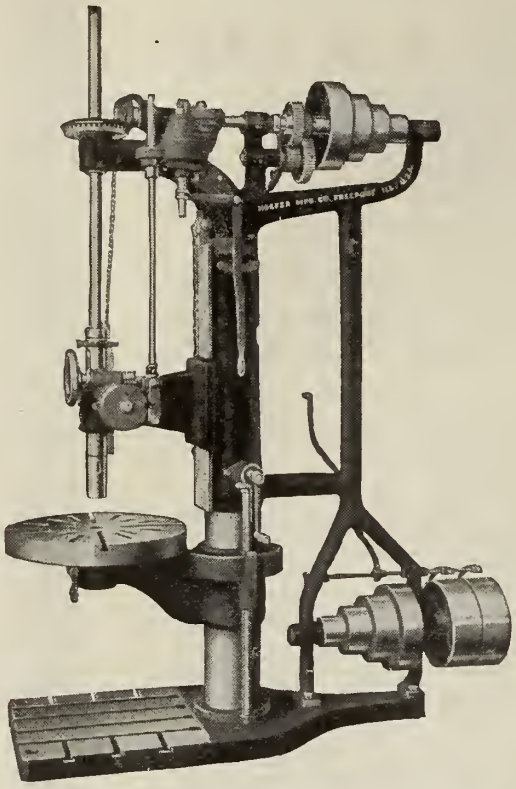

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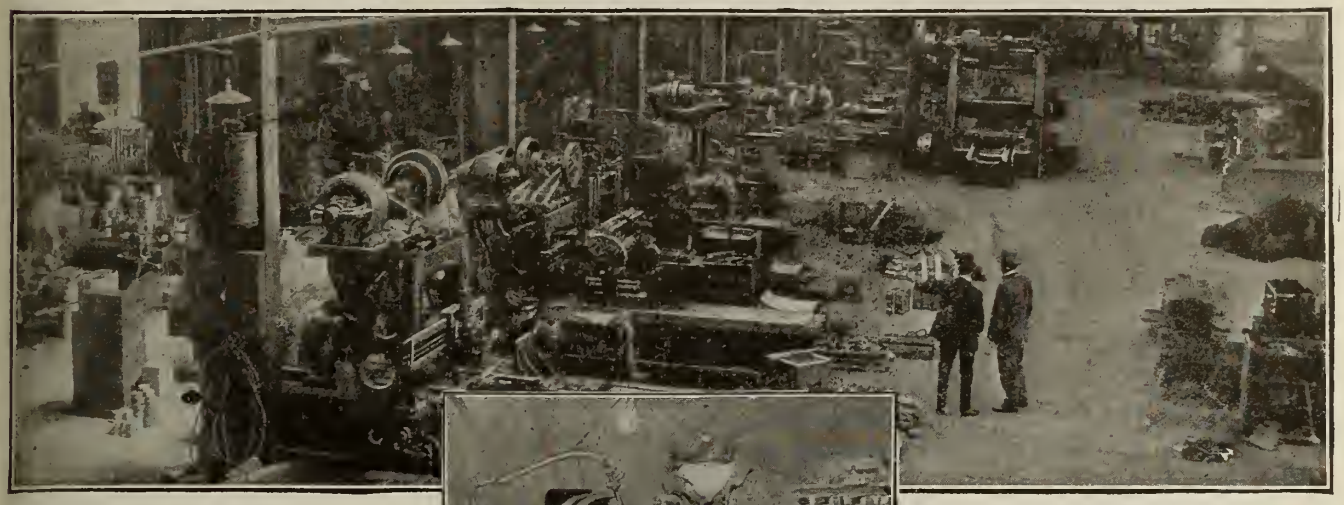

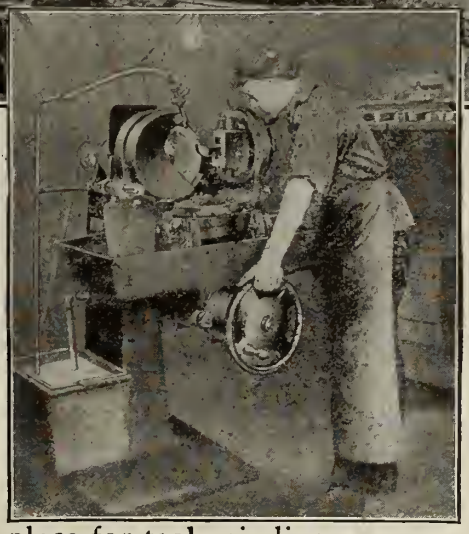

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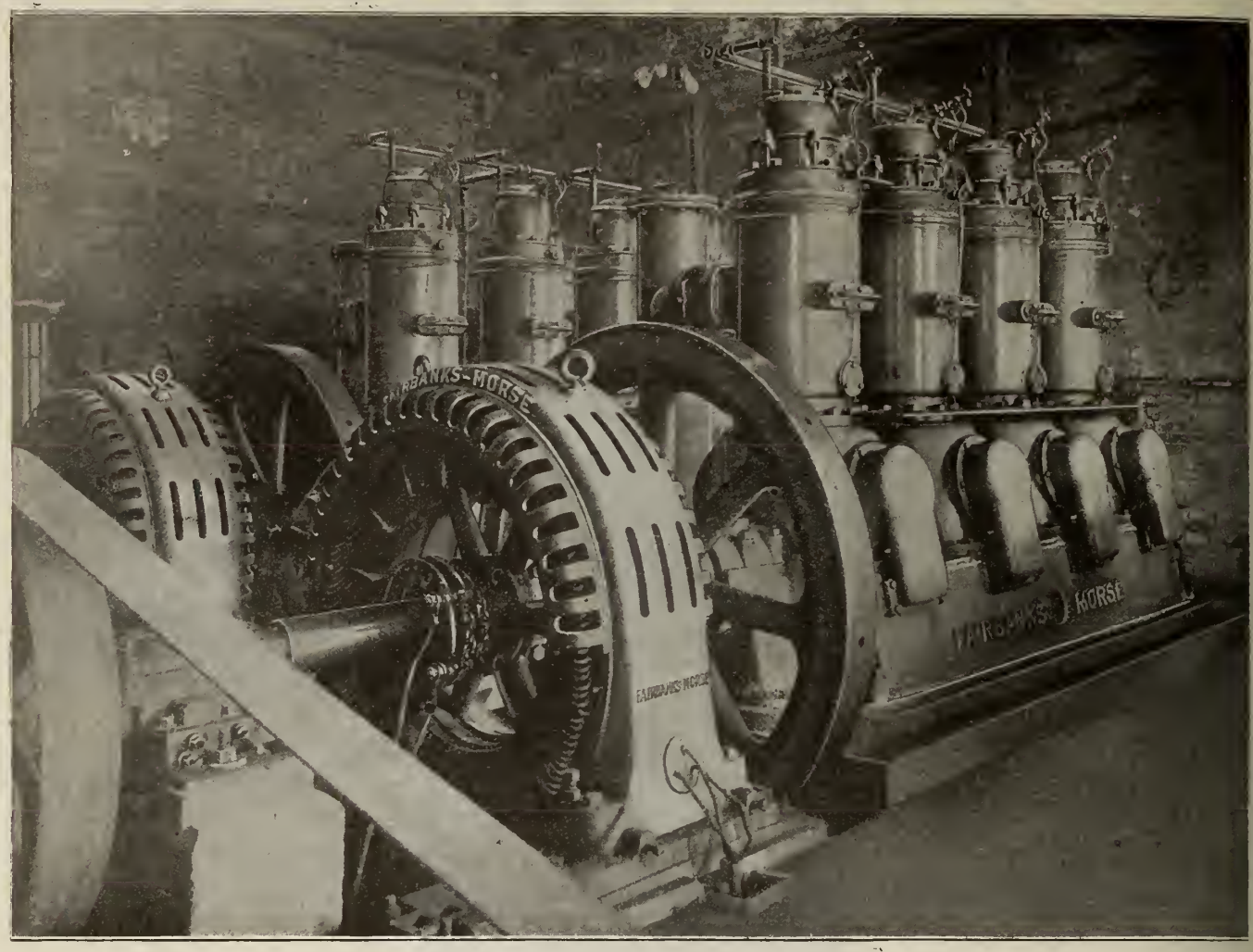

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CANADIAN MACHINERY
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MANUFACTURING NEWS

Vol. XIII, No. 18. April 29, 1920.

Are You Acquainted With Art of Roll Turning?

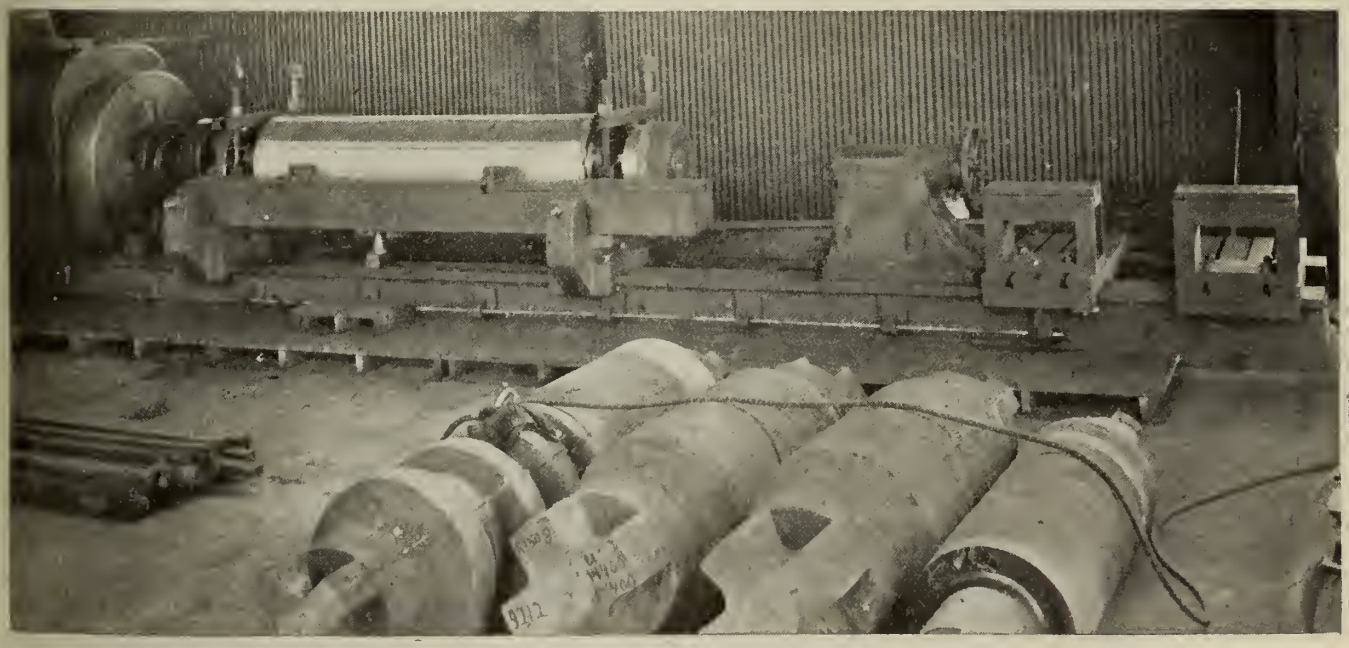
The Average Person Holds a Very Hazy Idea as to What is Meant by Roll Turning—The Art is a Very Important One, So We Give a Detailed Description Herein

By W. S. Standiford

AMONG all the various trades in the world. that of roll turning occupies a position which is important and unique. It is an occupation that is little known except by those who work in rolling mills, and the average person generally has a very hazy idea of the trade. I once asked a man: "What is a roll turner?" The answer I received was: "A roll turner is a baker." This man evidently had bakers' rolls on the brain. Some other people think that a roll turner is a machinist; this is also a wide mistake, as the trades are separate and distinct, the lathe and tools used in the one working in an entirely different manner from that characteristic of the other. As a general rule, machinists know nothing about roll turning; of course there are some who have taken advantage of an opportunity and learned the trade, but there are very few of them, as the rank and file of journeymen are recruited from apprentices who have served their four years' time at turning rolls.

The influence that this trade has on the progress and civilization of the world is most remarkable as well as beneficial. Before the era of rolling iron and steel beams, rails, etc., came into use, the usual method was to forge or cast them. This was a slow and uncertain way, and produced articles far inferior in strength and appearance to the rolled ones; the output also was limited. The reason why the cast is inferior to the rolled section is that rolling gives a fibrous and more homogeneous structure which resists strains better. The rapidity with which various shapes and sections of steel can be rolled as well as the excellent quality and cheapness per ton secured has given to the world an engineering material that is unsurpassed for building bridges, steamships and machinery and the cheapness of its production is due largely to the improvements in roll-turning and rolling. Much of the comfort and safety in travelling and many of the luxuries we enjoy nowadays are due to the roll-turner's art, and it is the foundation of the iron, steel, copper, brass, and aluminum industries.

Roll turning was invented in 1785, by Henry Cort, an Englishman, and ever since then the trade has been developed by various roll turners and mechanical engineers, each one having added his "mite," until we have in our modern reversing and continuous mills machinery that is capable of turning out an enormous tonnage of iron and steel with very few men employed to handle the mills; this produces large profits with small expenses, and also a first-class product. The majority of rolling mills in the United States, however, are small ones, capable of turning out an output of 15 tons per turn and upwards. They are



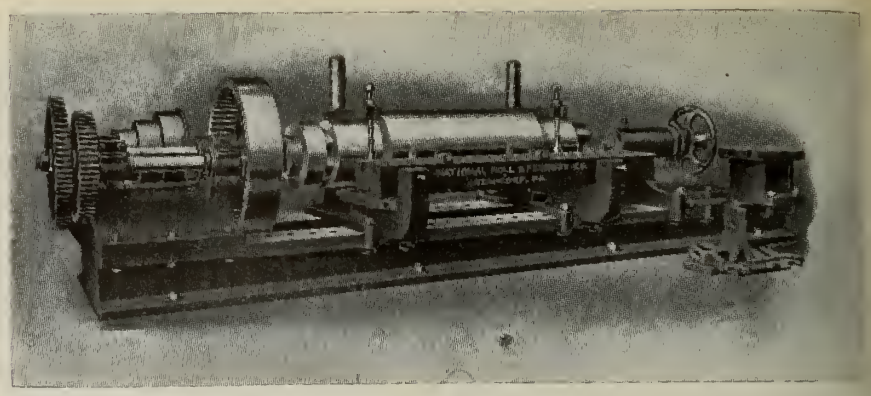
A LARGE SIZE ROLL TURNING LATHE AT WORK.

gradually giving place to modern equipment, and there is no doubt but that in the future the small industrial plants will be equipped with up-to-date machinery. The rivalry for commercial supremacy will finally bring about this result. It is a case of the "survival of the fittest."

While the science of roll turning has advanced very rapidly, yet curiously enough there have been very few improvements in the lathe by which the roll turner produces such excellent results. Such as have been made relate to minor details, such as adjustments to permit the topping of rolls quickly, the fastening of the tool rest, the tailstock, the shape of housings, and also the application of electric motors mounted on the lathe for direct drive. Some of the modern direct-driven lathes are splendid examples of the machine-tool builders' art, the machines having gears running in an oil bath, the machines being stopped and started by means of push buttons. These lathes are about as nearly noiseless as can be achieved. Some have a controller like the ones that are on street cars, it being possible to reverse the machine at will when it is desired. This feature comes in handy when the tool prop bends and allows the tool to jam, it being very easy to withdraw the tool by reversal. But outside of all of the modern improvements, the fundamental principle of working remains the same, and always will despite the march of progress in other directions.

The Roll Lathe

The roll lathe is a device of extreme simplicity, and the turning tools are of such a character, and the methods of working them are such as are found in no other lathe. The machine is built in various sizes to take in different classes of work. It consists of a long and wide bed, hollow in the middle to hold the turnings, technically called "swarth." The necessary gearing and pulleys to drive the machine are located at one end of the bed. Revolving on a hollow shaft connected with the various gears and placed at a right angle to the bed, is a heavy wheel having the driving teeth inside in some lathes, and in others, the teeth are on the outside. The total diameter of the wheel is four feet or more in diameter. This wheel is called the "face-plate," and it has bolted onto the side, in the middle, a square-shaped box with fluted insides. Placed partly inside the fluted box and projecting outside of it is a square piece of iron about



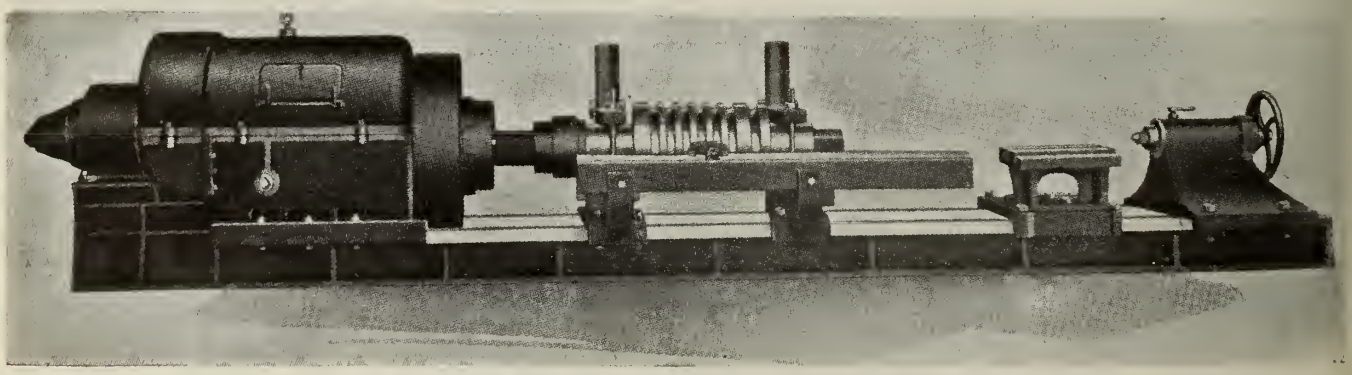
THIS VIEW ILLUSTRATES A WELL-KNOWN TYPE OF ROLL TURNING LATHE.

18 inches long, with fluted sides; this is called a "spindle." Over this spindle is put a round iron box, the length depending upon the size of the lathe and the diameter of the rolls that the lathe is made to take. In this case it will be 8 inches long and is fluted inside; this is made of sufficient diameter so as to slide freely on the spindle. This arrangement is used to drive the roll when it is in the lathe.

All rolls are made with a journal or "neck," as it is technically called—on each end and also fluted wobblers on the extreme ends of the roll. The wobblers are of such a size that the round box on the end of the spindle is placed half-way on the latter and half-way on the roll. This makes a very flexible driver. Across the bed of the lathe and at a right angle to the bed, are two cast iron devices called "housings." There are square depressions in the middle of each housing, each containing an iron block with the upper end hollowed out and lined with babbitt. These form the bearings for the neck of the roll to revolve in. The bearings are arranged so as to have some end play; this being secured by set screws on the housing. bearings. The top bearings or "caps" are formed of long rectangular pieces of cast iron having a circular depression in the middle; each cap contains a round hole of sufficient size so as to slide freely over the back ends of the housings and down it. The front ends of the caps usually have inverted U-shaped slots. Through these extend long iron rods each threaded on the upper end and carrying a nut and washer; the lower ends of the rods are slotted and held in place by keys.

The back ends of the housings where the caps go over it contain a rectangular slot, and also a removable key which, with the aid of the threaded front rods with their washers and nuts, keep the top bearings or caps pressing down on the roll. The latter is put into the lathe, and so adjusted that there is ¼-inch clearance between the driving spindle and the wobbler on the roll; the spindle being turned around until the flutes in it are opposite the flutes of the roll wobbler. The box is then pushed half-way onto the wobbler. The caps are next placed upon the necks of the roll, the keys put in the back ends and the nuts on the front rods tightened. The set screws that operate the bottom bearings are then screwed up to prevent end play of the roll; the back bearings are also screwed up and pressed against the necks of the roll by the screws in the back of the housings. In adjusting the pressure of the various bearings upon the roll necks, it is important not to get them too tight as the roll, when it is revolving, will operate with a jerky motion and thus make chatter marks upon the work, which latter in turn will mark the bars. Too tight bearing pressure will also scrape the lubricant off the necks and cause cutting.

Across the front ends of the housings is placed a long rectangular casting containing two inverted T-shaped slots, one at the front end and the other at the back. This is used to hold the tool and is called the "rest." It also has numerous square holes extending from top to bottom. The rest is held from sliding endwise by bolts extending through the T-shaped slots in the bottom of it and the slots in the housings. The front ends of the housings also contain bolts so as to hold the rest from moving



ANOTHER STYLE OF GEARED HEAD ROLL TURNING LATHE.

ackward when the tool is cutting, a ock nut on each bolt being provided to eep the bolts tight. In the slot running aralle! to the roll, and next to it, is laced the tool carriage, a rectangular asting or forging with flanges on the ottom of sufficient size so as to allow to slide freely in the T-slot. On the ront slot of the rest is located the usher, which is a solid piece of iron ith a flange on the bottom working in T-slot in the front of the rest. This usher contains a long screw with one d tapered to fit a wrench; this is used feed the tool into the roll.

Roll Versus Ordinary Lathe

There is considerable difference beween roll lathe and machinists' tools, eir shape and methods of working beg entirely different. In order to show is clearly, we will suppose that a roove is to be turned in a roll for makg bar iron. The tool consists of a piece hardened steel 1¼ inches thick and 2 inches long, the width depending upn the size of the groove wanted; in this se, it will be four inches wide. The ont edge is ground to a straight-edge; e right and left sides of the tool are round a few degrees off a right angle, as to leave the groove with a slight per for clearance. The bottom edges both sides and the front of tool also e tapered, so as to clear the roll, leavg the top edges to do the cutting. It then placed in the tool carriage, and small flat piece of iron called "packg" put on it and an iron wedge driven to hold it in position. A post containg a set-screw is then inserted into e of the square holes in the rest opsite the front of the tool, another post ing located on the other side near the ar end.

The pusher is then put in position ck of the tool; lathe started up and e wrench on the pusher given a suffient number of turns until the tool gins to cut, and given a turn once in ery revolution of the roll. Should the tter be calipered at this juncture, it ill usually be found that the cut is t going down straight, one part of the ll being cut deeper than the other. is is remedied by giving the shank a ht blow with a hammer or else pressg the shank over by tightening the set rews in the side posts. In managing e tool and handling the calipers there a considerable difference between the ll turner and the machinist. The latr, in beginning new work, sets his lipers a little larger than the finished ze that is wanted, and feeds the tool tached to the slide rest into the work hand, calipering with a set-spring lipers until he has the desired size. en he connects the slide rest with the ad-screw and the tool is then dragged leways along the work, cutting upon e side and point. The V's on the lathe sure that the work is turned straight. ork on a machinists' lathe is always ghtly out of true circular form, no atter how fine the feed is. This is due the cut being dragged sideways bere it runs out. The machinist when ing work with his calipers generally has a heavier touch than the roll turner. The latter handles his calipers so as to just feel the roll; this is called a "feather-touch," and it is essential to good roll turning. The roll turner does not set his calipers to the desired size, he being obliged to follow the cut down by knocking the calipers gently until it touches the roll lightly; he then tries the feel of it on the part of the roll opposite to the one touched. This shows him whether the tool is cutting straight or otherwise. In order to keep the cut going straight, the groove requires to be calipered often, as the roll turning tool shifts slightly which is due to the wedge and the pusher action; the latter moving off the centre of the tool and the former loosening slightly as the tool is fed into the work. When the groove is within 1-32 of an inch of the finished size wanted, the workman takes out the roughing tool and puts in the finishing one, which is very sharp; he takes a light cut and allows it to run out when the groove will be found to be accurately round.

In turning the necks or journals for rolls, the housing, rest and driving box and spindle are removed from the lathe. A centre is put in the hole in the face plate; the tail-stock containing its centre is put in place on the bed of lathe and bolted down. The roll is centered and the holes bored in both wobbler ends to match the angle of the centres. A driving dog is slipped over the end of the wobbler next to face-plate, its bent ends pressing against lugs cast in relief upon the face-plate. This drives the roll when it is on the centres. The tool rest for necking is a casting about two feet wide, having the usual slots and holes on its top as previously described. The rest is of sufficient length to go across the bed of lathe, the height being such as to allow the tool to be one inch below the centre of roll, which gives the cutting power to it. A machinists' lathe tool can cut on the centre, and above or below it. Roll turners' tools will not cut on a centre line of the roll, nor above it, but always have to be placed below the centre. Machinist lathe tools operate with a true cutting action as contrasted with roll lathe tools, the latter cutting with more of a scraping action, hence the necessity to use them below the centre line. The power required to run roll lathes varies with the weight of the roll, the width and angle of tool used and the material turned such as cast iron, semi-steel, steel and chilled iron rolls, also speed of lathe and thickness metal removed. Using a 3½ inch wide tool and taking as heavy a roughing cut with ordinary high-carbon tool steel as the metal will stand, it was found that 7½ h.p. was required. Taking a finishing cut with the same-sized tool 3¼ h.p. was needed. These results were taken from actual tests made by the writer and were given by means of electrical measurements, the lathe being driven by an electric motor of 15 h.p. The roll diameter being 26 inches, a cast steel roll being used for the test.

Heavier cuts can be taken on cast iron (called sand rolls) than on steel rolls. This is due partly to the tougher and harder nature of the steel which in the thick diameters is not as well annealed as it might be. Steel also exerts a "drawing-in" action on the tool, the latter being dragged into the roll metal while the turning is being done. When a heavy cut is taken, the roll continues to draw the tool in until the latter has over-reached its cutting capacity; then the weight of the roll comes on the tool, bending the prop under it and breaking the tool. For this reason it is not advisable to take too heavy cuts in turning steel rolls. It must be understood that the above-mentioned width is not the widest tool that can be used on roll lathes, various sizes being used. The width of the tool also depends on the method of driving the lathe—whether belt or direct driven. Some belt-driven lathes having all they can do to pull a cut 6 inches wide, steel for roll turning tools should be very high in carbon, 1.50 per cent. making fine tools. This, however, must be heated very carefully by the blacksmith so as to avoid burning; a cherry-red is the highest that it will stand. When rightly heated and hardened it gives fine service, and takes a good sharp edge. High-speed steel is not used for turning rolls to any extent on account of its price, as roll turning tools require more metal in them, which makes them more expensive than the ones used on machinists' lathes. But it would seem that there is a brilliant future for using high-speed steel for roughing down work on all metals except chilled cast iron, providing that a satisfactory method of welding the metal to a bar of ordinary steel can be found, as only a small piece of the high-priced material would have to be used.

The writer had a test on roughing down work using high-speed metal for turning a steel roll, the tool being a solid bar of the steel ground to shape and hardened in an air-blast. Using the fastest speed on a modern roll lathe, it was found possible to take a far heavier cut than the best ordinary metal would stand; the chip being the color of a blued watch spring. The test also showed that the roll lathe pusher screw should have a coarser thread, as it required a large amount of quickness and brute force to sustain such heavy cuts. High-speed steel was tried out on a chilled cast iron roll, but the edge lasted for only one revolution of the roll. Rehardening did not make any difference in the results, it being concluded that this metal is unsuitable for turning chilled rolls. However, for ordinary work, the writer likes high speed steel, both for roughing and finishing work, there not being so much grinding tools for roughing down as the ordinary variety needs.

STRENGTH OF PLATES AND RIVETS

(Concluded from Page 415)

The diameter of bar which will have the same area as the net area of the plate.

The thickness required in a plate having more holes than another, but to have the same net area.

The load which any of the above will carry at either of the two stresses.

Chart for Net Strength of Plates and Rivets

Designers Working Out Connections for Tension and Compression Members Which Have to be Connected With Gusset Plates, etc., Will Find This Chart Very Useful in Making Their Calculations

By John S. Watts

THE accompanying chart will be found useful in working out the connections for tension and compression members which have to be connected by gusset plates, and for such cases as brake straps to which have to be riveted the forged end connections, or, in fact, any case where we have to make a riveted connection to carry a given load.

In the solution of the above problems, the width and thickness of plate required is dependent upon the number and size of rivets adopted, and the problem cannot be solved directly, but generally involves a series of calculations on the cut-and-dry method, which is a tedious and time-consuming one.

By using the chart, we can see at once all the possible combinations, and quickly choose the most convenient one.

To use the chart, simply follow along the horizontal line for the load required at the allowed stress. For a dead load, the stress may be taken as 16,000 pounds per square inch, and 12,000 pounds for a live or intermittent load. The foregoing are the tensile tresses on the plates, for the rivets take 12,000 and 9,000 pounds per square inch, respectively.

The width of plate required for each thickness, to carry the load, can then be scaled off at the bottom of the chart by dropping a vertical line from the intersection of the diagonal line for the thickness and the horizontal load line to that line marked for the diameter of rivet called for by the chart.

The total width of plate required is that length from this vertical line to the intersection of the lines for the number and diameter of rivets (that is, the number of rivets in the first line of rivets) called for, scaled from the chart with a half-size scale.

For example, we will take the design of a brake strap and forged end connection to take a pull of 20,000 pounds at a stress of 12,000 pounds per square inch, the general design being as shown in Fig. 2.

In this case the width of the plate is already decided by the width of the brake surface required, and we will assume this to be six inches.

Now drawing the horizontal line at the height representing 20,000 pounds on the 12,000 pound stress scale, shown by the dotted line in the chart, we see at once that 5-16 inch is the thinnest plate that will give the required strength.

For flexibility the brake band should be made as thin as possible.

The plate, then, being 5-16 inch thick, the chart shows that the largest rivet we can use in single shear will be 11-16 inch diameter of hole, and that six of these rivets will be required.

The chart gives us the choice of other sizes of rivets, but to use smaller rivets and more of them would be of no advantage, and larger rivets would not, in a

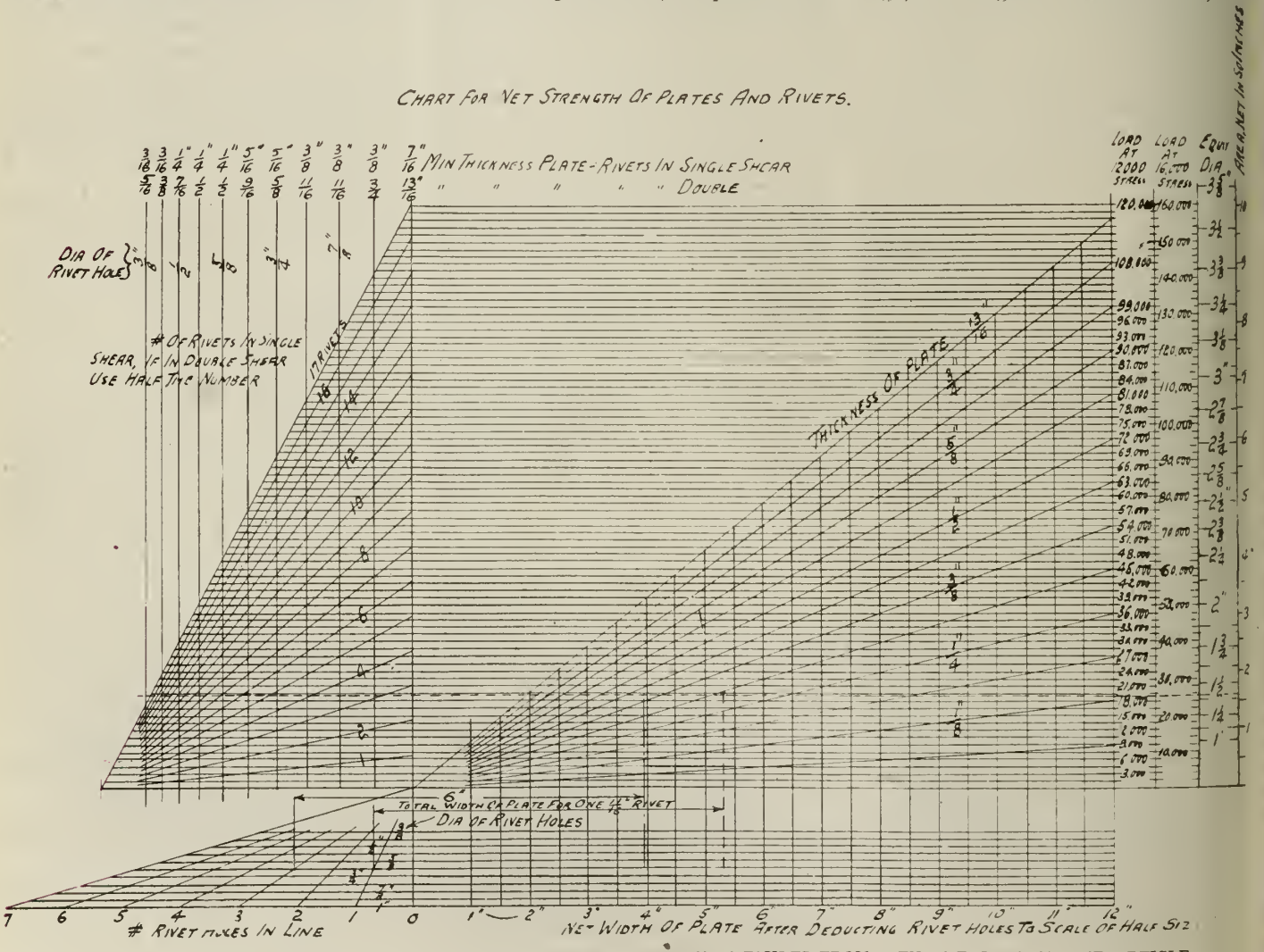


CHART FOR NET STRENGTH OF PLATES AND RIVETS.
MIN THICKNESS PLATE - RIVETS IN SINGLE SHEAR
" " " " " DOUBLE
DIA OF RIVET HOLE
OF RIVETS IN SINGLE SHEAR, IF IN DOUBLE SHEAR USE HALF THE NUMBER
THICKNESS OF PLATE
LOAD AT 12000 STRESS
LOAD AT 16,000 STRESS
EQUIV DIA
AREA NET IN SQ INCHES
TOTAL WIDTH OF PLATE FOR ONE 1" RIVET
DIA OF RIVET HOLES
RIVET HOLES IN LINE
NET WIDTH OF PLATE AFTER DEDUCTING RIVET HOLES TO SCALE OF HALF SIZ

A STUDY OF THE CHART IS ESSENTIAL IF YOU DESIRE TO OBTAIN THE BEST RESULTS FROM THE READING OF THE ARTICLE.

5-16 inch plate, develop in compression their full shearing strength.

Checking back, by measuring the width of the plate, six inches from the intersection of the 11-16 inch rivet line and the diagonal for one rivet, we find that the six-inch width is slightly more than is required, but that two rivets in the first row would reduce the strength too much. We, therefore, space the rivets, as shown in Fig. 2, with one rivet only the first row, two in the second, and three in the third.

At the end of the strap, then, we have a line which has three rivets on it, and, as this line is the one on which the forged end would tear apart, the forging must be increased in thickness here to give the same net area as that of the plate after deducting the rivet holes.

The required thickness is found on the chart by measuring back six inches from the intersection of the 11-16 inch rivet line and the diagonal line for three rivets and raising a vertical at this point, when we find that the required thickness is 7-16 inch.

At the extreme right-hand side of the chart, we find the diameter of the forged end will require to be 1½ inch, to have the same area as the plate has after deducting the rivet hole.

If it should be desirable to use some other stress than the 12,000 or 16,000 pounds used in the chart, it can be accomplished by taking for the load

$$\frac{\text{the actual load} \times 16{,}000}{\text{stress.}}$$

A description of the method of laying out this chart will make the user more familiar with its use and convenience, and is as follows:

First, we lay off the horizontal line for the base of the two triangles, the triangle to the right having a base line twelve inches long drawn to half size.

The vertical line for this triangle is made 13-16 inch high, to a scale of 3-8 inch = 1-16 inch, division being marked to indicate each 1-16 inch thickness of plate to the same scale, and drawing diagonal lines from each point to the end of the base line, as shown.

On the base line, points are marked representing the widths of the plate in half-inches up to twelve inches, and vertical lines drawn at each point.

It is obvious now that the height to the intersection of any thickness line, with any width line, will be proportional to the area of a plate of that width and thickness (without rivet holes), and hence, proportional to the load it will carry with any given stress.

This being the case, we can calculate the safe load on the maximum size of plate, viz., 12 inches by 13-16 inch, and divide up the vertical line to show that load at 12,000 and at 16,000 pounds stress.

Coming now to the triangle at the right, we calculate the load that can b carried by from one, to seventeen, one inch rivets at 9,000 pounds stress in single shear. Marking these points on

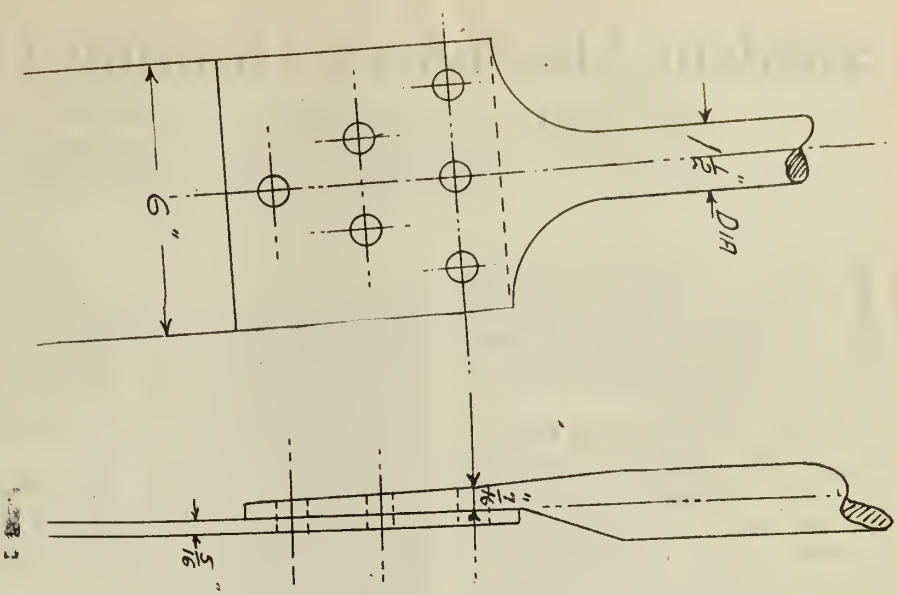


FIGURE 2.

the vertical line of the left-hand triangle, as shown, using the scale for the 12,000 pounds stress on the plate, which is the stress used, when using 9,000 pounds stress on the rivets.

This means that the rivets will, in all cases, according to the chart, be stressed at 75 per cent. of the stress in the plate; or, if the stress in the plate is taken at 16,000 pounds, the stress in the rivets at 75 per cent. of the stress in the plate; is stressed 12,000 pounds, the rivets will be stressed to 9,000 pounds in shear.

The base of this triangle is made to scale, the lengths marked being equal to the squares of the diameters of the rivets, to any convenient scale. This, because the strength of the rivets in shear varies as the square of the diameters. This is accomplished in the chart by taking the diameters of the rivets in eighths, i.e., the one inch rivet is 8⅛ inches, and $8^2=64$; therefore, the length of the base is 64 units long, to a scale of ⅜ inch=12 units in the chart, and the other points are marked in the same way.

Now we join the seventeen points on the vertical line to the end of the base line, and erect vertical lines on each point marked for the diameter of a rivet. The height to the intersection of any diameter line and any "number of rivet" lines will clearly be proportional to the load that can be carried by that number and diameter of rivets, and will be the load found marked at the right under the stresses 12,000 and 16,000, but the stresses on the rivets will be respectively 9,000 and 12,000.

As already shown, we have at the base of the right hand triangle, the net width of the plates, to which must be added the width taken up by the rivet holes, to get the total required width of plate.

To accomplish this, the lower left-hand triangle has been added, the vertical of which triangle is made one inch high, for the diameter of the largest rivet, and divided up into sixteenths to denote the smaller diameters.

The base is made 7 inches long, to the same scale as the base of the right-hand triangle, namely, half-size, and diagonal lines drawn to each one inch division. It follows, then, that the length of any horizontal line to its intersection with any diagonal "number of rivets" line, is equal to the diameter of the rivet multiplied by the number of rivets represented by the lines intersecting at that point. Or, in other words, is the width to be added to the net width of the plate to cover the amount cut away by the rivet holes.

We can, therefore, scale off the total length of any plate, by measuring the length from the net length required, as given by the vertical from the load and thickness intersection to the point where the lines representing the number of rivets and diameter of rivets intersect.

At the top of the diameter of rivets lines, note has been made of the least thickness of plate, which will develop in compression, at a stress of fifty per cent. more than the tensile stress, the full strength of the respective diameters of rivets in single and in double shear.

As the chart is made up for rivets in single shear, only half the number of rivets called for by the chart will be necessary, if the rivets are in double shear.

To summarize, the chart will show, given a certain load,

The number and diameter of rivets required at either 9,000 or 12,000 pounds stress, in single or double shear.

The minimum thickness of plate at which these rivets will carry the load at either 18,000 or 24,000 pounds bearing stress.

The width and thickness of plate required to carry the load with one to seven rivet holes from ⅜ inch to one inch diameter, at a stress of 12,000 or 16,000 pounds.

The net area of the plate after deducting the rivet holes.

Continued on page 413

Canadian Machinery Drafting Course—Part XIII

We Next Go Into the Design of the Swivel Base—Students Are Given Two Views, the Third to be Completed From the Information Given on Plate and Text Matter

—By J. H. Moore

HAVING completed the drawings for the vise—in as far as the actual working parts are concerned, we will next take up the problem of drawing the special swivel base as shown on the present plate.

For ordinary straight milling machine work this base would be unnecessary, but when one might desire to set the work at some particular angle, the swivel base would be very essential.

In order to make their vises useful for varied classes of work, manufacturers adopt different ways and means of designing them. Some are equipped with a tilting arrangement in addition to the horizontal swivel movement, but this type of vise is seldom used for milling machine work, but more generally on drill presses. As a rule, a vise similar to what has been already drawn by the student, is the type adopted for milling machines.

The practice which the student has already experienced on the previous plates should stand him in good stead in the present instance. We would strongly advise that frequent reference be made to the previous plate when preparing this one in order that every student be absolutely sure why he is drawing the base as it is shown.

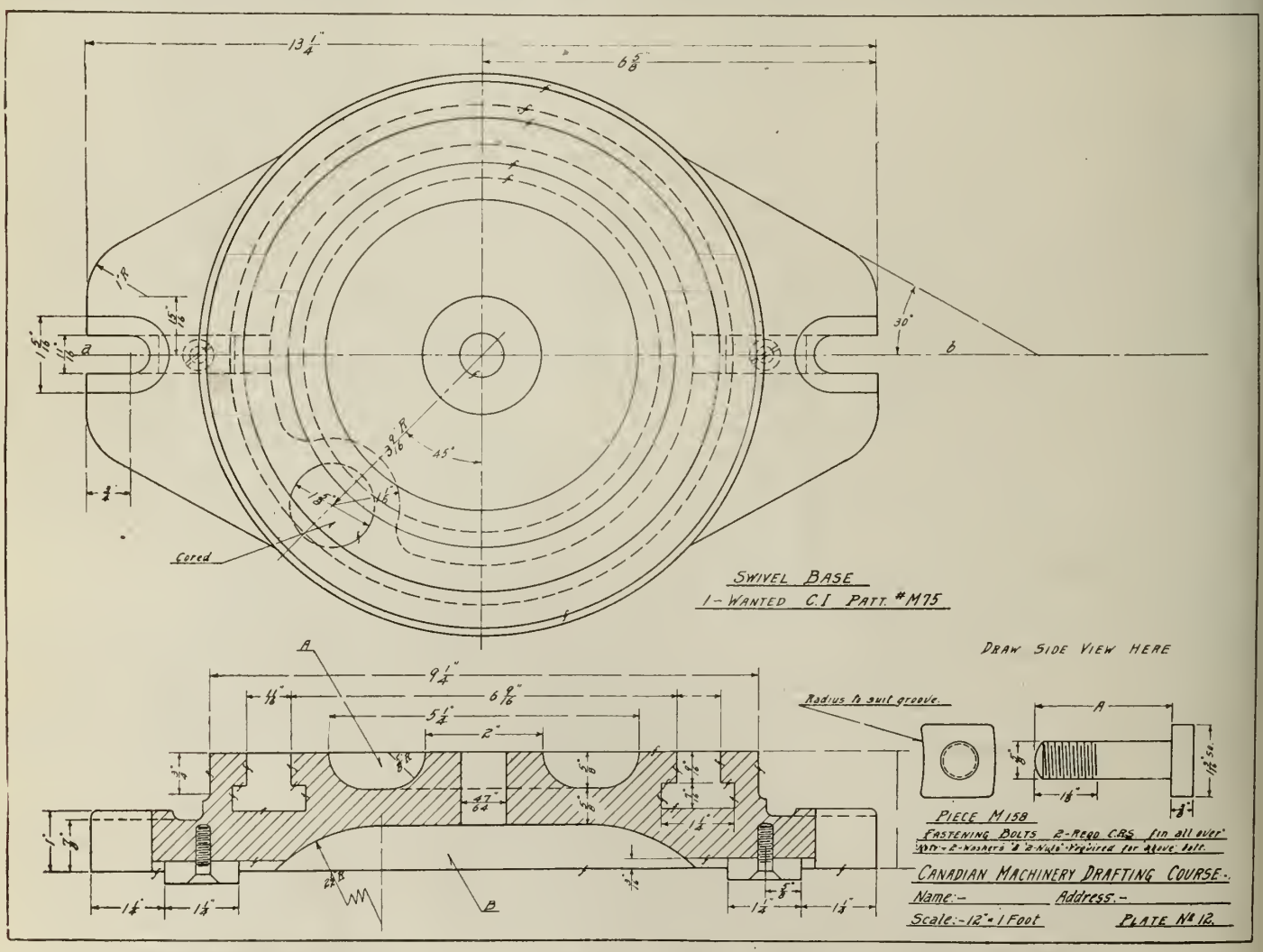
Straight copy work is not time study. The basic principle must be kept in mind and before a line is drawn the student should spend at least ten minutes discussing in his mind the whys and wherefores of the plate.

In preparing the plate, it would be well to keep in mind the fact that in actual designing it is not always possible to complete one view without partially completing another view. In other words, in actual designing, it is often found necessary to partially draw (say, a side view) in order to project up certain opertions of this view to the plan.

Another point to be borne in mind is that a safe place to start from is the centre lines. For example, let us consider the present plate. An ideal spot to commence work on this plate is at the centre line intersections of the plan view. From this point one can work along without any difficulty. For the purpose of ascertaining how students are progressing in what might be termed good judgment in arranging of views, we will state no particular size for this plate. The only stipulation that we make is that all the views must be drawn full size.

No doubt student can readily grasp the use of this base, and can understand why the circular Tee slot is necessary and so on. Briefly, the base rests on the miller table, and is kept in line longitudinally by the ⅝ inch wide tongues on the bottom. These tongues go into the Tee slots on the miller table. This naturally lines the base up.

Directly on top of the 9¼ inch diameter portion sets the regular vise. On



REMEMBER THAT THE BEST WAY IS TO START ON THE PLATE AS SOON AS YOU RECEIVE THE COPY.

referring back to the previous plate it will be noticed that the straight base of vise had two lugs cast on it which were 4⅝ inch radius from the centre, or in order words, an equivalent to 9¼ inch diameter. This means that the 9¼ inch portion on the straight base matches with the 9¼ inch portion on the swivel base.

The holding down bolt shown at Fig. 2 (and of which there are two), goes into the circular Tee slot in the swivel base, projecting up through the base, and into the two slots shown on the straight base. The idea is self-apparent, for by slackening off the two bolts, the vise can be swiveled to any desired angle, then immediately locked in that position. To get these bolts into the Tee slot looks perhaps to the tyro a ticklish proposition, but the solution is easy to the initiated. A 1⅝ inch hole is drilled up from the bottom of the base, and a wall of metal, as shown by the dimension 1⅛ inch radius run around this hole. The bolts are so made that their extreme measurement from corner to corner of head is less than 1⅝ inch, which allows the bolts to pass through this hole up into the Tee slot. Once in place the rest is easy.

It will be noticed that the bolt heads are made with a radius similar to the radius of the Tee slot. This, of course, is absolutely necessary when one considers that the bolts must travel around in the circular Tee slot. The depression marked A is merely a method adopted of relieving the metal in order that unnecessary machine work be eliminated. When a machined face is of undue and unnecessary width, there is a great chance for the surface not being absolutely straight, which would, of course, show up on the portion resting on it. The outcome would be a rocking motion between the surfaces, causing inaccuracies, which later would mean spoiled work.

This is a point often forgotten by many designers, so that we mention this as a hint and as a good-natured warning to those already following the drafting profession. Always be sure to give enough bearing surface BUT give only enough. Any more than enough is needless machine work and a chance for error.

The same principle holds good for the depression B. Not only is this relief made to eliminate unnecessary machining, but it is so designed to reduce the weight of the vise as well. Depressions in this way accomplish a double purpose, and as students proceed further on in the course they will realize more and more their value.

Having pointed out these few items, let us proceed with the drawing of the plate.

Starting at the plan view, first draw your two centre lines. Having done so, proceed to describe your circles. It is optional which you draw first, but this is the method the writer would adopt personally. He would first describe the 9½ inch circle, which is the extreme width of the base. Next would come the 9¼ inch circle representing the diameter at the top finished portion. Now would come the 6 9-16 inch circle to the inside upper edge of the Tee slots, after which he would draw another circle 1⅜ inch diameter larger. This circle would, of course, represent the outside upper edge of the Tee slots, as twice 11-16 inch widths equals 1⅜ inch.

Next in order would come the 5¼ inch circle which is plainly visible to the eye on the plan view.

The next step would be to draw the dotted or hidden circles. As the Tee slot is 1¼ inch wide at the bottom, this means that it is ⅝ inch from the centre of the T slot to either edge of the bottom of slot. Figuring from this, we have the following: 6 9-16 inch, the dimension to the inside upper edge of slot, plus 11-16 inch, which means the width of the slot, we have 7¼ inch centre to centre distance to the Tee slot. Deducting 1¼ inch from this, we have 6 inch diameter for the inside lower edge, and adding 1 inch we have 8½ inch to the outside lower edge. This means that the one circle has to be 6 inch and the other 8½ inch.

Having completed these circles, we next draw the relief depression B. As this is plainly marked 7 inch, proceed to draw this circle, but watch out for the point when the 1⅝ inch hole is marked. This hole comes at 45 degrees from the centre lines as shown, and is 3 9-16 inch from the centre point. Draw the hole in place, describe also the 1⅛ inch radius, and join this radius to the 7 inch circle by small ½ inch radii.

Next let us draw a faint line 6⅝ inch on each side of the vertical centre line. Coming in ¾ inch on the horizontal centre line from these points, we can next draw the 11-32 inch radius, and 21-32 inch radius, joining these by straight lines as shown on plate. This represents the shape of slot and outline of boss for the table holding down bolts.

Going up and down 15-16 inch from the horizontal centre line we next proceed to describe the 1 inch radii shown, joining these curves to the 9½ inch diameter portion by straight lines. This completes the outline of the base. The next and last step is simple. 5-16 inch from each side of horizontal centre line describe line to represent the hidden slot at bottom of base.

Draw a vertical line 1¼ inch in from each end, also one 2½ inch in from each end, these two lines representing the outline of the two tongues. Central with these two outlines describe the outlines of the flat head screws, and in case students are not familiar with the dimensions of a 5-16 inch flat head screw, the following sizes are the usual standard adopted. Diameter of bolt, 5-16 inch; diameter of head, 7; the length of head, ? This completes the plan view, so next we will proceed to the side view, which for clearness is given in section form.

In commencing this view the value of projection must first be remembered. Proceed to draw down from all points thin faint lines. Before drawing these lines a good plan is to determine the actual location of your view, that is what space you propose leaving between your views.

For example, suppose we decide to leave 1¾ inch between the top line of side view and the edge of the 9½ inch circle on plan. Having decided this point we draw a line as long as we think necessary, then measure down from this line the complete depth of the base, in this case, 2 inch. We now draw this line in similar manner. Having done so we have actually decided the limit points of the projection lines, and saved ourselves a good amount of unnecessary erasing at the finishing up of our plate.

After projecting down the various vertical lines, we proceed to measure the sizes shown on the side view, drawing in the various points.

For example, suppose we again start from the centre line and work out. Having projected the 2 inch and the 5¼ inch dimensions down, let us join these points with a ⅝ inch radius. As our centre point for this radius is shown to be on the upper line of the base, this means that the depression is ⅝ inch deep. Next, we can construct the Tee slots. Measuring down 9-16 inch and 7-16 inch, we soon complete these points.

We can now proceed to come down ¾ inch on the 9¼ inch portion, and at this point describe a ⅛ inch radius to meet with the 9½ inch portion. This point showns where the machined portion of the base ends. The laying out of the feet of the base could come next, and this is so simple that no comment is necessary.

We can next draw the lower depression B. The diameter inch is, of course, projected from the plain view. We might say at this point that some students will be apt to say: "Oh, hang the projection! We can measure it 3½ inch on each side of the centre line," but this is not the correct method. Learn to use your knowledge of projection for you will require it later on. Always remember the fact that in designing, a good knowledge of projection is absolutely essential.

Referring once more to the depression B we see that this portion is ¾ inch deep, but that a 2½ inch radius is described to join the horizontal line. Students can readily accomplish this without trouble. Lastly, draw in the tongues, their screws, and the outline of the tongue slot.

This completes the view, with the exception of the section lining, and as the material is grey iron, the lines are single, and about spaced as shown. Some drawing offices order their section lining closer, but we do not wish to give students undue work, and the style shown on plate will be o.k. Remember, of course, that the plate illustrated is much reduced in size, so allow for this fact. About ⅛ inch between lines will be splendid in every way.

The Principle of Sectioning

In order that students thoroughly

grasp the idea, and fundamental principles involved in the art of sectioning, we will devote a short time to the discussion of this subject.

There is no hard and fast rule regarding sectioning. From this we do not mean to infer that no standard practice is followed out. A standard style of sectioning IS followed out, but should one wish to deviate from one section line and jut over to another, this is permissible.

The section shown is one taken through a straight line, in this case the centre line, but this is done simply because it so suits our purpose. For example, suppose this base had been more intricate in character, and that we had desired to show up certain portions of it in section.

Some of these portions happened to be on the centre line, while others were not. What could we have done? We could easily follow out two plans. Either make two sections or a partial section on the centre line as far as we desired, then jut up to the other desired point and proceed as usual. To illustrate where we had taken the section, we would have drawn a line showing the path taken by the section, which brings us to the point of "What is a Section?"

About as simple an explanation that the writer has ever heard is as follows: Suppose the object (no matter what it be) is made of wood. Let us further suppose we desire to see what this object looks like in section along a certain line. Let us mark on the object the line through which we desire a section.

Now let us suppose that we take a saw and cut through the object along this line. Having cut through, let us take up the object and examine it. Where the saw has cut through the material you will see saw marks, and where no material exists (such as holes) you will see no saw marks. Section line the parts touched with the saw and you have your section. This principle we believe is so simple that every student will grasp the idea. Let us consider the section shown on the present plate and imagine that we started to saw through the plan view along the line a—b.

First, our saw didn't touch any metal till it reached the end of the holding-down slot. Now we proceeded to not only saw a portion of the base but also into the tongue at the bottom, also right through the flat head screw. Shortly after this point our saw entered the T-slot and of course had no metal to come in contact with. Next we struck another part of metal and suddenly we entered both the top and bottom depression. The only metal encountered with at this point was the centre web, which gradually thickened around the centre boss. The other side of the centre line was of course a reversal of the side already described. Believing this thoroughly describes the principle of sectioning we will pass on to the subject of the side view.

The Side View

This is the point where the student has a chance to shine and show his knowledge. Having given the plan and sectional views, we feel that the student with the practice so far received, is no doubt competent to draw this view unaided, so that we have left the view blank on our plate, merely stating: "Draw side view here.

Relative to this view we can only add, take lots of time, project your various points across, and study the various details before completing the view. This will be good practice for you, at the same time showing us how you are progressing. The fastening bolt drawing is so simple that no comment is necessary.

As final advice on this portion of our course we would like to emphasize the danger of copying our plates without first studying the principle involved. Do not be in a hurry for we will not judge any future plate until one month from date of issue.

This plate will not be judged until one month from present date. We do this in order to give everyone a chance to complete the plate. We have students in Vancouver, Chicago, St. Louis, New York, New Glasgow, in fact at all corners of the country. We want them all to have a chance, so go it every one of you and show us that you are following our instructions.

We call students' attention to the fact that the original plate shown in this lesson was drawn, not by the writer, but by another member of the staff. This was done to illustrate the different styles adopted by different draftsmen, and students will, upon investigation, find various differences regarding the placing and arranging of arrow-heads, etc. It will pay readers to compare the two styles, for, by so doing they will learn that individuality counts a great deal in the preparing of any drawing. Be natural above all else and do not try to copy anyone else's style.

Interesting Facts to be Found in This Week's Advertising Section

That a belt was sometimes used for harness.
How to secure information on any machine tool that interested me.
A clutch that saved space and power.
Where to use die castings to advantage.
The place to use small compressors.
What to try if I found a leaky screw thread joint.
How to clean castings, forgings, or stampings quickly and economically.
How to use oil gas for heat.
That better tools make better workman.
How to true emery wheels.
That if I had a cleaning problem, I need not worry, for there was a firm would solve it for me.
How I could rectify slight defects in castings.
A jack that could lift 100 tons with ease.
How you judge an emery wheel.
What to do if I required special machinery.
How electric drills and grinders save money.
A machine that spins a polished rivet every sound without noise.
How to go about securing a patent.
A material that gets tougher, harder, and more lasting the hotter it gets.

ANGLE OF VEE

The generally accepted rule for bevelling the edges of pieces to be welded is to cut each side at an angle of 45 degrees, thus making the included angle of the groove about 90 degrees. It would be incorrect, however, to state that the angle should be invariably 90 degrees, without qualification. While it is true that the 90-degree angle gives the best average results, and the welder should always aim to maintain this angle at the point of fusion and welding, this does not necessarily mean that, when preparing a heavy broken casting the included angle should be 90 degrees from the bottom up. On the contrary, it would be a mistake to bevel the edges of a casting 4 ins. thick so as to produce a 90-degree groove throughout. It would mean waste of gas, adding material and time, and no better result than could be produced if the sides were cut at an angle of, say, 80 degrees, thus producing an included angle of 60 degrees. The bottom of the V can be maintained at the proper welding angle very readily and all the advantages of the 90-degree groove secured. A curved effect is even better, as the sides can then be made practically parallel at and near the top. So long as there is room in the groove for the welder to manipulate the torch and to see what he is doing, that is sufficient. The rule, then, should be to cut the bevel with the object of providing sufficient room for manipulating the torch, and no more. The rule providing a 90-degree angle for the groove applies correctly only in comparatively thin metal when the thickness is not sufficient to warrant any great amount of trouble being taken in bevelling the sides to save metal.

INTERESTING CATALOGUE

The Bellevue Industrial Furnace Co., Detroit, Mich., have, in their catalogue No. 4, a book that should be in the hands of all interested in the treating of steel.

Various style furnaces, ovens, blowers, testing kilns, tire heaters, pyrometers, etc., are fully described and illustrated. There are 88 pages to this book, and all cram full of information. A copy of this catalogue will be sent up on request.

The Albert Herbert, Ltd., Coventry, England, have placed on the Canadian market through their branch at 21 Yonge St., Toronto, their line of patented concentric chucks.

These are made in six sizes from 9 in. to 25 ins. diameter, and embody many features of interest. We intend showing this chuck in detail in a later issue.

WELDING AND CUTTING

Lessons on the A.B.C. of Good Welding

This is the Second Lesson by an Authority on the Subject—The Remainder of the Series Will Follow

By W. B. Perdue*

HAVING familiarized himself with the muscular training necessary to proper manipulation of the welding torch, the beginner is ready to learn how to properly adjust welding or neutral flame.

The muscular and other training exercises should be continued unceasingly, as only by patient and persistent practice can perfection be attained. These exercises will be explained in every detail to the degree that the only excuse for failure will be the lack of will to continue the practice; or, in rare cases, physical or mental deficiency.

It is absolutely essential that the welding flame be accurately adjusted and kept so. Not one welder in fifty knows how to do this. The pressure tables furnished by some makers of welding equipment are at best misleading. The only real welder is the one who can pick up a torch of a type that he has never seen or used and instantly adjust the flame in such manner that no excess pressure will be carried on the oxygen line, thus insuring the best results obtainable from the torch used.

Acetylene Needed

It should be emphasized that acetylene is the fuel gas, and that it requires a certain definite quantity of acetylene to produce a certain definite amount of heat. Proper regulation of the flame depends, therefore, upon first passing through the torch the correct volume of acetylene, and afterward adding to it an exactly equal volume of oxygen. Any attempt on the part of the operator to draw in an increased amount of acetylene by means of excessive oxygen pressures is tantamount to an admission on his part that he is unfamiliar with the principles of combustion. In such cases the temperature of the flame is actually lessened. The excess gases are in all such instances entrapped within the weld, which cannot be other than unsound.

*Director Welding Department, Healds Engineering School, San Francisco, Cal., also manufacturer of Perfectype acetylene generators, torches, and regulators.

Further consideration of the above facts, and further study of the principles of combustion, should convince the student that he must, without further delay, master the rules which govern the regulation of the welding flame; that any excess oxygen or acetylene passed through the flame is ruinous to good welding; that even the trained operator cannot make a sound weld with inferior apparatus which does not properly stir the gases together; and that, for his own protection, he must be able to make the tests necessary to determine the efficiency of his apparatus.

Process of Regulation

Having set up the welding station and noted that the valve on the torch marked "oxygen" is closed, the operator will open the torch needle valve marked "acetylene" one-half turn.

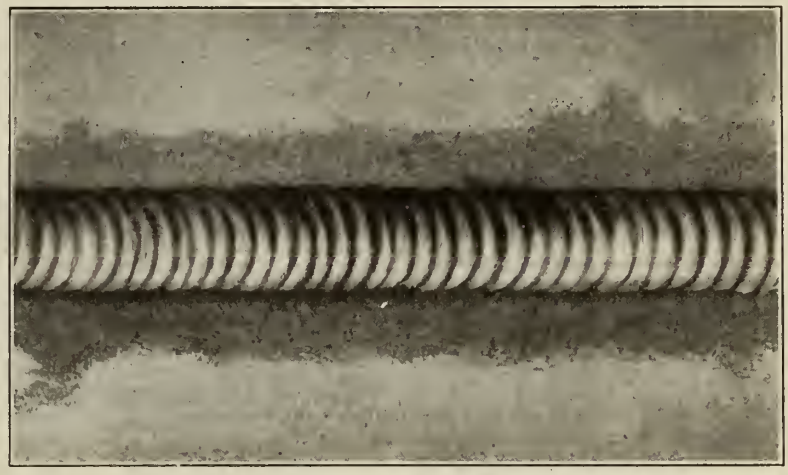
He will then turn the pressure regulating screw of the acetylene regulator to the right until the acetylene begins to flow through the torch. When sufficient gas has passed through to expel the air from the hose, the torch is lighted, after which the pressure is increased until the flame ceases to give off smoke.

This, of course, indicates perfect combustion. It is imperative that the volume of acetylene passing through the torch be sufficient to cause this perfect combustion, and that, having secured the proper volume of acetylene that it shall not be increased either by turning on a greater pressure at the regulator or by sucking in an increased amount by means of excessive oxygen pressures.

Relighting of Torch

Regulating the pressure in this manner enables the operator to extinguish and relight the torch and instantly secure the proper acetylene flow by opening the needle valve one-half turn.

With just enough acetylene flowing through the torch to prevent the flame from giving off smoke—no less, no more—the operator will open the torch needle valve marked "oxygen" two half turns (one full turn), or twice as wide as the acetylene needle valve.



A VIEW OF A RIPPLE WELD MADE BY A STUDENT.

He will then turn the pressure regulating screw of the oxygen regulator to the right until the yellowish flame (called the reducing or carbonizing flame) blends with, but is not entirely removed from the clear-cut white cone. To entirely remove all trace of this yellowish flame produces an oxidizing flame. To leave it too much in evidence produces a carbonizing flame.

It sometimes happens that the acetylene flame is blown out when the oxygen is turned on. Opening the acetylene needle valve to a certain predetermined point enables the operator to partially close this valve until sufficient oxygen has been turned on to heat the flame, then open it to the proper point, and af-

terward make the final adjustment of the flame with the oxygen needle valve.

With extremely large tips, it may be desirable to open the acetylene needle valve more than one-half turn. In such case the opening of the oxygen needle valve need not exceed one and one-half turns.

Proof of Regulation—Tests of Torches

To prove that this is the correct adjustment of the flame take a torch and, having adjusted it as above described, bring the outer end of the white cone down until it barely touches a piece of steel or iron, imparting to the torch the proper motion used in welding. The metal will melt and the surface will have a mirror-like clearness, but no reddish bubbles will appear beneath the surface. nor will the metal begin to froth or foam so long as proper motion is given the torch.

Then diminish the oxygen supply and reddish bubbles will appear just at the surface of the metal. This shows that the carbon from the flame is entering the melted mass. Carefully note this phenomena. In welding it indicates that the flame is carbonizing; that the tip in use is too small for the job, or that a larger area of metal in the vicinity of the weld must be brought to a cherry-red heat.

Readjust the flame and melt another spot, this time increasing the oxygen supply. This increased oxygen supply may or may not suck in an excess of acetylene and cause the flame to become carbonizing. At any rate it will cause the surface to become covered with froth or foam—the indication of the oxidation or burning of the metal. This phenomenon should be noted and carefully avoided while welding.

The burning of the metal produces heat, which, in turn, increases the fluidity of the metal in the vicinity of the weld. A weld—if such it may be called—can thus be executed with great rapidity and with a spectacular display of flying sparks. Many self-trained operators honestly imagine that this burning process actually makes a dependable weld. A few bending tensile or acid tests of their work will reveal to them the fallacy of their opinions.

Next take an inferior torch and make the same tests. Observe that the metal continues to absorb carbon long after every trace of the yellowish flame has been removed from the cone. Also observe that the metal froths and begins to burn long before the yellowish flame is shortened down and merged with the outline of the cone.

When using low-pressure injector type torches, which cannot be regulated by the methods just described, these tests are particularly valuable. With this equipment it is advisable to open the acetylene needle valve on the torch twice as wide as the oxygen valve and then secure the neutral flame by adjusting the pressure at the oxygen regulator.

Tests vs. Theories

These tests prove the theory advanced many years ago to the effect that "The freedom of a flame from being carbonizing and oxidizing is not necessarily indicated by the clear outline of the cone, which merely indicates that all the particles of oxygen and carbon that come together are burnt, but free particles of each may, with some torches, pass through the flame into the molten metal, which is thus injured and gas wasted, even though the theoretically correct proportions of the two gases are being supplied."

These tests also substantiate the theory that "Perfect combustion within the zone of the welding flame becomes possible only when the atoms of acetylene and oxygen are brought into intimate contact with each other. This in turn becomes possible only when the gases, in theoretically correct proportions, both under their own independent pressures, are driven and combined together; and, after being thoroughly stirred are brought without convulsive motion and without excess pressure through the orifice of the tip to produce the welding flame."

For practice secure a quantity of steel or iron in strips from 1-16 to ⅛ inch in thickness. Practice on this material should be continued until the operator is able to produce a fairly even "ripple" twenty-four inches long on the surface of the metal. The position of the body should be as erect as possible; the left hand should be encouraged to follow the motion of the right; and the right foot should be placed slightly in advance of the left.

Having mastered the "ripple" the operator should commence practice with the rod, assuming the position shown in Fig. 3. The rod is given the same oscillatory movement as is given the torch (Fig. 2).

It will be noted by reference to Figs. 2 and 3, the flame impinges upon the sloping portion of the built-up metal in the weld It is particularly important that the flame be kept in this position and that the sides of the weld shall be in thorough fusion prior to the addition of the welding rod. It is equally important that the work be finished while heated, as any attempt to go over and "smooth up" the work afterwards will result in injury to the part reheated.

Nothing will be gained by any attempt to produce an actual weld before the operator is able to produce a neat ripple on the surface of the metal following a straight line twenty-four inches in length.

There is a tendency with beginners to experiment with various kinds and thicknesses of metal, all of which consumes time and should be devoted to the work in hand and delays their progress. It is as essential for the welder to master the "ripple" as it is for the typist to master the "touch system."

Back-fire or Flash-back

Non-flash torches are so constructed that a partial obstruction of the tip will create a slight explosion, the force of which will remove whatever obstruction is blocking the orifice. The flame will then relight and welding may be continued without interruption.

Most flash-backs, however, are caused by improper regulation of the welding flame, and particularly in those torches which use oxygen pressure in excess of that carried on the acetylene lines. Increasing the proportion of oxygen to that of the acetylene increases the speed with which the flame will travel backward to the point of combination of the two gases.

The flow of acetylene is controlled by regulators which operate on the diaphragm principle. It requires just so many ounces pressure against the diaphragm to move it. Now, if the pressure at the acetylene regulator is very low, say only one-half pound, it may be possible that under certain conditions it will fall to one-quarter pound before the diaphragm operates. This means that the amount of acetylene supplied to the torch may be reduced one-half, which is almost certain to produce a flash.

With higher pressures, say five pounds, the same reduction of one-fourth pound in pressure reduces the volume of acetylene supply but 5 per cent. which is hardly noticeable. The remedy in all such cases is obvious. Carry higher acetylene pressures at the regulator and control the flow of gas by means of the needle valve on the torch.

Another Trouble-Brewer

Another cause of trouble is the use of cylinders or generators too small to supply the welding torches in use. The use of a welding tip with an hourly capacity greater than one-seventh the capacity of the cylinder from which the acetylene is drawn, results in the drawing from the cylinder of some of the acetone (the liquid in which the acetylene is dissolved). This causes the amount of acetylene supplied the torch to fluctuate and produces a flash. Remedy: Use larger cylinders or manifold two or more of them together.

Other torches flash when two combining points of the two gases become hot. This is often due to the use of imperfect seals, in which the heating of one part produces an expansion which results in the leakage of one of the gases past the seals which should separate them. Only where the taper of the seat is sufficiently gentle, is sufficient compression to prevent such leakage possible.

Surfaces Examined

When frequent flash-backs occur, which cannot be otherwise accounted for, the seating surfaces should be examined, the leak found, and the parts ground, filed or machined to fit. This should be done under the personal supervision of the operator or some competent person, who must see to it that no oil is used on any part of his equipment. Oil used where it may come in contact with oxygen under pressure may cause a serious explosion.

If the torch is held at the proper angle it rarely occurs that the internal part of the tip becomes hot enough to ignite the gases. It is quite probable

Continued on page 58

DEVELOPMENTS IN SHOP EQUIPMENT

VARIED LINE OF HOLDERS

The Eclipse Counterbore Co., Ltd., Walkerville, Ont., have placed on the market a full line of holders, pilots, core drills, countersinks, counterbores, cutters, and special tools.

The feature in connection with the holders made by this concern is that there are no screws, balls, springs, plugs, or in fact any loose or moving parts connected with the driving. The transverse driving pin construction is designed in such a manner that the stress is distributed along the entire length of the pin instead of a single point contact as in the ball or set-screw drive. These holders are made in both standard and adjustable lengths.

When using the adjustable type holder it is not necessary to select cutters of the same length, for all one need do is re-sharpen the cutter and extend length of holder to conform to the desired depth. This feature is especially valuable on multiple spindle machine work.

For turret lathe work, etc., the holders are made with straight shanks as this style is most convenient.

Their line of safety holders are adapted for use in quick-change chucks, eliminating the necessity of purchasing collets. To go into details regarding their counterbore cutters and other varied lines without illustrations is impossible, so that, if interested in any of the style tools already mentioned, we would suggest you enquire for catalogue covering the same in detail.

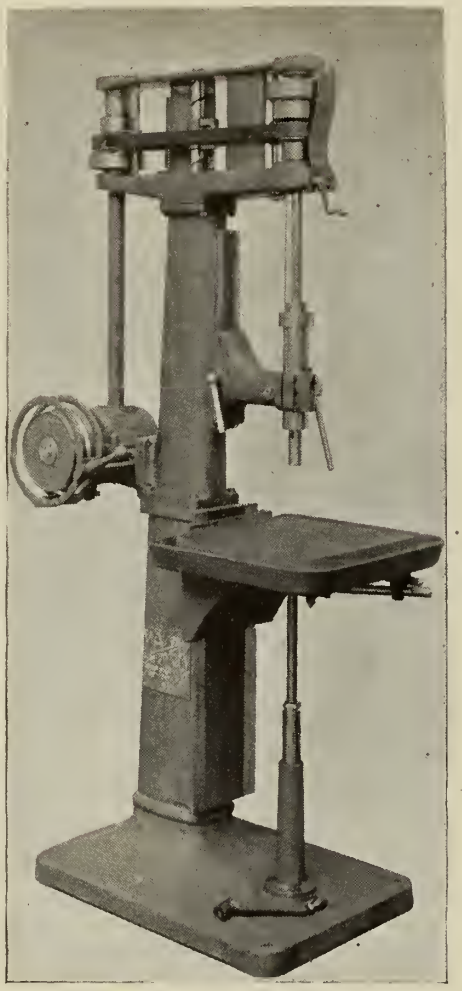
THE MASON-WIDMER DRILLING MACHINE

The Arthur C. Mason, Inc., Hamilton, N. J., has placed on the market a heavier type of sensitive drilling machine which is illustrated and described herein.

The spindle on this machine is entirely equipped with:

Ball-bearings throughout, and is self-oiling. It is made of tough spindle steel of high tensile strength, accurately ground, of extra large diameter, containing the thrust and radial ball-bearings in which the spindle is mounted. A reservoir in the sleeve contains enough oil to lubricate the spindle for one week.

The spindle feed handle is extra heavy,



GENERAL VIEW OF MACHINE.

and is especially mounted in order to prevent any looseness, and to remain fixed in any position convenient to the operator.

The head is of ample strength and contains a simple quick change belt shifting device. The complete range of speeds may be obtained in less than two seconds, the belt being shifted by shifter forks, so arranged as to have a reciprocating movement, which hugs the pulley closely and prevents the belt from turning over. It is operated by a crank handle in front of the cone pulley, and directly underneath the dial showing the proper speeds for the various sizes of drills. It is only necessary to give this handle one complete turn for any one of the speeds. On each turn the belt shifters are positively locked in place, insuring proper tracking of the belt, and no wear due to the belt dragging on improperly placed shippers.

On this head the four-step cone pulleys are so mounted with their own self-contained ball-bearings, that they can be removed without disturbing adjacent parts.

The slack in the horizontal belt is automatically taken up by two ball-bearing idlers, so arranged that they adjust themselves to the load as it is applied to the belt, in such a way that the belt is under tension only when the load is applied. This means extremely long life to the belt and a minimum amount of wear and tear on the machine as a whole.

The spindle bracket is of rigid construction and clamped on the dovetail of the column with a simple screw clamp.

The table is elevated and lowered by a telescopic screw, geared to a crank handle shaft, so arranged that it is not necessary to bore a hole through the floor to accommodate the screw. The table is clamped to a substantial dovetail on the column, and it has a generous channel on all sides to gather chips and compound.

The driving mechanism is a tight and loose pulley arranged for either foot or hand belt shifter on a horizontal shaft, and transmits the power through a pair of bevel gears to the vertical shaft, running in a bath of oil enclosed in a substantial case. The back vertical shaft is so mounted with its gear, that it can be removed without tearing down the whole driving mechanism.

The "Safety First" feature has been fully carried out in the design and in the attachments.

The machine can be so arranged that it can be made a plain drilling machine with four instantly obtained speeds, or second, as a single speed purpose machine, or for a tool room machine with an additional multiplicity of speeds. Automatic power feeds can be arranged on any spindle alternating with built-in tapping attachments. All screws used are A.L.A.M. standard. All run-

VIEW OF DRAW BOLT, COUNTERBORE AND HOLDER

ning parts are equipped with S. K. F. ball bearings. Pump and piping can be furnished for all machines. Motor-driven machines can be obtained with either vertical or horizontal motors.

"SAFETY" SWITCHES

THE "safety" switch is one of the ramifications of the safety movement that has gained such tremendous headway in the last few years. It is common sense to prevent accident to life and property, because it is a matter of human decency and because it is a paying investment. The proper safeguarding of points where accidents are liable to happen and the proper protection of mechanisms, which in themselves are potential danger hazards also, means better insurance rates and fewer law suits. Industrial plants are pretty well in touch with the situation, having learned through real experience the need to protect life and property at every turn of the wheel. They do not think so much in terms of first cost as in terms of safety and the secondary expense of accidents.

One of the hazards to which attention was early drawn was the open knife switch, and to-day these are almost a thing of the past, insofar as industrial plant applications are concerned. It is now customary to enclose switch and fuses in steel boxes, so arranged that switch operation is possible from the exterior.

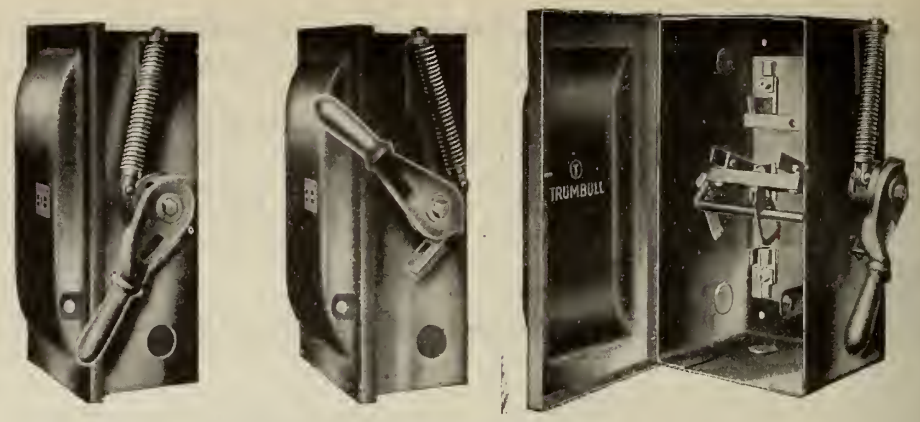
A switch externally operated may suggest to a man that he should throw off the switch before he puts his hand in the box, but an interlocking safety device, which prevents his opening the box until the switch is off makes him keep his hands away from live switch blades.

This latter accident prevention feature has been developed by the Trumbull Electric Mfg. Co., Plainville, Conn., in a line of externally-operated switches recently placed on the market.

By reference to the accompanying illustrations a very good idea of the arrangement of these switches may be gained. The box cannot be opened until the switch is in the off position. A catch prevents the switch from being closed with the box open, although the catch can be manipulated by a tool if necessary to close the switch with the box open for inspection, by an experienced man. It will thus be seen that with fuses and blades always dead whenever the switch is exposed, the fire and shock hazard are eliminated.

All single throw switches are equipped with an outside handle stop as a means of indicating when switch blade is in full contact. A further advantage is seen in the fact that the switch can be locked open.

There is a growing demand for a safety switch with quick make, as well as quick break, particularly where a careless operator might neglect to follow the handle through and so leave the blade in partial contact with the jaw post. The switches shown in our illustrations are equipped with this feature. A further device is seen in one of the types illustrated where a "100 per cent. safety shield" is shown. This is a further protection to the operator or electrician when the cover is open for fuse replacement.



SAFETY SWITCH SHOWING MECHANISM.

Secured Contracts.—The Mackinnon Steel Co., of Sherbrooke, have recently received the following orders: Steel work for a skating rink at Bathurst Lumber Co., Bathurst, N.B.; steel work for new store for C. O. St. Jean, Wellington Street, Sherbrooke, Que.; J. W. Gregoire, architect; A. Dion, general contractor, Sherbrooke, Que.

VIEWS SHOWING SAFETY SWITCH OPEN AND CLOSED AND WITH COVER OPEN SHOWING 100% SAFETY SHIELD.

STEEL TREATERS

Last Tuesday, April 20th, the first meeting of the Toronto Chapter of the American Steel Treaters' Society was held at the King Edward Hotel.

A large gathering was present and listened with interest to Mr. Eisenman, National Secretary of the society, who was speaker for the evening. He told the story of "Heat treatment, its past, present and future," in an interesting manner, and pointed out the need of proper steel treatment especially at the present time. "In many cases," he said, "a company would spend thousands of dollars on jig and tool equipment, in order to make their product interchangeable, and then go to work and place their heat department in some pokey corner, and forget all about them."

He emphasized the need of manufacturers realizing the important fact that their product was made or marred in their heat treating department. He stated that it gave him pleasure to be able to say that this fact was being recognized more and more every day and that the old secretive method of conducting the heat treating department, was being done away with.

"If you have a dollar and I have a dollar, and we swap dollars, we each have a dollar," said Mr. Eisenman, "but if you have an idea, and I have an idea and we swap ideas, we each have two ideas. That in brief is the object of the society. By meeting together and swapping ideas, you each know more than you did before, and therefore are better men."

After his talk, those present were invited to join the society, and a large number were enrolled. No doubt every reader has read the aims and purposes of the society in last week's issue, so that if interested in any way fill in the coupon below and send it to this office, care of our associate editor, J. H. Moore. Remember it is not necessary that you be actually engaged in the heat treating business to become a member, for if you are interested in any way in the heat treatment of steel, this qualifies you for membership.

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Standardization Again

THE agitation for the standardization of parts of agricultural machinery still continues at Ottawa. Like many things that go on there, it is done without a working knowledge of what the programme would entail.

Standardization of certain parts, such as bolts, nuts, threads, etc., so that they can be interchanged, should be made compulsory.

Further than this the making of laws to compel standardization is simply a lot of monkey work that will make good election stuff in rural ridings.

Makers of farm implements have thousands of machines all over the world. They agree to supply duplicate parts of any of these. It is a safe estimate that some of the large companies with a number of lines would have anything from 25,000 parts and up. They have a tremendously intricate system for stocking and shipping these. A move that would disrupt this work, throw the patterns and stock out and interfere with patents, would double the price of machinery instead of cheapening it.

This business of standardization is something that farmers themselves have never followed out. Were a buyer of sheep, cattle, horses or seed grain, to come into this country, he would have to scratch all over the place in order to get a shipment of one well-defined and clearly specialized kind.

And yet we don't hear of any agitations at Toronto or Ottawa to compel farmers to standardize in certain communities in regard to their product.

The tinkers had better turn their efforts to something about which they are qualified to speak.

The Wearing of Overalls

THE wearing of overalls is not going to help cheapen living.

Such a move is a flash in the pan. If you put on overalls for the purpose of getting out and growing a few bushels of potatoes it may get you some place.

If you put on overalls simply for the purpose of protesting against the price of clothing, you will land only one place—in a heap.

The occasional spasms that come over us to do something out of the ordinary accomplish little.

The overall fad may have been engineered by overall makers who want some cheap and efficient advertising.

If your putting on overalls means that you are seriously and honestly going to get down to hard work—then put 'em on, and glue them on.

But for the fad idea of cheapening the cost of clothing in this way—forget it.

Canada's Trade Balance

CANADA needs to get busy and produce in order that she shall have something to sell.

There is something radically wrong with a people living in such a country as this, who import more than they export.

It is a mighty poor tribute to the brain and muscle of the people, and a forceful commentary on their hit-and-miss habits.

Here are the figures for the past seven years:—

	Exports	Imports
1914	$ 431,588,439	$ 618,457,144
1915	409,418,826	455,446,312
1916	741,610,638	507,817,159
1917	1,151,375,768	845,356,306
1918	1,540,027,788	962,543,746
1919	1,216,443,806	916,429,335
1920	1,239,492,098	1,064,516,177

If Canada is to learn the lesson the exchange rate should have taught her, there will have to be a changing around of some of these figures.

Shorter hours and less output will never do it.

Ode to a Potato

THE grocer man is sellin' spuds at a dollar for a peck; it causes me to have a pain located in my neck. And there they set, them scabby things, them skinny-lookin' scuds, a-throwin' on all kinds of airs for common things like spuds.

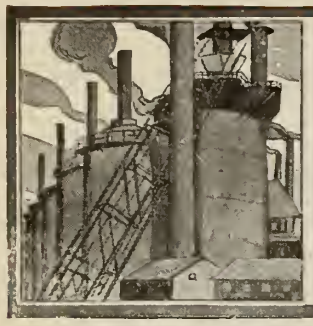
Why, say, you spud, I well can mind not many years ago, I worked to keep your kin alive with sprinklin' can and hoe.

I used to pick ten thousand bugs from off your family tree, and now, you scabby faced galoot, you make a face at me, and claim to be worth six times more than was your former price when I was rescuin' your like from tater bugs and lice.

When I worked in a grocery store, way back in '65, we sold all sorts of truck and stuff to keep the folks alive; when in them times, you scabby thing, you wizzled, freckled sprout, we used to stick the like of you upon the oil can spout.

You make me sick, by heck you do, you aint no friend of minewe used to toss the likes of you to fatten up the swine.

You think you're smart, you cross-eyed spud, you wall-eyed scaly thing, for bouncin' up the price of eats 'tween summer and the spring. I'll gorge myself with punkin pie, with turnips and with cheese, and eat enough of these here things to make me snort and wheeze, while you at 15 cents a quart are worth more than I've got, and you can sit right there, old top, until you durned well rot.—"Ark."



MARKET DEVELOPMENTS

Big Spread Exists in Selling Prices of Steel

Independents Are Still Well Above the Prices Charged by the Corporation—Old Country Lines Are Making Better Showing and Are Reaching Here More Freely Now

THE market now has the peculiar spectacle of the United States Steel Corporation selling its output at a price many dollars a ton lower than the independents. Just how long this can be continued is hard to state, but the fact remains that with the steel markets of the world empty, the premium business is likely to last for months yet. The Corporation no doubt figures that in the long run it will be in a strong position by not having engaged in any gouging of the market when the demand was at its highest and supplies at the lowest.

Makers of machine tools in several points announce increases in selling prices. The trade has ceased to figure out when this is going to end or where it is going to lead. It is known, though, that there are large schemes in mind in this country, but work on them is hung up for the present, the promoters fearing to go into the machine tool market and engage on the building operations that would be necessary.

The scrap metal market is dull. Lead is lower in price, the reason apparently being that lead from the Old Country is likely to be on the U.S. market before very long at a figure below the prevailing price. Tea lead is also lower. The latter, by the way, has a variety of experiences, from the grocery store over the package of tea to the house, to the garbage pile, to the dump, and then rescued by the pickers. At least that is where much of it comes from.

Old Country importers report that shipments are coming through better, and they expect that with the opening of the St. Lawrence to Montreal this will be more noticeable.

BRITISH GOODS COMING IN ON MONTREAL MARKET MORE FREELY

MONTREAL, April 29.—The disturbed railroad conditions that have prevailed in the States during the past few weeks have been reflected in this district by the inconvenience that dealers have experienced in obtaining supplies from American mills and manufacturers. It is believed that the railway strike is nearing an end, but the disorganization resulting from recent unsettled conditions will prevent a return to normal movement for some weeks. The near approach to May-day has not aided in dispelling the uncertainty that is on the minds of many regarding the possible attitude of labor during the next two weeks. Until this doubtful period is over it will be impossible to give any definite assurance regarding the betterment of trade in general. There is little encouragement in the reports of dealers here as to the steel situation, and many claim it is as difficult to get material just now as it ever was in the past. Plates and tubes are very scarce and warehouse stocks on these lines are practically nil. The supply of sheets is not sufficient to meet even the most moderate requirements and consumers have to be content with the allotment that is accorded them. A factor that has been added to the problem of securing American made product is the attitude of the United States railroads that are carrying goods to Canada. Effective May 1st all consignments of material or equipment to Canada must be paid for in American currency. With goods going to the United States the charges are collected at the destination, so that Canada suffers in either case by the high exchange rate still prevailing. It is thought that some action may be taken by shippers here, but it is not likely that any concessions will be made, and the only logical solution will be an increase in the prices of affected commodities proportionate to the rate of exchange against Canadian currency.

Metal Demand Easier

The week has been comparatively quiet in the metal market and dealers' reports indicate that present demand is slightly below normal. The general tendency is to lower prices. Tin has declined and is now quoted at 73 cents per lb. Spelter shows a falling off and the price of 12 cents shows a drop of ½ cent per lb. Lead, after a brisk period, has again quieted down and quotations are easier at 11½ cents per lb.

Little Improvement in Delivery

Machine tool conditions are hardly more promising than they have been for many weeks past, the uncertainty of delivery continuing to be the outstanding feature of the present situation. Many builders of machinery are willing to place orders on the books, but the indefinite nature of the shipping date does not encourage customers in the placing of orders, as the needs in many cases are for immediate and not the distant future. Dealers in used equipment continue to repart a steady business and demand for supples and machine accessories keep the dealers busy in locating and delivery of the same. British goods are coming to hand steadily and the reopening of the Montreal service is expected to give still better delivery from across the Atlantic.

Steel Scraps Active

Apart from the slight reduction in the volume of business passing there is little to indicate a change in the old material situation. During the past week there have been some fluctuations in non-ferrous scrap quotations, but the latest reports are to the effect that the market is steadier. Coppers were inclined to weaken early last week, but strength has apparently returned and prices are firm. Lead developed a strong tendency last week but has again declined to the price of a week ago. Zinc scrap has declined and is quoted locally at 6¼ cents per lb., a drop of ¼ cent on last week's

quotation. The bulk of present movement is in the iron and steel lines, but the market is not exceptionally active and quotations remain steady on the majority of scraps. The scarcity of machine scraps is still pronounced and prices continue strong. Dealers here are quoting the average figure of $33 per ton on machinery scrap. Car wheels are in greater demand and the shortage has advanced the price to $26 per ton. Stove plate at $26.50 is active, this price being an advance of $1.50 per ton.

WORLD'S MARKETS ARE STILL EMPTY

And From That Basis It Is Figured That Lower Prices Are Not Coming To Pass Yet

TORONTO.—Although some manufacturers intimate that they are now holding back on account of prices of tools, there is not much to encourage the belief or supposition that they are going to get a cheaper outfit by holding off. Just this morning the mail contained announcement of several advances in prices, and this morning was not particularly different from any other morning in that regard.

There is a very fair amount of business being placed in places that are not generally regarded as good for the metal working machinery trade. Textile mills are buying machinery in several cases, in order to keep their plant in shape, or to bring out special machines for their own use, or the making of attachments and new devices to their existing plant.

This general buying is reflected in other ways. Deliveries are not encouraging in the matter of the small motor. On the large type one can get better service, but there seems to be no chance of getting on top of the demand that keeps up for the small and average size motor. There has been an advance in the price of these in United States, and it has been thought that the movement would find its reflection in the same way here, but so far there is nothing to indicate that this is going to be the case.

There is no outstanding large business in small tools and supplies just now. The railroads, usually large purchasers, have some lists out, but they are small in comparison with their ordinary requirements. Prices are holding firm now.

An Empty Steel Market

One large dealer has addressed a letter to his customers, in which he makes use of the following:

"Our customers will, I feel, be interested in what our principals tell us from time to time about world-wide steel conditions. An extreme shortage has existed for a long time and there appears to be little relief in the immediate future. The rehabilitation of the railways and their urgent requirements long overdue for additions and repairs to rolling stock would alone tax the capacity of the mills were they not already called upon to meet a demand far in excess of the possible production. The accumulated demand for steel in the United States is far greater than it was before the war. There is practically a cessation of European activity in the steel business. Production in Great Britain is still far below normal due to a variety of causes and their home demand is so great that in some lines, the British mills are fully booked up for the whole of the present year. Germany has ceased to be a factor in the steel export situation and cannot enter in to the export business for at least a year or two. The work of reconstruction of the steel mils of France and Belgium is proceeding as rapidly as can be expected under the circumstances, but no immediate tonnage will be available for export from these countries for a considerable time to come. It would therefore appear beyond reasonable doubt that the world's demand for steel products will continue to exceed the possible supply for at least a year to come and probably for much longer. Absurdly heavy premiums have already been exacted for such small quantities of steel as are available for prompt shipment, or obtainable within the next few months. Our principals, however, strongly deprecate this kind of profiteering. Prices for the limited tonnage which we expect to get for the balance of this year will be pretty much the same, or possibly at moderate advances."

A Dull Scrap Market

Right now there would seem to be a good time for factories having anything in the line of scrap to get it sorted and put on the market. Material that will sort as stove plate, heavy melting steel and cast iron scrap will bring a good price. In fact prices published in the old material table for these three lines are more or less nominal. Scrap metal dealers claim that the steel companies are to blame for the shortage in heavy melting by allowing nearly all of the shell steel of the Imperial Munitions Board and the U .S. Ordnance Department to get out of the country. Much of it went to Britain and most of the remainder to United States. Steel mills are now in the market, and are paying much higher prices for material no better. The scrap men claim that the taking of all this material out of the country cleaned up the available stuff in Canada, and the market has been empty ever since.

Lead is weaker this week, also tea lead. The lead, as a general thing, has a variety of experience before it comes back to the scrap market. Most of it is used in making up packages for tea. Then it goes to the garbage tin, and gets a ride to the dump. Here the pickers gather it up and turn it back to the scrap metal dealers. Lead prices are inclined to sag both here and in United States just now. It is expected that English copper will be on the U.S. market before long at prices slightly below those prevailing. None of this material has been shipped across since the early stages of the war.

POINTS IN WEEK'S MARKETING NOTES

The switchman's strike gets the steel mills both ways. It may shut off raw materials, or, failing, sending cars may clog the mill with finished material.

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The U. S. Steel Corporation, it is estimated, makes 44 per cent. of the finished steel in the States.

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The independents continue to sell at prices $15 per ton and more than U. S. Steel Corporation prices.

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English lead may soon be on the U. S. market, and at prices below the present figures.

—

This is a good time to dispose of anything that will grade as stove-plate, cast iron scrap or heavy melting steel.

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The local scrap metal market is doing only a fair volume of business, brass and copper being weak. Iron and steel scrap are wanted, but the supply is poor.

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Two American makers of machine tools announce increases in prices this week.

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Montreal reports that shipments of Old Country goods are coming in more freely, and an improvement in this line is looked for with the opening of navigation.

NEW YORK RECORDS MORE ADVANCES

But Deliveries are Pretty Well Tied Up On Account of Railroad Strike

NEW YORK, N. Y., April 29.—Considering the handicaps due to the demoralization of railroad transportation, machine tool business keeps up a very fair rate, particularly in the East. Shipments are held up at many machine tool plants and it is evident that promises of delivery cannot be kept. Some manufacturing plants are in a bad way due to shortage of material, machinery repairs, etc.

The General Electric Co. has purchased the shell manufacturing plant of Bartlett-Hayward Company, Baltimore, Md., and will convert it at once into a manufacturing plant for some of its products. A part of the machine tool equipment bought for the new Bridgeport, Conn., plant is being delivered to Baltimore.

The U. S. Roller Bearing Co., a new concern, with offices in New York, is buying tools for a new plant at Manahquan, N. J.

The Automatic Straight Airbrake Co., another new concern, is buying tools for a plant at Eleventh Avenue and Twenty-Sixth Street, New York City. Purchases are being made by George W. Goettals and Co., New York.

The Mergenthaler Linotype Co., New York, has an inquiry out for a list of tools. The Simms Magneto Co., East Orange, N. J., and the VanSicklen Speedometer Co., Newark, N.J., continue to buy.

The Columbia Graphophone Co., Bridgeport, Conn., has arranged for financing of $4,600,000 for new plants at Baltimore, Md., and Toronto, Ont. Practically all of the equipment for these plants was bought several weeks ago.

Two leading makers of milling machines have advanced prices about ten per cent.

INDEPENDENTS ARE SELLING IN ADVANCE OF CORPORATION FIGURE

Special to CANADIAN MACHINERY.

PITTSBURGH, April 29.—Transportation conditions as affecting the iron and steel industry of the Central West have been little better in the past week than in the first week of the rail strike. Current reports of the strike waning are somewhat exaggerated, and in any event apply to districts in which the iron and steel industry is least interested.

Between one-fourth and one-third of the iron and steel production of the Central West is cut off, but in the East production is almost normal, while the South is scarcely affected at all. The chief cause of the curtailment is lack of coal or coke, or both, but in one or two instances there is a shortage of iron ore. If prolonged, the strike would cause curtailment by the mills becoming choked with finished products, but thus far the situation in this respect is not serious. In the early part of the strike the mills found enough empty cars to load their current product, and only in the past week has there been much piling of steel.

The movement of coke from the Connellsville region has been reduced to relatively small proportions, but there has been some movement, and there is more now than a week ago. Only a few channels are open. There is a fairly free movement from Connellsville to Buffalo, where the merchant furnaces are operating almost normally, though the New York Central is not moving any coke to that point. Some solid trainloads have been made up and moved to the Youngstown district, particularly to the Republic Iron & Steel Company. There have been various other special movements. The railroad yards in and near the coke region are now congested and while the yards are now almost fully manned the movement is slight.

Shipments of steel are of course curtailed much more than the production. Illustrating the extreme, the Jones & Laughlin Steel Company, one of the very largest independents, with two plants in the Pittsburgh district, has had practically normal production but has shipped scarcely any steel. It loaded no less than 1,500 cars before the supply ran out, then beginning to pile steel, but the cars either stayed on company sidings or moved out to main line sidings near at hand.

The great curtailment in shipments of steel does not seem to have incommoded consumers as much as would be expected. Some consumers, of course, have their own operations curtailed by the strike, and do not need as much steel as usual. Others, perhaps, are operating on stocks, though it was claimed, in many quarters consumers did not have stocks.

The rail strike has had practically no effect upon the pig iron and steel markets. They are neither stronger nor weaker as a result of the strike, and while they are dull it is a question whether this condition is attributable to the strike.

Price Prospects

There is no material change in the steel prices, and there has been none of consequence for several weeks. This does not mean, however, that there is no change in the market as to the strength of prices or as to the prospects. There is and has been an unprecedented situation and naturally there are unusual consequences. It is absolutely unprecedented for nearly half the the steel (the Steel Corporation according to the latest statistics makes 44 per cent. of the country's finished steel) to be sold at one price and the remainder to be sold at much higher prices, most of it $10 to $15 a ton higher, with the small remainder at higher prices still.

It might have been expected that when the buying pressure should decrease the prices asked by the independent producers would decline, but the independents have elected not to reduce prices. This is individual, not collective, action since the producers have no conferences with each other. Evidently the large independents felt that reducing their prices would discourage buyers from taking hold, the alternative being to adhere to any prices attained and let buyers take what they would. The general alignment of the market has been that the nearer the delivery the higher the price. Hence if a mill has a certain price and sells at only two-thirds the rate at which it ships, it gradually becomes able to make earlier and earlier deliveries, and the price becomes more attractive to the buyer. This will work all right for a time but when the mill got entirely caught up on deliveries something would occur.

Some of the large independents state positively that they have not regularly opened their order books for third quarter business, though of course, they have taken some orders from special customers, and they would probably will have a little lapover from the second quarter. The smaller independents, that have had still higher prices, on account of delivery, are naturally sold still less distances ahead. The Steel Corporation's unfilled obligations at the end of March amounted to 9.892.075 tons. having increased by 389,994 tons during March. Even assuming a smaller rate of increase since the beginning of this month, there would be say 10,100.000 tons now on books. At the corporation's recent rate of shipping this tonnage would be equal to shipments up to the middle of next January, this being merely an average period since some products are sold much further ahead than others.

The divergence between the order books of the Steel Corporation and the independents is therefore very great. Nothing like such a situation has ever obtained in the past. While many of the smaller producers do not usually sell far ahead, the large independents, like Republic, Lackawanna, Jones & Laughlin, and others, have in the past sold for practically the same periods as the Steel Corporation. Not only is there this remarkable divergence, the divergence is increasing, for the Steel Corporation is selling more than it is shipping, while the independents as a whole are selling less than they are shipping. Out of this condition something very interesting will have to develop, and in the not distant future. Unless there is a sudden and large increase in consumptive demand the independents will eventually be looking for business, and they can hardly get it by cutting prices to buyers who have been patronizing the Steel Corporation as buyers will remember the circumstances of the past few months.

Pig Iron

The interesting question has been presented whether the rail strike has made pig iron scarcer or more plentiful. Obviously it has made it scarcer at some points and more plentiful at others, but the general balance is a matter of doubt. It is clear that pig iron production since the first of the year has been greater than was expected, that the productive capacity is still greater than the recent production, and that some classes of consumers cannot afford to pay the prices now being asked. From the present outlook it seems reasonably certain that pig iron will decline before it advances, but there may be no important changes in quoted prices for quite a while, the furnaces being content to do without sales, merely shipping against the large volume of contract business they have on books. The valley market remains quotable at $42 for Bessemer, $41.50 for basic and $43 for foundry iron, f.o.b valley furnaces, freight to Pittsburgh being $1.40.

The Week's Events in Montreal Industry

The pontoon recently completed and launched at the yard of the Davie Shipbuilding Company for the Canada Steamship Lines, and which will be used as a landing stage for the company's steamboat service at the port of Quebec, will be the largest of its kind in the world, being 225 feet in length and 45 feet wide.

In anticipation of the abnormal demand that will be made this season on the accommodation of the hotels of the city, the directors of the Ritz-Carlton Hotel of Montreal are contemplating the erection of an additional wing to the present building that will add about one hundred rooms to the existing structure.

H. J. Griswold, who in May, 1918, was engaged from the Dominion Engineering and Inspection Company to organize and operate the Canadian branch of MacGovern and Co., Inc., of New York City, is completing a two-year contract on June 1 and then will resume active participation in the affairs of the Dominion Engineering and Inspection Company, in which he is a partner.

Recent Department of Marine estimates that have been passed by the House includes items of $1,500,000 for the maintenance and repairs to Dominion steamers and ice-breakers; $478,000 for dredging in certain portions of the St. Lawrence River between Montreal and the sea; $2,000,000 for the construction of a new ice-breaker to be used on the St. Lawrence. This last amount is for a vessel of 8,000 horsepower and will have a crew of about ninety men.

The first ocean arrival to the Port of Montreal this season was the Canadian Government Merchant Marine steamer, "Canadian Aviator," which docked about noon last Sunday, this arrival announcing the formal opening of navigation on the St. Lawrence. In accord with previous custom, Capt. Hilton, who was in command of the vessel, will be entitled to the gold-headed cane or other recognition that is generally presented to the captain bringing in the first ocean vessel.

A petition bearing some 14,000 signatures will be presented to the chairman of the Administration Commission of Montreal this week, urging consideration regarding the changes to the building code of the city and to abolish limitations to the height of buildings. This is the outcome of the request made some time ago by a certain syndicate to build a sixteen-storey hotel on St. Catherine St., but which at that time was considered inadvisable owing to the present by-laws in this connection and the lack of adequate fire-fighting facilities for buildings of such a height.

The opening of navigation was fittingly celebrated last Saturday at the yard of the Canadian Vickers Company, when the 8,300-ton Norwegian steamer Tatjana was launched. This vessel has a length overall of 413 feet, a beam of 52 feet and a depth of 31 feet 1 inch. She is fitted with triple expansion engines and three Scotch boilers, adapted to burn either coal or oil fuel, the boilers being equipped with Howden's forced draught system. The sponsor of the vessel was Mrs. Hans Johansen, wife of the chief surveyor of Norwegian Veritas in the United States and Canada.

The American Waterworks Association will hold its 40th annual convention in Montreal from June 21 to 24, with headquarters at the Windsor Hotel, the Windsor Hall being reserved for an exhibition display, where many American and Canadian manufacturers of waterworks equipment will have exhibits. The meeting will bring many prominent hydraulic engineers from many points of Canada and the United States, and it is expected that about 1,000 delegates will be in attendance. Extensive plans are now in preparation for the professional meetings and entertaining features. H. G. Hunter, of Montreal, is the chairman of the entertainment committee.

The Administrative Commission of Montreal are again proposing that the City Council accept their suggestion for the adoption of a by-law relative to the compulsory installation of dry sprinklers in the basement of all public and other large buildings. The first suggestion as originally drawn up included dwelling houses, but in the revised form this class of building has been exempted. The purpose is to provide more adequate facilities for fighting fires where the nature of the material would produce noxious gases and suffocating fumes: the proposed method enabling the firemen to connect the hose and drench the interior without danger to themselves.

The formation of the Dominion Engineering Works, Ltd., represents another enterprise of the Dominion Bridge Company, and the new organization, which will take over the present holdings of the Dominion Engineering and Machinery Co., a subsidiary of the Dominion Bridge Co. inaugurated last fall for the manufacture of paper-making machinery. The new company will, in addition to the manufacture of paper machinery and turbo equipment, engage in the production of all classes of heavy hydraulic and hydro-electric power equipment. The plant of the old St. Lawrence Bridge Company will be utilized for the new enterprise. In addition to Dominion Bridge interests, many business men associated with large pulp and paper industries and of hydro-electric developments and power companies are on the personnel of the newly-formed board of the new concern.

An interesting and impressive demonstration of fire-extinguishing was given last week on the Champ de Mars in Montreal by the Canadian Foamite Firefoam Company. The extinguishers are very similar to many others, but the difference is in the effect of the combination of the two chemicals. When these are combined—by inverting the container—the result is to generate a coffee-colored foam full of minute bubbles, which contain carbon-dioxide gas, the deadly foe of combustion. The foam produced by the mixture of the chemicals has a volume eight times that of the original contents. This foam will not mix with water or oils, but floats or clings to any surface it hits, and completely smothers the fire. Several tests were made in direct competition with soda and acid mixtures, and in every instance the Foamite showed its superiority over the other extinguishers. The first test consisted of a tank seven feet by six, filled with ten gallons of crude oil and gasoline. Two ordinary soda and acid extinguishers were first used, and the fire was put out in 46 seconds, but the same quantity of Foamite put it out in 26 seconds. A wall fire contrived by the erection of a wooden door, eight feet high by four feet wide, with two burning strips twenty feet long, all drenched with oil, took two of the soda and acid extinguishers 56 seconds to put out. Half the quantity of Foamite put it out in 20 seconds. A circular tank with ten gallons of oil and gasoline took Foamite 21 seconds to put out. The most exciting test consisted of a pan, five feet by four, surrounded by a wood pile and filled with water and oil. The ordinary extinguisher utterly failed: Foamite had it out in a few seconds. The final test was on a large pile of wood, hay, barrels, and other material, all saturated with oil and gasoline, on which a 40-gallon extinguisher was used. The fire was put out in about 20 seconds, with plenty of foam to spare.

The death took place at Brantford of Major T. Harry Jones, who for 37 years has been chief of the Engineering department of the city. He held front rank in his profession, being frequently called upon by engineering bodies to give papers on technical matters, particularly on roads. He was a member of the Corps of Guides of Canada and an active member of Brant Avenue Methodist Church. A widow and a large family in Brantford, and two brothers, Col. C. S. Jones, Toronto, and A. S. Jones, K. C., of Brantford, survive.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$42 40
Lake Superior, charcoal, Chicago	57 00
Standard low phos., Philadelphia	50 00
Bessemer, Pittsburgh	43 00
Basic, Valley furnace	42 90
Toronto price:—	
Silicon, 2.25% to 2.75%	52 00
No. 2 Foundry, 1.75 to 2.25%	50 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 50
Steel bars, base, Toronto	5 50
Iron bars, base, Montreal	5 50
Steel bars, base, Montreal	5 50
Reinforcing bars, base	5 00
Steel hoops	7 00
Norway iron	11 00
Tire steel	5 75
Spring steel	10 00
Band steel, No. 10 gauge and 3-16 in. base	6 00
Chequered floor plate, 3-16 in.	9 40
Chequered floor plate, ¼ in.	9 00
Staybolt iron	9 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	4 00
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 90
Small shapes under 3"	3 62

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points	C.L.	L.C.L.
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

Gross.

	Montreal	Toronto
Lake copper	$25 00	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	77 00	75 00
Spelter	12 50	12 25
Lead	12 00	12 00
Antimony	14 50	14 00
Aluminum	34 00	35 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$ 7 25	$ 7 25
Plates, ¼ up	6 50	6 50

PIPE—WROUGHT

Price List No. 44—April, 1920.

STANDARD BUTTWELD S/C

	Steel		Gen. Wrot. Iron	
	Black	Galv.	Black	Galv.
⅛ in.	$6 50	$ 8 50	....	....
¼ in.	5 13	7 26	$ 5 43	$ 7 56
⅜ in.	5 13	7 26	5 43	7 56
½ in.	6 84	8 42	7 27	8 84
¾ in.	8 45	10 58	9 03	11 16
1 in.	12 50	15 64	13 35	16 49
1¼ in.	16 91	21 16	18 06	22 31
1½ in.	20 21	25 30	21 59	26 68
2 in.	27 20	34 04	29 05	35 89
2½ in.	43 00	53 82	....	....
3 in.	56 23	70 38	....	....
3½ in.	71 30	88 32	....	....
4 in.	84 48	104 64	....	....

STANDARD LAPWELD S/C

	Steel		Gen. Wrot. Iron	
	Black	G lv.	Black	Galv.
2 in.	$30 90	$37 74	$34 60	$41 44
2½ in.	45 34	56 16	51 19	62 01
3 in.	59 29	73 44	66 94	81 09
3½ in.	73 14	90 16	82 34	99 36
4 in.	86 66	106 82	97 56	117 72
4½ in.	0 98	1 23	1 24	1 49
5 in.	1 15	1 44	1 44	1 73
6½ in.	1 49	1 86	1 87	2 25
7 in.	1 94	2 43	2 42	2 90
8-L in.	2 04	2 55	2 54	3 05
8 in.	2 35	2 94	2 92	3 51
9 in.	2 81	3 52	3 50	4 21
10-L in.	2 61	3 26	3 25	3 90
10 in.	3 36	4 20	4 18	5 03

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.

4½" and larger 50%.

4" and under, running thread, 30%.

Standard couplings, 4-in. and under, 30%

Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices.

Per 100 Pounds.

	Montreal	Toronto
Copper, light	$15 00	$14 00
Copper, crucible	18 00	18 00
Copper, heavy	18 00	18 00
Copper wire	18 00	18 00
No. 1 machine composition	16 00	17 00
New brass cuttings	11 00	11 75
Red brass cuttings	14 00	15 75
Yellow brass turnings	8 50	9 50
Light brass	6 50	7 00
Medium brass	8 00	7 75
Scrap zinc	6 50	6 00
Heavy lead	7 00	7 75
Tea lead	4 50	5 00
Aluminum	19 00	20 00

	Per Ton	Gross
Heavy melting steel	18 00	18 00
Boiler plate	15 50	15 00
Axles (wrought iron)	22 00	20 00
Rails (scrap)	18 00	18 00
Malleable scrap	25 00	25 00
No. 1 machine cast iron	32 00	33 00
Pipe, wrought	12 00	12 00
Car wheels	22 00	26 00
Steel axles	22 00	20 00
Mach. shop turnings	11 00	11 00
Stove plate	25 00	25 00
Cast boring	12 00	12 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜-in. and less	10
Carriage bolts, 7-16 and up	Net
Coach and lag screws	25
Stove bolts	55
Wrought washers	45
Elevator bolts	Net
Machine bolts, 7/16 and over	Net
Machine bolts, ⅜-in. and less	15
Blank bolts	Net
Bolt ends	Net
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square, blank	add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 50
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55⅓
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	25 and 5
Sq. and hex. hd. cap screws	22½
Rd. and fil. hd. cap screws	plus 17½
Flat but. hd. cap screws	plus 30
Fin. and semi-fin. nuts up to 1-in.	20
Fin. and Semi-fin. nuts, over 1 in., up to 1½-in.	10
Fin. and Semi-fin. nuts over 1½ in., up to 2-in.	Net
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

Per gross ton

Bessemer billets	$60 00
Open-hearth billets	60 00
O H. sheet bars	76 00
Forging billets	56 00-75 00
Wire rods	52 00-70 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 70
Cut nails	5 85
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 35½
British Manila rope	0 28
New Zealand hemp	0 28
Transmission rope, Manila	0 47
Cotton rope, ¼-in. and up	0 88

POLISHED DRILL ROD

Discount off list, Montreal and Toronto ..... net

Real Bargains in Machine Tools

WE have for sale the up-to-date manufacturing plant of the Roelofson Machine Company of Galt, Canada. This enables us to offer exceptional bargains in high-grade Machine Tools in exceedingly good condition. The entire plant must be sold before June 1st, and is priced accordingly.

Look over the list—we venture to say you have never seen a better collection of high-grade machine tools anywhere—every one of them the best in its class. Immediate shipments can be made.

5—Heavy Duty LeBlond Lathes, 21″ swing, 10′ bed. These Lathes are double back gear, quick change gear and have pan, bed and pump.
3—22 Barnes Self-oiling Drilling Machines.
7—18″ x 8′ Stevens Lathes.
1—American 15″ x 6′ Lathe.
1—Hamilton make 14″ x 6′ Lathe, with taper quick change.
1—Gisholt Turret Lathe, 18″ x 8′.
1—Davis Lathe, 18″ x 8′.
1—Hendey Tool-room Lathe, 14″ x 6′.
1—Hendey Tool-room Lathe, 16″ x 8′.
The three latter have taper attachment and draw-in collets.
1—Leland-Gifford 3 spindle Sensitive Drilling Machine.
1—LeBlond Universal Grinder.
1—15″ Potter & Johnston Universal Shaper.
1—No. 2-G Hendey Universal Milling Machine.

In addition there are a large number of other machine tools, also 9 in. x 9 in. Curtis Air Compressor; Frankford Furnaces, Hoskin Electric Furnace, and one each 40, 30 and 20 H.P. Westinghouse Motors. Three phase, 25 cycle, 550 volts, 750 R.P.M., with no-voltage release starters, Base and Pulley.

Plant open for inspection daily. Telephone us or write Machine Tool Department and special representative will meet you.

The A. R. WILLIAMS MACHINERY CO.

LIMITED

64-66 Front St. West, Toronto, Ont.

Telephone Adelaide 20.

Offices at Halifax, St. John, Montreal, Hamilton, Walkerville, Winnipeg and Vancouver.

If interested tear out this page and place with letters to be answered.

MISCELLANEOUS

Solder, strictly	$ 0 40
Solder, guaranteed	0 43
Babbitt metals	18 to 70
Soldering coppers, lb.	0 62
Lead wool, per lb.	0 16
Putty, 100-lb. drums	8 30
White lead, pure, cwt.	20 00
Red dry lead, 100-lb. kegs, per cwt.	16 50
Glue, English	0 40
Tarred slater's paper, roll	1 30
Gasoline, per gal., bulk	0 35
Benzine, per gal., bulk	0 35
Pure turp., single bbls., gal.	3 60
Linseed oil, raw, single bbls.	3 00
Linseed oil, boiled, single bbls.	3 03
Sandpaper, B. & A.	List plus 43
Emery cloth	List plus 37½
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin, "D," per lb.	0 14
Borax crystal and granular	0 14
Wood alcohol, per gal.	2 70
Whiting, plain, per 100 lbs.	2 75

CARBON DRILLS AND REAMERS

S.S. drills, wire sizes	32½
Can. carbon cutters, plus	20
Standard drills, all sizes	32½
3-fluted drills, plus	10
Jobbers' and letter sizes	32½
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	net
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	20 to 40
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At warehouse]

Rounds and squares	$7 base
Hexagons and flats	$7.75 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	60	75
Class B	27	37
Class C	18	27

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 8 50	$ 9 50
Sheets, black, No. 10	8 50	9 00
Canada plates, dull, 52 sheets	8 50	10 00
Can. plates, all bright	8 60	9 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	11 00	....
Fleur-de-Lis, 28 B.W.G.	10 50	....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28.	....	....
Premier, No. 28, U.S.	11 50	10 50
Premier, 10¾-oz.	11 50	10 90
Zinc sheets	16 50	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$
1¼ in.	29 50	
1½ in.	31 50	29 50
1¾ in.	31 50	30 00
2 in.	30 00	30 00
2¼ in.	35 00	29 00
2½ in.	42 00	37 00
3 in.	50 00	48 00
3¼ in.		48 50
3½ in.	63 00	51 50
4 in.	85 00	65 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	24½
Palacine	27½
Machine oil, per gal.	43½
Black oil, per gal.	18½
Cylinder oil, Capital	82
Cylinder oil, Acme	70
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	$2 60
Union thread cutting oil, antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil, bbls., net	13½

BELTING—No 1 OAK TANNED

Extra heavy, single and double	10%
Standard	10%
Cut leather lacing, No. 1	2 75
Leather in side	2 40

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 60
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	09
Pumice, ground	06
Emery glue	30
Tripoli composition	09
Crocus composition	12
Emery composition	10
Rouge, silver	60
Rouge, powder, nickel	45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 43

WASTE

XXX Extra	.24	Atlas	.20
Peerless	.22½	X Empire	.19½
Grand	.22½	Ideal	.19
Superior	.22½	X Press	.17½
X L C R	.21		

Colored

Lion	.17	Popular	.13
Standard	.15	Keen	.11
No. 1	.15		

Wool Packing

Arrow	.35	Anvil	.22
Axle	.28	Anchor	.17

Washed Wipers

Select White	.20	Dark colored	.09
Mixed colored	.10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades ... 15%

ANODES

Nickel	.58 to .65
Copper	.38 to .45
Tin	.70 to .70
Zinc	.18 to .18

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6 x 4 base	45 00	44 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 75	$14 50
Sheets, 3½ lbs. sq. ft.	10 50	14 00
Sheets, 4 to 6 lbs. sq. ft.	10 25	13 50

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

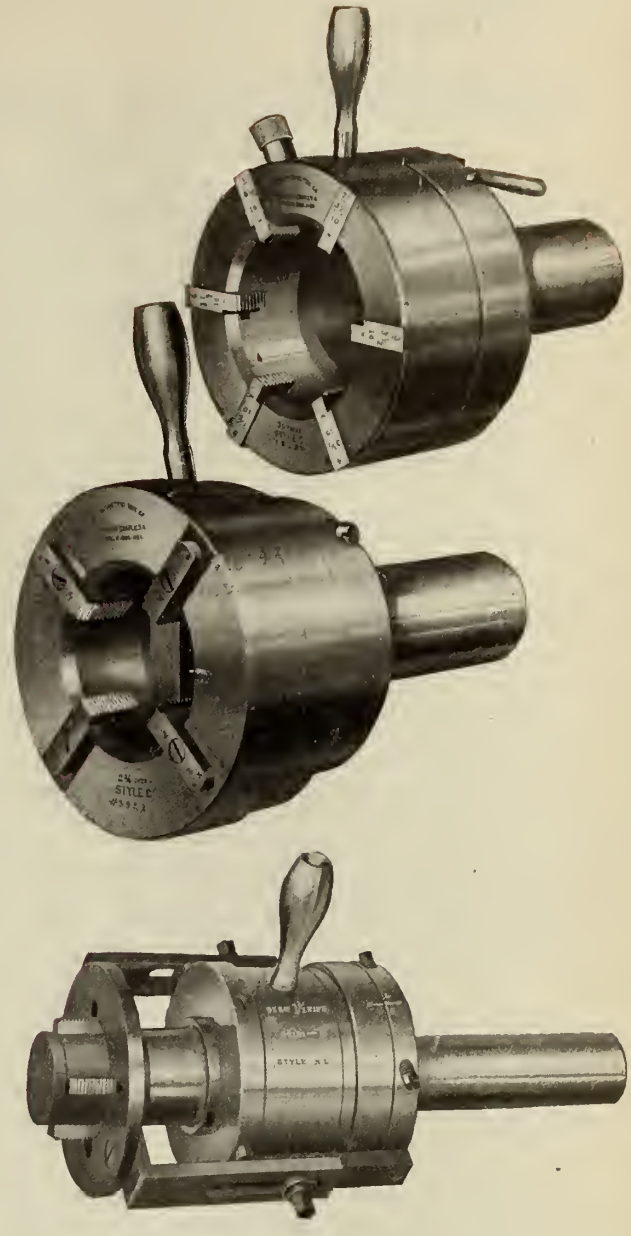
Acid, boracic	$ .23
Acid, hydrochloric	.03¼
Acid, nitric	.10
Acid, sulphuric	.03¼
Ammonia, aqua	.15
Ammonium, carbonate	.20
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.14
Copper, carbonate, anhy.	.41
Copper, sulphate	.16
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.08
Nickel carbonate	.32
Nickel sulphate	.19
Potassium sulphide (substitute)	.42
Silver chloride (per oz.)	1.25
Silver nitrate (per oz.)	1.20
Sodium bisulphate	.11
Sodium carbonate crystals	.06
Sodium cyanide, 127-130%	.38
Sodium hyposulphite per 100 lbs	8.00
Sodium phosphate	.18
Tin chloride	1.00
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated

A GOOD BOON

"Geometric Tools are a good boon in our business. Always reliable and sure of turning out a class job; in fact, I don't know how we could secure a decent output without them."

This is what the Works Inspector of a London (England) shop says. He adds that they are making screw and small parts for air craft, and have quite a lot of Geometric Dies in constant use.



Because of the fact that Geometric threading tools are "a good boon" in the thread cutting business, the majority of screw machines and turret lathes are equipped with Geometrics.

THE GEOMETRIC TOOL CO.
NEW HAVEN, CONN.

Canadian Agents:

Williams & Wilson, Ltd., Montreal
The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg and St. John, N.B.
Canadian Fairbanks-Morse Co., Ltd., Manitoba, Saskatchewan. Alberta

For any thread, any size, any pitch,—there's a Geometric Collapsing Tap or Self-Opening Die Head. Be assured there is one to meet your particular threading need—whatever it may be. Ask us.

If interested tear out this page and place with letters to be answered

Forging Ahead in Spite of Poor Conditions

Keeping Ahead With Material for Turning Out Automobiles a Difficult Undertaking—Willys-Overland Have Opened Cafeteria for Convenience of Their Weston Road Plant

A PAYROLL of 1,500 employees, an output of fifty cars per day, and the output four thousand cars behind the business booked, may be looked upon as a fair year's after-the-war business. That, in short, is what the Willys-Overland have done since they put their Overland-4 on the market in Canada as a Canadian product.

At the opening of the new cafeteria in connection with the Weston Road plant, Mr. T. A. Russell, president; Mr. J. F. McKay, secretary-treasurer, Mr. Dover, sales manager, and other officials of the company, told of some of the troubles and triumphs of the first year's business. The cafeteria is part of the program of industrial betterment that Mr. Russell has in mind for the plant. Arangements are made whereby the men in the plant, the girls in the office or the office staff generally, can be served at a very reasonable rate, an upstairs room being set aside for the use of the girls. The cafeteria is not put up as a money maker, but as a matter of convenience to many of the employees who find it impossible to get away at noon. A very substantial meal can be secured from 25 to 35 cents, which, in these days of high prices, is a modest enough sum.

Part of the cafeteria is set aside for the use of the Executive of the company. As far as possible they intend to have their noon-day meal together. It is almost impossible to get these men together, or to reach any number of them at any time during the day, as they are often engaged or away when wanted. "But we figured," remarked Mr. Russell, "that they would all eat once a day, anyway, and we find that our guess is correct."

The story of the turning over of the plant from the manufacture of Sunbeam motors for the fighting airplanes to the making of automobiles has been told in the columns of CANADIAN MACHINERY several times. Just before the conclusion of the war, production was being so perfected that it was within reason to state that the plant was on the verge of production where they could get one of these engines every hour, developing 200 h. p., although some of them tested as high as 250 h. p. The sudden cessation of hostilities left the company with a great amount of equipment, a good organization, but nothing to produce. The work of turning to a Canadian-made car was a big proposition. It required a lot of confidence in the stability of this country to go ahead and make the enormous initial investment. Nor have conditions been favorable in the fullest sense of the word, at any time since. There were labor troubles last year, and there has been, without a let-up, a shortage of material, especially in all lines of steel, that has made it impossible to plan for quantity production as the engineers at the plant would like to do.

The Returned Man

"We have made it a rule in our plant," said Mr. Russell, "to give preference to the returned men who apply for work, and also to make every allowance for them after they get started. If they fall down for a while, we regard it as all the more reason why they need more consideration. The results we are getting from the work of the returned men are satisfactory in every way, and a number of them are now holding responsible positions." A poll of the men employed in the plant was taken recently, and it was then found that one out of every three was a returned man.

"We have kept before us the idea of having a Canadian-made car, and at every opportunity we cut down the amount of material imported by replacing it with Canadian-made. Right now the value of the imported material in each car is $120. Some of the Canadian manufacturers from whom we buy parts may get some of their raw material from United States, but as quickly as practicable and possible we are trying to reach the made-in-Canada stage. With the shortage in all kinds of material it is serious business trying to keep up the production. There are in the Overland-4 exactly 1,296 parts, and the absence of any of these will hold up production. Our purchasing department is having a busy time trying to keep the factory in anything like full operation."

Mr. Russell also intimated that the Willys-Overland company had further extensions planned on an elaborate scale, but for the present the company was undecided as to the advisability of starting a building program, and also about going into the machine tool market for the necessary equipment.

Mr. Dover, sales manager of the Willys-Overland Co., speaking of the automobile market in Canada, said it was impossible to get the production at the plant keyed up to the amount of business in sight. Unless something very unforeseen happened, there would be no chance of catching up with the business by the end of 1921. "Just take yesterday for an example," was his way of explaining the situation; "we had orders coming in for 87 cars and the output of the plant was under the fifty mark on that day due to the lack of material. That shows how bookings are piling up ahead of the ability of the plant to turn them out. The farmers are buying cars in greater numbers. In fact they are our best customers right now."

Through the Plant

Following the luncheon, a number of the party went through the plant with Mr. Fred Adams, superintendent, and Mr. H. E. Brasier, manager of the Service Department. The making of the Overland-4 has been described in detail to readers of CANADIAN MACHINERY before. The Service Department is one that would surprise the layman, owner of a car though he might be, and yet not acquainted with the workings and the system used to keep a number of every piece in all the models on hand for immediate shipments. Sections are set aside for all the older models of Overland cars, as well as the Four. There is over a million dollars tied up in parts at the Weston Road plant, and every facility is provided to give speedy service to every driver of an Overland.

Need More Attention

Officials of the Willys-Overland Co. do not mince words when they come to speak of conditions of the roads leading from the city to their plant. "It is impossible for us to send a new car from the plant to the city without getting the 'Sunday' all spoiled on it. It is either splashed with mud or buried in dust according to the season." That is the official view of the situation. "While other cities in Ontario are giving free sites, exemption from taxation, and all sorts of concessions, Toronto does not seem to think it worth while to build a decent road to industries already here, and which are enlarging all the time."

The road going to the plant at this time of the year is certainly of the pioneer type, and what little repair work has been done is crude and of no consequence.

The Sick Benefit Fund

The employees of Willys-Overland Ltd., organized their own sick benefit fund A general meeting of the men was held some few weeks ago and officers elected. They are as follows: President, A. Ellis; vice-president, J. McDonough; secretary, G. Kingsburgh; treasurer, J. Easton; trustees, W. L. Clarke, C. Glen, H. E. Brasier, H. Singer, W. Mellis, H. B. Capsey.

The levy made by the men is ten cents per week on the members. This amount is deducted from the pay, but not without the consent of the employee. Of course if the employee puts nothing in he is not entitled to take anything out.

The benefits are placed at $6 per week for sickness or accident outside of working hours, and not covered by the Workmen's Compensation Act; not to exceed

Garlock-Walker's List of Machines in Stock and for Immediate Shipment

LATHES

1—7A Cataract Precision Lathe, NEW.
1—7B Cataract Precision Lathe, with compound rest, NEW.
2—7" Cataract Precision Lathes, with attachments, USED.
1—12 x 8 Carroll-Jamieson Q.C.F., S.B.G., USED.
1—14 x 8 Carroll-Jamieson Q.C.G., S.B.G., USED.
1—14 x 6 Hamilton, Q.C.G., S.B.G., USED.
1—16 x 6 Cisco, Q.C.G., S.B.G., USED.
6—16 x 6 Reed-Prentice Single Purpose, Semi-Automatic, NEW and USED.
1—16 x 8 Reed-Prentice Plain Screw Cutting, USED.
1—16 x 8 Bradford Plain Screw Cutting, USED.
1—16 x 6 Morris, Q.S.F., S.B.G., USED.
1—18 x 8 Rae, Q.C.G., D.B.G., NEW.
1—18 x 8 Milwaukee, Q.C.F., D.B.G., NEW.
1—18 x 8 American Tool Works, Q.C.G., D.B.G., USED.
1—18 x 8 Cincinnati, Q.C.G., D.B.G., USED.
1—18 x 8 Bradford, Plain Screw Cutting, USED.
1—18 x 8 Whitcomb-Blaisdell, W.C.G., D.B.G., USED.
1—18 x 8 Morris, W.C.F., S.B.G., USED.
1—18 x 8 Flather, Plain Screw Cutting, USED.
1—18 x 10 McDougall, Q.C.G., D.B.G., Taper Attachment, USED.
1—20 x 10 Rahn, Plain Screw Cutting, USED.
1—24 x 10 Milwaukee, D.B.G., Q.C.F., NEW.
1—30 x 16 Advance, D.B.G., Q.C.G., Heavy, NEW.
1—36 x 16 Bridgeport, Heavy Duty, NEW.
1—36 x 18 Putnam, Plain, Heavy, USED.
1—50 x 40 Ryerson-Fifield, Heavy, NEW.
1—18 x 10 McDougall, Q.C.G., D.B.G., Taper Attach., USED.

TURRETS

10—No. 4 Millholland Power Feed Turret Screw Machines, Wire Feed, Cut-off Slides.
3—Davis, 24" Turrets, 2" Hollow Spindle, USED.
5—Oliver, 16" and 18", 2½" Hollow Spindle, USED.
1—Hartford Full Automatic, 2 7-16" Hollow Spindle, USED.

DRILLS

2—No. 1 Burke, 10" Sensitive Bench, NEW.
2—15" Barnes, Geared Head, USED.
1—16" Single Spindle, High Speed Edlund, NEW.
1—20" Barnes Automatic Stop and Return Feed, NEW.
2—20" Champion P.W. & L. Feed, NEW.
1—32" McKay-Bertram Heavy Duty, USED.
1—No. 314 Baker 3" capacity, nearly new.
1—No. 14 Colborn, 2" capacity, nearly new.
1—D8 Colburn Heavy Duty, nearly new.
1—4' Radial Ryerson Gear Box Drive, NEW.
3—4-spindle Woodward & Rogers, ½" capacity, NEW.

SHAPERS

1—16" Queen City Back Geared, USED.
1—16" Milwaukee Back Geared, NEW.
1—24" Steptoe Single Pulley Drive, NEW.
1—24" McDougall Back Geared, USED.

PLANERS

1—24 x 24 x 8 McK.-Bertram, USED.
1—24 x 24 x 8 Whitcomb-Blaisdell, USED.
1—48 x 48 x 14 Powell, USED.
1—48 x 48 x 18 Ryerson Multispeed, NEW, four heads.
1—30 x 36 x 12 London, one head, USED.

GRINDERS

1—No. 2 Bath Universal, NEW.
1—8 x 36 Fitchburg Cylindrical, NEW.
1—No. 1 Cincinnati Tool and Cutter, USED.
1—No. 1 Wilmarth & Morman, Universal, USED.
1—No. 1 Le Blond Universal Tool and Cutter, USED.
1—Barnes Wet Emery Grinder, USED.
1—No. 12 Gardner Disc Grinder, USED.
1—No. 65A Blount Wet Tool, Used.
1—14 x 72 Norton Plain Grinder, USED.
1—Wilmarth & Morman Wet Tool and Drill Grinder, USED.

MILLING MACHINES

1—No. 3 Ryerson-Owen Universal, NEW.
1—No. 3 Ryerson-Conradson, Plain, NEW.
1—No. 3 Ryerson-Conradson, Universal, NEW.
2—No. 3 Ford-Smith, Plain, USED.
1—No. 1 Kempsmith Universal, nearly new.
4—Type A & B "Briggs" Heavy Duty, Plain Millers, NEW.
Several Hand Millers, pedestal and bench type.

PUNCHES, SHEARS AND PRESSES

Several Small Punches and Shears. Capacity to ¼", NEW.
1—Ryerson Rotary Bevel Shear. Capacity 1", NEW.
1—Ryerson 8' Double Housing Type Splitter, Cap. ¾", NEW.
1—Ryerson Kling Punch, 1¼ x 1", 48" Throat, NEW.
1—Styles Parker Sprue Press, stroke 1¼", USED.
1—Brown, Boggs Single Crank Double Arch Geared Press, 4" Stroke, USED.
1—No. 200 Brown, Boggs Press 1¾" Stroke, USED.
2—No. 13 Stoll Plain Inclinable Open Back Presses, NEW.
1—No. 57½ Toledo Geared Press, USED.

AUTOMATICS

1—No. 2 Garvin Automatic Screw Machine Wire Feed, USED.
1—No. 2 Brown & Sharpe Screw Machine Wire Feed, USED.
1—National Acme Automatic Screw Machine, Four Spindle, Capacity 1", USED.
1—National Acme Automatic Screw Machine, Four Spindle, Capacity, 1⅛", USED.
1—National Acme Automatic Screw Machine, Four Spindle, Capacity 1 7-16", USED.
10—Cleveland Single Spindle, Capacities ¾" to 1 3-16", USED.
1—Cleveland Single Spindle, Capacity ⅜", USED.
6—Brown & Sharpe Auto. Screw Machines. Various capacities.

ENGINES

1—21 x 30 Right-hand Heavy Duty Goldie-Corliss, speed 150 R.P.M., Rites Governor and 75' drive belt 37" wide, Tightener.
1—20 x 40 x 42 Cross Compound Goldie-Corliss Rope Drive with Condenser.
1—13 x 14 Robb High Speed Engine, with 70 K.W. Generator, 60-cycle, 3-phase, 220 V. Direct Connected, with Exciter.
1—18 x 18 Robb-Armstrong High Speed, Belt Drive.
1—75 H.P. Peerless Self-oiling Automatic Steam Engine, direct connected to 50 K.W., 220 V. Generator, with Switchboard.
1—75 H.P. High Speed "Bell" Steam Engine.

AIR COMPRESSORS

1—8 x 8 Sullivan, Belt Drive.
1—8 x 8 Bury, Steam Drive.
1—10 x 18 Ingersoll, Belt Drive.
1—10 x 10 Sullivan, Belt Drive.

MISCELLANEOUS

Beaudry Hammers, Power Hack Saws, Ventilating Fans, Roots Blowers, No. ½ and No. 1, High Speed Riveting Hammers, Portable Cranes, Chain Blocks, Vacuum Pumps, Moulding Shop Equipment, Shafting, Pulleys, Belting and Hangers.

May we have your enquiries?

Garlock-Walker Machinery Limited

567 Banning Street
Winnipeg

32 Front Street West
TORONTO

334 St. James Street
Montreal

"Everything in Woodworking and Metalworking Machinery"

If interested tear out this page and place with letters to be answered

26 weeks in any one year, and in case of death $50 for funeral expenses.

Mr. Russell, after the formation of the Willys-Overland Mutual Benefit Society, wrote, on behalf of the company, approving of the idea, and by way of showing tangible sanction, offered to employees of six months' standing a 50 per cent. increase in the sick benefit and 100 per cent. in the case of a funeral, making $9 per week for sickness and $100 for funeral expenses.

FACTORIES EXTEND PLANTS IN GUELPH

Additions at Gilson's and the Malleable Iron Works, as Well as at Lang's.

Guelph. — The Gilson Manufacturing Co., of Guelph, makers of the Goes-Like-Sixty gas engines and tractors, etc., are adding a two-storey brick extension, 140 by 80 feet, to their main building, to be used as a machine shop and assembling room.

This, along with the large extension to the molding shop which has recently been completed, will put them in a better position to cope with the extra volume of work which is coming their way.

White Sewing Machine Extensions.

The White Sewing Machine Co. of Canada, Limited, have just completed some very extensive alterations to their plant, several new buildings have been added, and a considerable amount of new machinery installed. The company is now manufacturing at their Guelph plant several types of machines which formerly had to be imported from their plant in Cleveland. A very busy season is anticipated.

Second Extension in 12 Months

The Lang Manufacturing Company, Limited, general machinists, who opened their plant at Guelph in May, 1919, and who found it necessary to build an addition in the fall, have again been obliged to extend, and the foundation is being laid for an additional structure, 45 x 33 feet. The company manufactures the Guelph Convertible Seat and does a big business in oxy-acetylene welding in addition to a general line of machinery repairing and rebuilding, and are exceptionally busy at the present time. One large order which they have just filled is for convertible seats for the million dollar inn at Huntsville. These seats are so constructed that they can be converted into combination seat and dining table for picnic parties.

South African Trade—Mr. P. M. Ward, Assistant Trade Commissioner to South Africa, is of the opinion that there is a great field for Canadian manufacturers to develop an export business to South Africa. The chief lines that are needed are building materials and machinery and agricultural implements. The obstacle presented by the exchange situation was expected to be soon relieved by the arrangement with London for payments of drafts.

LARGE ADDITIONS BY BUTTERFIELD CO.

Capacity Has Been Quadrupled During the Last Four Years

The Butterfield & Co. division of the Union Twist Drill Co. have signed the contract for a large addition to their factory at Derby Line, Vermont. Buildings will consist of one three-storey building, 180 x 50 feet, and one single storey building, 180 x 60 feet. Concrete and brick construction used throughout. Contract price, $200,000.

Plans are also drawn for an addition to the companies' plant at Rock Island, Quebec, to consist of a three-storey building, 180 x 60 feet, of concrete and brick.

The growth of Butterfield & Co. since its acquisition by the Union Twist Co. has been nothing short of phenomenal; the working force and floor space having been quadrupled in the last four years.

SHOULD CUT DOWN NUMBER OF LINES

Too Many Varieties of Steel Interferes With the Operation of the Rolling Plant

Leaders in various lines of industry are considering the question of standardization to a greater extent than formerly. In the last issue of "Financal Post" a number of instances were cited.

C. W. Sherman, president of Dominion Foundries & Steel, Ltd., touches on a different phase of Canadian industry, but the underlying conditions are practically the same. He points out that the reduction of the variety of products in Canada would be most desirable, due to the fact that the volume of business in this country is less than 10 per cent. of the American volume and the variety of demands just about as great as in the States. He proceeds as follows:

"Up to the present time we have only written and suggested various lines to our customers, and I mention the following: Take the one item of frame steel for automobiles—three thicknesses, light, medium and heavy, should cover the entire requirements of all the companies in Canada. On the other hand, we receive orders for at least twenty different thicknesses, varying in gauge from 100 to 200 thousandths of an inch. This greatly upsets our operation of rolling, shearing and shipping. This same condition also applies to other thin-shaped flat steel for miscellaneous plate work, agricultural work and deep drawing work.

"For Canadian consumption we would recommend that sheets be limited to four gauges—14, 18, 22 and 28, and that light plate steel up to quarter-inch be limited to six gauges—.095, .125, .150, .200 and .225. It can readily be seen that this would greatly facilitate manufacturing, carrying in stock and delivering flat steels."

ENGINEER HAS A DUTY TO PUBLIC

Calvert Townley Pointed This Out at Meeting of the A. I. E. E.

FOLLOWING the annual meeting for the election of officers and an informal dinner, Calvert Townley, president of the American Institute of Electrical Engineers, spoke before the Toronto section in the Engineers' Club on Friday last.

While much of his address was necessarily devoted to institute affairs, the speaker dealt at considerable length with the relations of the engineers to the public and the need for his taking an active part in affairs of the present moment. The engineer had always had an enviable reputation for truthfulness and fair dealing and was looked upon by the public as one whose opinions were worth listening to.

Modern civilization had been practically founded upon the work of the engineer and his guidance would be equally necessary in the present period of readjustment.

Speaking of institute affairs, Mr. Townley stated that a flourishing condition prevails, the membership was showing a healthy growth, the journal in its new form has proved to be an unqualified success and many letters of commendation had been received by the executive.

The following officers were elected for the ensuing year: Chairman, Frank Richard Ewart, Ewart, Jacob & Ryan; secretary, Perry A. Borden, Hydro-Elec. Power Commission; members of executive committee, O. V. Anderson, Tor. and Niagara Power Co.; L. B. Chubbuck, Can. Westinghouse Co.; W. P. Dobson, Hydro-Elec. Power Com.; S. E. M. Henderson, Can. Gen. Elec. Co.; George D. Leaceck, Moloney Elec. Co. of Canada; Walter F. Wright, Eugene F. Phillips Elec. Works.

EXTENSIONS MADE BY LINK-BELT CO.

Policy of Expansion Has Been Announced to Affect Several of the Plants

Increased demands for their products have compelled the Link-Belt Company, whose general offices are in Chicago, to carry out an extensive program of expansion at their works in Chicago, Philadelphia, Indianapolis, Seattle and Toronto, Canada.

New manufacturing facilities have been added to the several plants, and the personnel of both factories and sales offices has been increased.

Two new furnaces—the seventh and eighth—have been added to the great chain works at Indianapolis in the last few months.

Announcement of the purchase by the Link-Belt Company of the Fairmount Foundry, at Philadelphia, was made a

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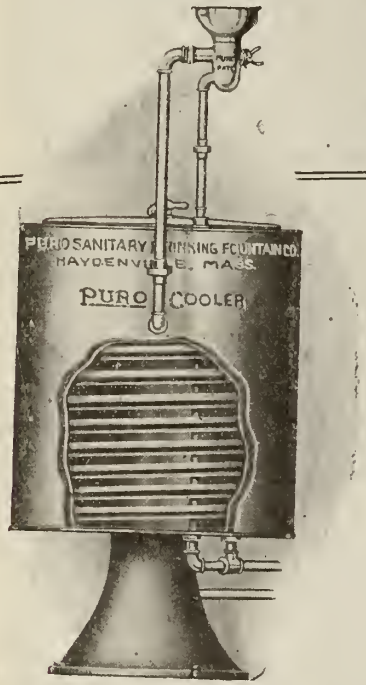

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few days ago by Mr. Charles Piez, president of the Link-Belt Company.

This deal involved several hundred thousand dollars. The foundry will be used as an adjunct to the Eastern works at Philadelphia, supplying this plant with grey iron castings.

A new administration building is under construction at the Philadelphia works, and plans are being made to erect another such building at the Chicago works, to make room for enlarged engineering, sales, drafting and clerical staffs.

The shops at Toronto and Seattle are being expanded to take care of the steadily growing business in those regions. In the Chicago works foundry a conveying system is being installed to speed up output. A new warehouse is under construction at Seattle. The Toronto shops and offices will shortly occupy new quarters there.

Mr. A. C. Johnston, formerly Chief Engineer of the Chicago works, has been elected vice-president of the Link-Belt Company, and resident general manager of the Chicago works. He succeeded Mr. Prentiss L. Coonley, who resigned to devote his time to the presidency of the Isko Manufacturing Company.

LESSONS ON THE ABC OF GOOD WELDING

(Continued from page 420)

that for such emergencies the manufacturer of your torch can provide you with a removable water-cooled tip and connections which can be attached to your welding torch. It is very essential that such tips and connections be removable, as their added weight would seriously impair the usefulness of the torch for ordinary work on which their use is not required.

If such water-cooled tip and connections cannot be secured, the head and tip of the torch can be cooled occasionally by plunging them in water. This is violent treatment, but any well-built torch must stand it. By using a well-filled pail, all the parts may be immersed except the flame and bare end of the tip, which are left protruding above the surface. This saves the time that would otherwise be spent in extinguishing, relighting and adjusting the flame

(NOTE.—This article is the second half of the first of twenty lessons used by the author for the instruction of students in the art of welding. Other lessons will follow in regular sequence.)

The Carlyle Johnson Machine Co., Manchester, Conn., have issued a very attractive booklet on their friction clutches as applied to machine building. Close to 50 different and varied applications are illustrated and described, each of particular interest to the machine tool builder.

A copy of this book will be sent upon request to the above-mentioned firm, and as this is something of particular value to the purchasing agent, owner, and designer, alike, we feel sure many will avail themselves of this opportunity.

TRADE GOSSIP

Montreal.—Mr. Thomas Robb, secretary of the Shipping Federation, will not be able to accept the appointment to represent the Canadian Shipping interests at the Seamen's Conference, to be held in Nenoa, Italy, in June next. The name of Mr. A. W. Wright of Kingston has been accepted instead.

To Take up Civil Engineering—Due to recent amalgamation placing them in a very favorable position for carrying out large contracts, Messrs. Armstrong Whitworth of Canada have decided to enter the public works contracting field. The new development will be under the control of Mr. Robert H. Mackenzie.

Action for Shell Commission—Mr. R R. Carr-Harris, general contractor of Toronto, is suing the General Electric Company for $658.80, which he claims to be due for obtaining contracts for the latter, and in accounting. The contracts were in connection with munition supplies for the Allies. The General Electric Company states in their defence that the contracts were secured by Sir Frederick Nicholls, and not by the plaintiff.

Merger Interests Meet—The British syndicate that is interested in the huge steel and coal merger in Canada held a meeting recently to hear the report of Sir Newton Moore, who had just returned from a tour of inspection in that country. The report presented by him and Mr. Talbot, a technical steel expert, was well received, and the representatives of the different interests present were fully satisfied of the ultimate success of the amalgamation.

Big Power Contract Let—The Nova Scotia Power Commission at a recent meeting let the contracts for the St. Margarets' Bay Power Development. The contract for the four electric generators went to the General Electric Co. and will be built in their shops at Peterborough. The Pacific Coast Pipe Co. of Vancouver were awarded contracts for wood stave pipe 6 feet and 10 feet diameter. The general construction contract, including the building of power houses, dams and intakes, were awarded to D. G. Loomis & Sons, Montreal.

TENDERS

Tenders are being called for four concrete bridges , for the County of Wellington. Tenders must be in by May 4th. Full particulars can be obtained from James Beattie, County Clerk, Fergus, or from Mr. A. W. Connor, 34 Victoria street, Toronto.

Tenders are being called for, and will be received until May 5th for the Sarnia Collegiate and Technical School. Tenders for reinforced concrete, brick work, flooring, etc., must be submitted to E. B. Coon & Son, Toronto, from whom plans and specifications can be obtained.

The Vancouver Harbor Commissioners are calling for tenders for the filling

and dredging for the Harbor Commissioners' new pier at Burrard Inlet. Plans and specifications can be obtained at the office of the Harbor Commission, 712 Pender Street, W., Vancouver, B. C., or at the office of Mr. A. D. Swan, C. E. 10 Phillips Place, Montreal, P. Q.

INTERESTING CATALOGUE

The Albert Herbert Ltd., Coventry, England, who have started a Canadian branch at 31 Yonge St., Toronto, have forwarded to this office a very interesting catalogue on "The Turret Lathe and Its Work."

This book describes what is known as their combination turret lathe, and illustrate various set-ups which contain valuable hints in turret lathe practice. There are about 60 illustrations of work performed on this type of machine and all worthy of attention.

The Capstan style lathe is next discussed and this style machine is also profusely illustrated and set-ups explained in detail.

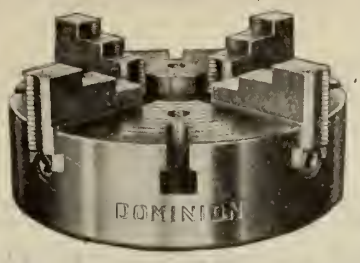
The Automatic trimming machine is next in order. This machine is somewhat similar to the P. and J. type and again the photographs of all set-ups are exceedingly interesting.

Last comes the Hexagon turret lathe, and the class of work performed on this machine is well worthy of attention.

This catalogue, or book as we prefer to call it, should be of decided interest to anyone contemplating the purchasing of new equipment and a copy can be procured upon request.

PIG IRON REVIEW

The loss of iron due to strike is estimated at 500,000 tons. The situation is clearing in various quarters, and shipments are going forward more freely. This is the case in the Eastern Pennsylvania district, according to despatches from Philadelphia. On the other hand, shortage of coke in the same district has caused several more furnaces to be banked. The business done during the week in this district amounted to a fair volume. Foundry's iron is on a base of $45 for No. 2 plain Eastern Penn furnace. There has been a fair amount of Bessemer sold also. The Chicago market presents no features of interest. The railroad situation is still bad in that district, and stacks are operating on a narrow fuel margin. Southern iron is quoted at $42 Birmingham, and northern iron is $43 Chicago. The strike of the railroad switchmen came at a bad time for the iron trade in the Pittsburg district which was in a fair way of overcoming the acute shortage. It is estimated that 50 per cent. of the production in this district was lost during the past week. It is expected that a strong demand for prompt iron will be one of the results, and already a strong tone is developing. 10,000 tons of basic was placed at $43 valley furnace. No. 2 foundry is quoted at $44 but only a few small sales have been made at that figure. One of the developments of the strike situation is the movement of resale iron in New England, and the fancy prices obtained for this material. No. 2 X has been sold under these conditions at $65, while the lowest price is $60. The embargo still holds on all New England railroads, and no iron is coming in from outside. New York reports very little iron coming in, though a good business was done during the past week.



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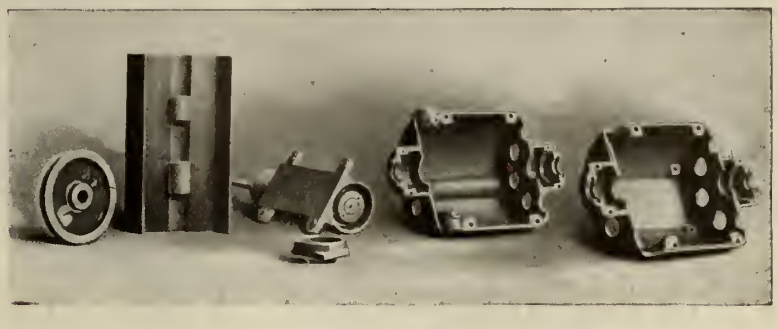
May Be Used for Many Purposes



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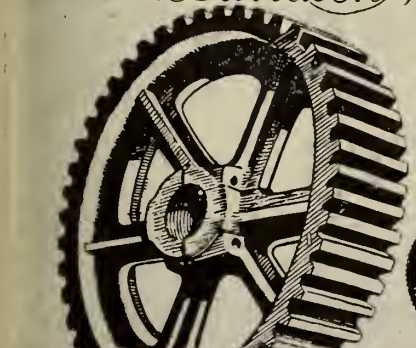

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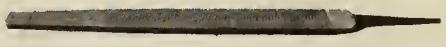

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INGERSOLL

BLIND BUYERS

A Straightforward Talk on Buying Babbitts

"Blind Buyers" is a term which we believe it is permissible to use to emphasize the lack of insight of some buyers when purchasing Babbitt metals. No buyer knows all about EVERY product used in his plant, and he cannot be expected to know all about Babbitt metals. For this reason, although he may order most of his requirements efficiently, he may actually be "blind" in connection with his Babbitt purchases, and will be thankful to us for pointing it out to him.

"SCRAP or virgin metals"—that is the question. Whether to buy the cheap-priced so-called Babbitt metals—mixed from remelted scrap; *or*

To buy a Babbitt, *alloyed from prime virgin metals,* at a bit more per pound, which has honesty in back of it—in the very fact that it *is* what it purports to be.

This is the manner in which a buyer *should* argue with himself when about to buy Babbitt. However, few buyers consider what is put into a Babbitt. The average buyer figures that "metal is metal" and, to him, the only distinction is that of price per pound. He might be surprised or even skeptical when we tell him that most of the metal makers use all the scrap they can in manufacturing Babbitt Metal Alloys.

Buyers usually argue that the Babbitt they are using is doing the work required of it. This is not sound argument. *Low-grade material cannot produce a high-grade product.* It will not have equal wearing ability. You cannot afford to pass by the better Babbitts which do not have to be replaced so often.

A cent or two or three added to the cost per pound of your bearings makes little difference in the buying cost, but will save you that slight additional cost many times over on the increased production of your machinery due to the lesser number of shut-downs for re-babbitting, besides saving the labor expense.

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ONE No. 3 KELLER AUTOMATIC DIE-Sinking or Engraving Machine, complete with Grinding Machine and Motors. For further information wire or write General Forgings & Stampings, Ltd., Merritton, Ont. (c20m)

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Machinery and Supplies

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TORONTO PATTERN WORKS, 65 JA[illegible] Street, Toronto. Patterns in wood and [illegible] for all kinds of machinery. [illegible]

BRANTFORD PATTERN WORKS ARE P[illegible] pared to make up patterns of any kind [illegible] cluding marine works—to sketches, blue prin[illegible] sample castings. Prompt, efficient service. [illegible] 'Phone 631; Machine 'Phone 733. Brantford [illegible] tern Works, 49 George St., Brantford, Ont. [illegible]

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Planer—24" x 24" x 6' London Machine Co., almost new.

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5—No. 0 Steptoe Hand Millers
13" x 5' 6" New Carroll-Jamieson Quick-Change Lathe
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15" x 6' New Sidney D.B.G. Quick-Change Lathe, swing 17"
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17" x 8' New National Quick-Change Lathe
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50KVA	2400	WESTINGHOUSE	1200	
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60KVA	2300		1200	
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75	2300	GEN. ELECTRIC	1200	ATB.
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90	2200	FAIRBANKS-MORSE	900	B.
100	2300	GEN. ELECTRIC	900	ATB.
100	2400	WESTINGHOUSE	900	
120	2300	WESTINGHOUSE	900	
150	1150	FT. WAYNE	900	TRB.
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200KVA	600	GENERAL ELECTRIC	600	TAB.
200	600	GENERAL ELECTRIC	600	ATB.
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375KVA	2300	FAIRBANKS-MORSE	450	ATB.
400	2300	GENERAL ELECTRIC	360	ATB.
400	2200	WESTINGHOUSE	450	
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SIMPLICITY

TRAHERN Lubricating Pumps are simple in design having no intricate parts to get out of order. Principal working parts are a pair of gears which revolve in an accurately machined case, allowing just enough clearance to assure maximum efficiency and minimum wear. Double automatic relief valve concealed in face plate.
Pump automatically reverses with the machine, delivering a continuous, steady flow of coolant.
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Geo. D. Roper Corp.
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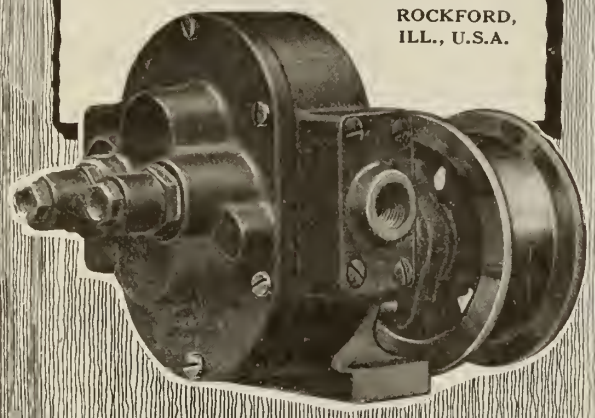

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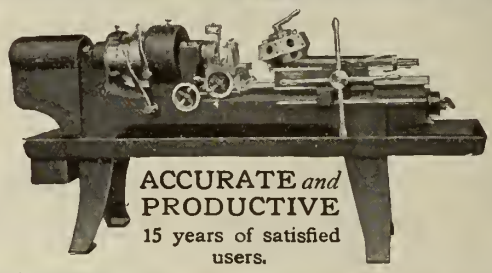

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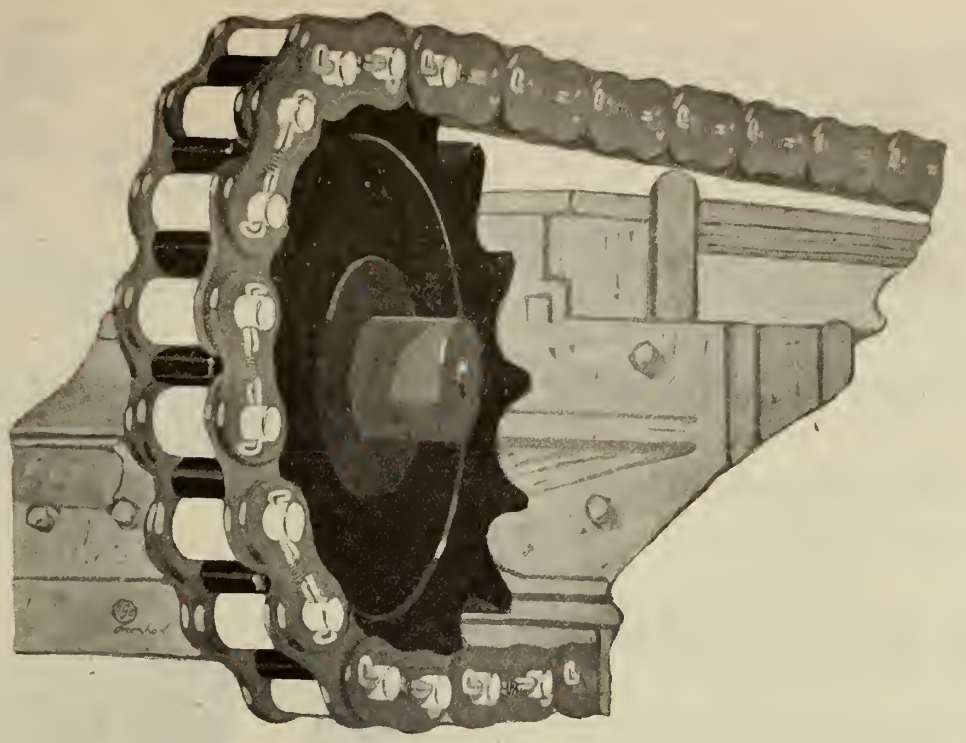

For every point of power transmission there is one best medium. Here it may be a belt — there gearing — but more often than is generally realized it is a

BALDWIN CHAIN DRIVE

The rollers and bushings of Baldwin roller chain are made of a high quality steel, case hardened and accurately machined. The pins are made of nickel steel, case hardened and heat treated and the side links are made of the toughest cold rolled steel. This construction produces a chain of greatest strength, long life and with the least possible friction resistance.

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As engineers, the makers of Baldwin Chain feel the responsibility for the design and proper functioning of every chain drive that leaves their factory—and we, as their Canadian representatives, share that feeling.

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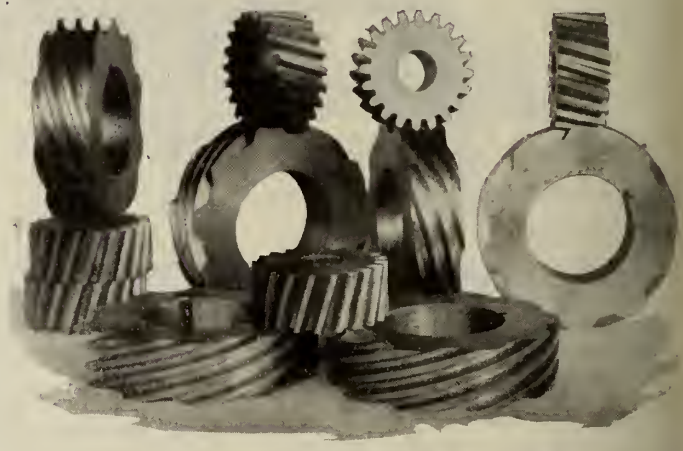

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2

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QUALITY SERVICE SATISFACTION

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Stellite—the hotter it gets the tougher, harder and more lasting it becomes. Stellite is immune to heat up to 1800° F.—far past the point where the finest of high speed steels burns and crumbles.

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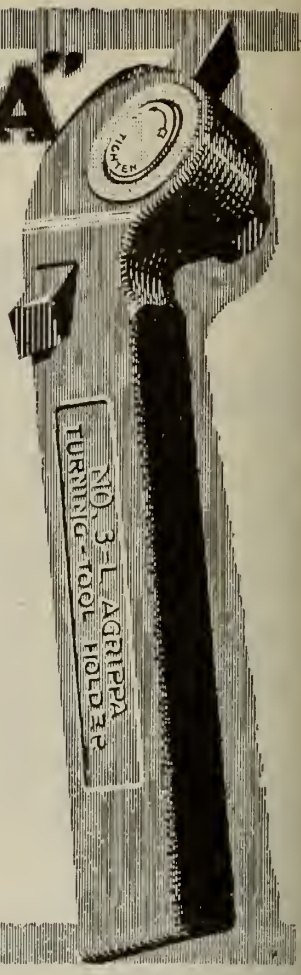

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Highly Endorsed by Canada's Best Manufacturers

Study long-wearing "Made-in-Canada" Chucks that are making good everywhere.

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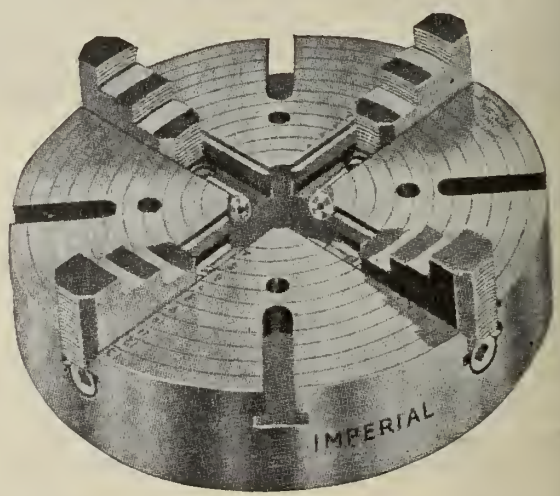

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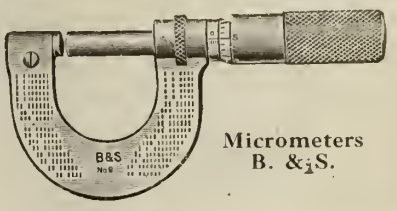

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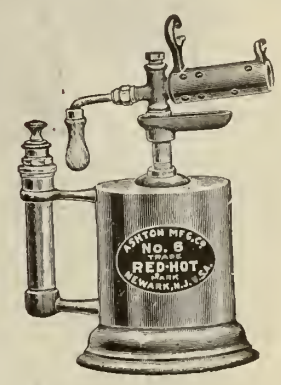

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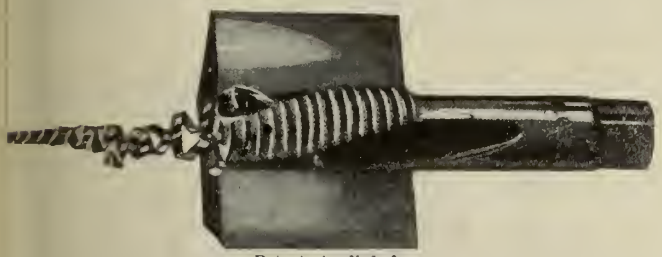
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All Compressors used about eighteen months, and in first-class condition.

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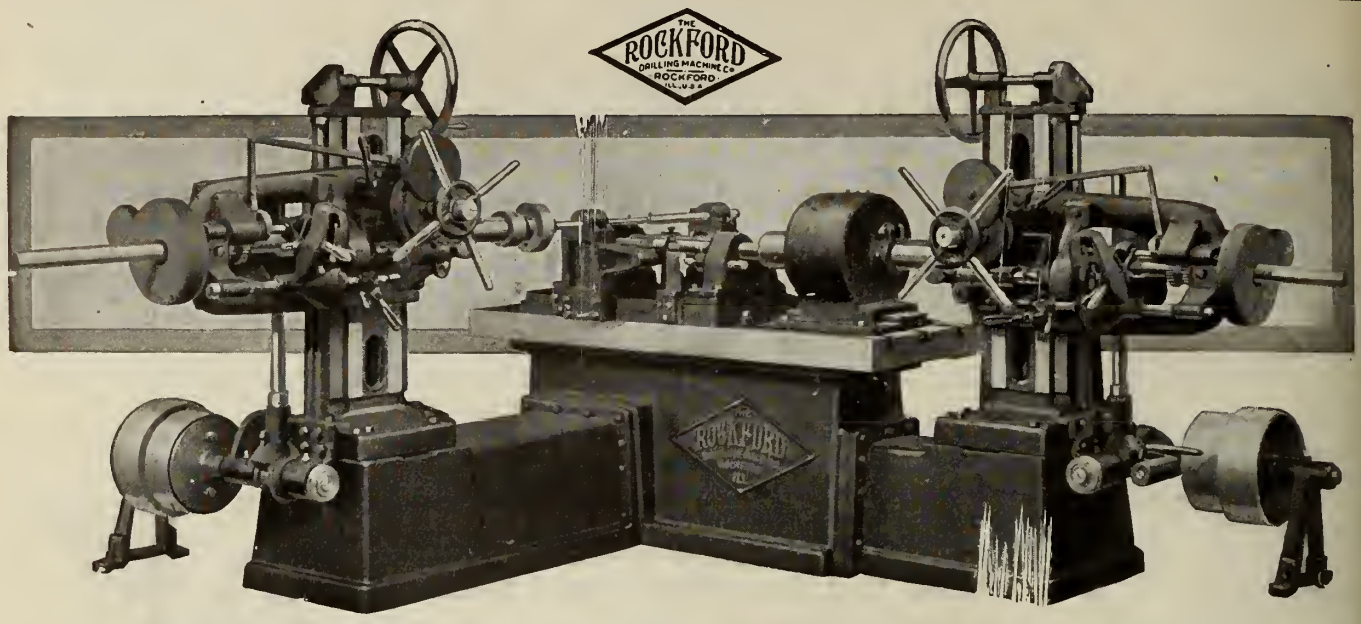

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This tool is especially adapted to automobile manufacture and is unusually rapid and accurate in the boring of crank cases, transmission cases and rear axles. Spindles are at right angles to each other and will bore longitudinal and cross holes in work simultaneously.

These machines have been installed in many prominent automobile plants. We will gladly tell you all about the good work they are accomplishing. **When writing send blueprints of your boring work and we will give you figures on the "Rockford's" ability.**

THE ROCKFORD DRILLING MACHINE CO., ROCKFORD, Ill.

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HACK SAWS

Sterling
HIGH SPEED POWER SAW

MANUFACTURED BY

DIAMOND SAW & STAMPING WORKS

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Elk Brand Firebrick is made in several qualities each brand being specially adapted to give better results in certain places, than other brands we produce. Put your problems in our hands, and get expert advice on the proper brand for your particular requirements. We always take an unprejudiced interest in seeing that you get the brick that fills the bill.

We never recommend a higher quality if a lower priced brand will stand up just as well.

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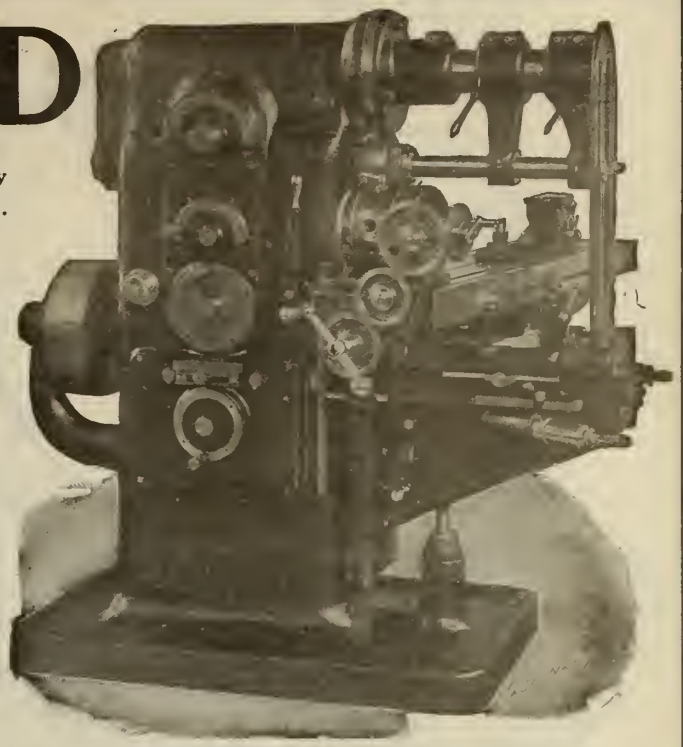
Saves Time, Labor, Expedites Production

ROCKFORD Milling Machine

Its speed, simplicity of operation and great utility Assure Big Profits in whatever work it is used.



And another profit-making feature of the "Rockford" Miller lies in its unusual capacity to do all classes of work.

In the tool room, in the shop, in the manufacturing or jobbing establishment this "Miller" is beyond comparison.

Has Power to Spare

Put the power of the "Rockford" to the severest tests. It's built to more than meet the demands likely to be made upon it. It is the pace-maker of the machine shop.

Look into the merits of this machine. Write to us without delay.

ROCKFORD MILLING MACHINE CO., ROCKFORD, ILL.

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Production of Rare Quality at Lowest Labor Costs

There is unusual strength, accuracy, speed, convenience and range in

AURORA

Drilling Machines

You can use them to great advantage on any work in your shop that's suitable for a machine tool of this kind. The operating is easy and the labor cost comparatively low.

Drop a line for full particulars and specifications.

Stationary Head Sizes 20"—21"
Sliding Head Sizes 22"—44"

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AURORA, INDIANA, U.S.A.

We wanted something original—this is what we got

"BOTH of these operations and half another — I'll show you later—completed in the time our old taps took to do one; that, I guess, is why we continue to use your Victor Collapsible Taps."

It was the often-heard story of time saved, of costs lowered, of all threads clean and smooth. And it was pleasant to hear.

Victor Tool Company
Waynesboro, Pa.
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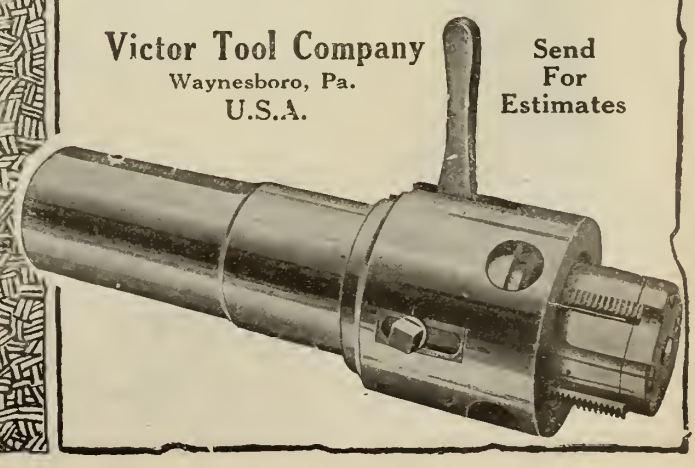
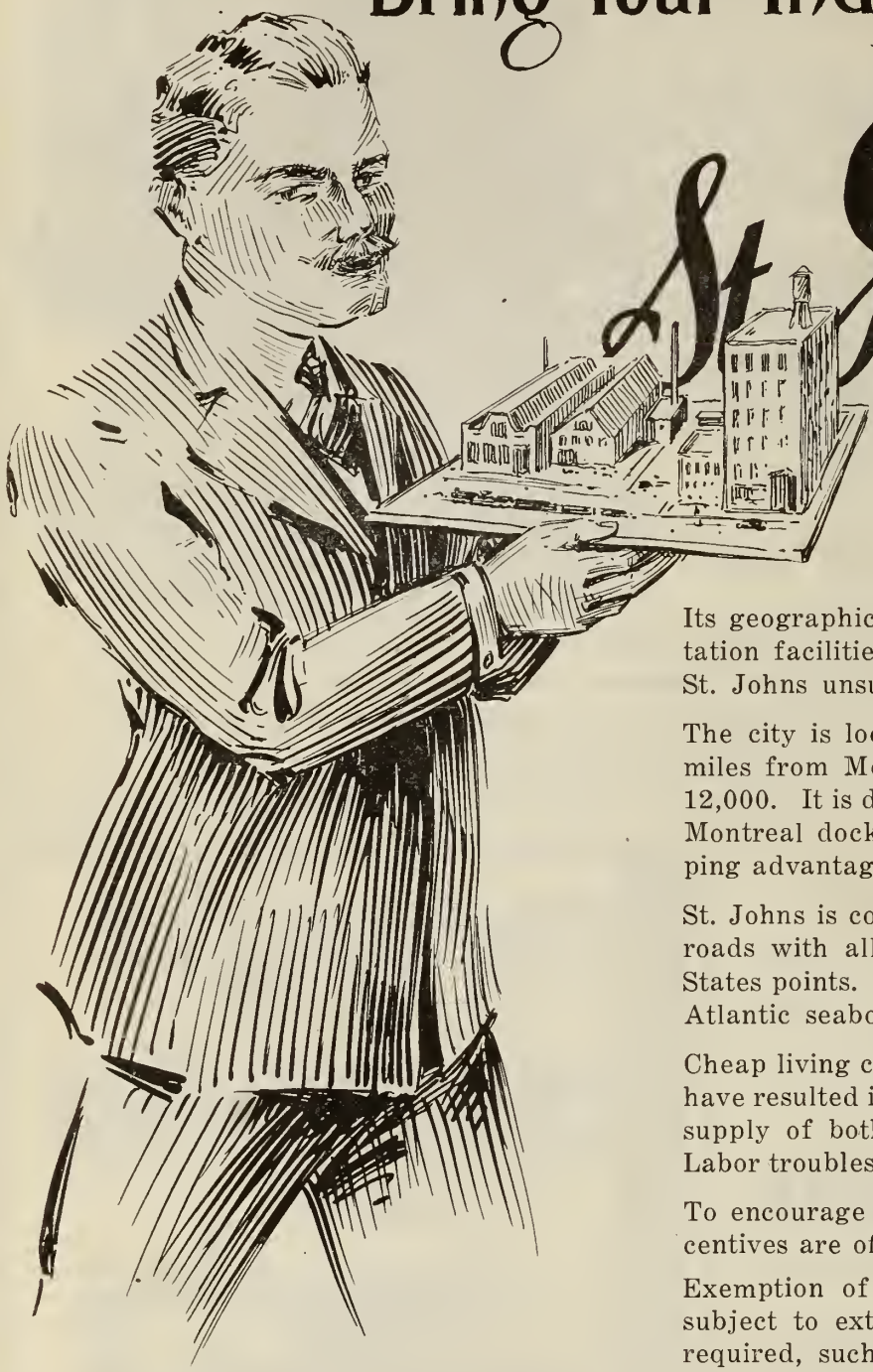


Bring Your Industry to St. Johns Quebec



Its geographical location, unequalled transportation facilities and cheap labor market make St. Johns unsurpassed as an industrial centre.

The city is located on the Richelieu River, 27 miles from Montreal, and has a population of 12,000. It is directly connected by rail with the Montreal docks, providing unusual ocean shipping advantages.

St. Johns is connected by seven important railroads with all Canadian and Eastern United States points. It has canal connections with the Atlantic seaboard and the St. Lawrence river.

Cheap living conditions and low rents and taxes have resulted in cheap labor and there is a large supply of both skilled and unskilled workers. Labor troubles are unknown.

To encourage new industries, the following incentives are offered by the city:

Exemption of taxes for fifteen years' period, subject to extension; all public improvements required, such as street extensions, sidewalks, waterworks and sewage; five per cent. bonus on your payroll for five years. If you wish it, this bonus will be advanced to you to be applied to the construction of a suitable building.

For more detailed information, communicate with

The Secretary of the City Council

St. Johns, Quebec, Canada

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HIGH SPEED STEEL
INTRA STEEL GIBRALTAR STEEL
Tool Steel for Every Purpose
Swedish Lancashire Iron

Twist Drills, Taps, Hack Saw Blades, Milling Cutter Files, Etc., Music Wire for Springs, Steel Balls. Cold Rolled Tool Steel in Strips and Sheets Circular Saws, Machine Knives.

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332 St. James Street, Montreal

Sole Agents for

JONAS & COLVER, LIMITED
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H. BOKER & CO., Inc.
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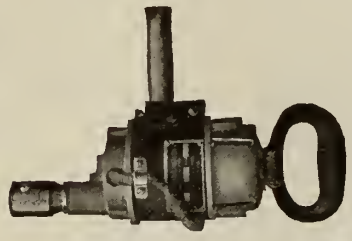
U. S. Electric Drills and Grinders

Save Time, Labor and Money



They can be attached to any lamp socket.

For drilling in metal they are superior to any other kind of portable drill. Cost 50% less to run than air drills.

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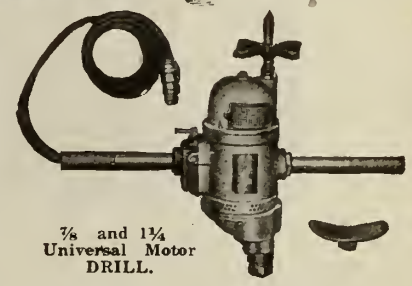

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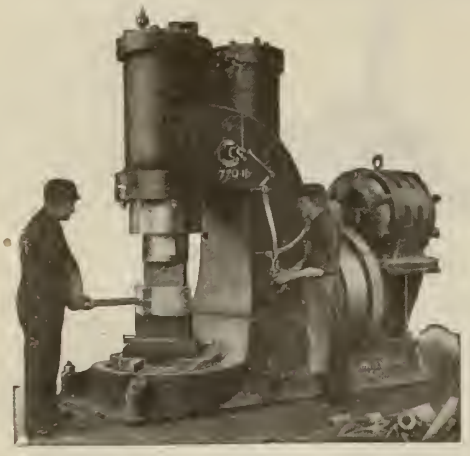

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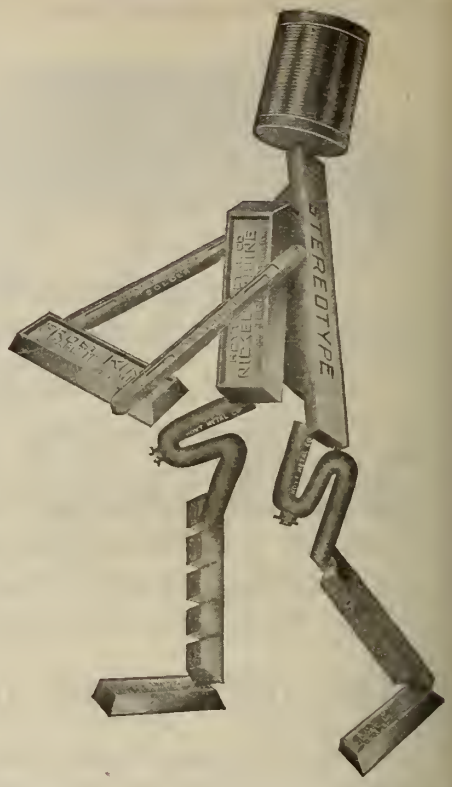

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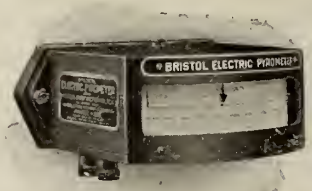

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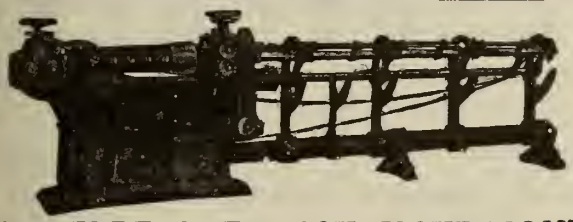

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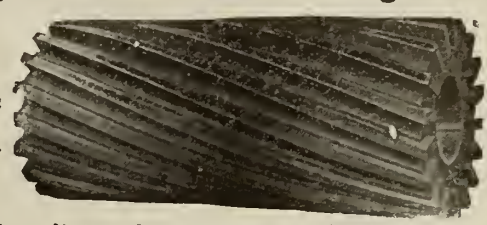

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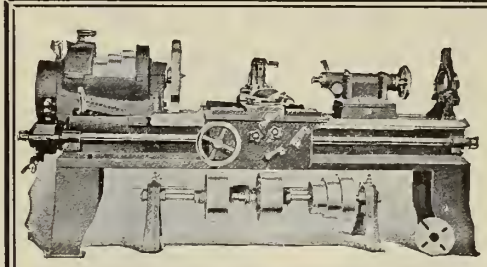

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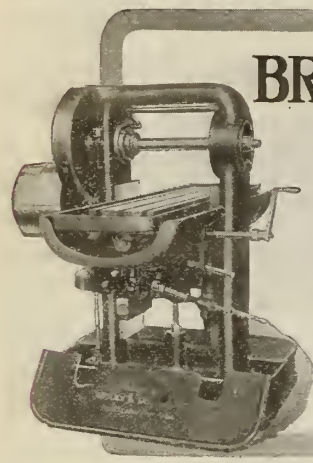

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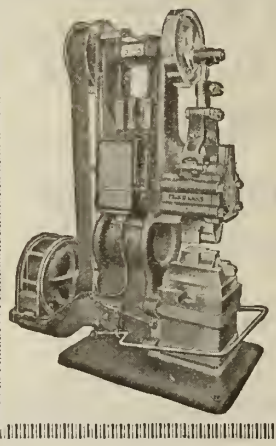

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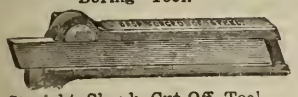
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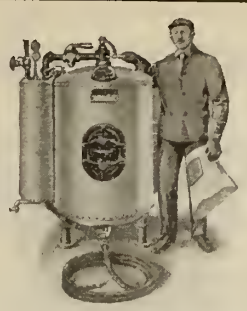
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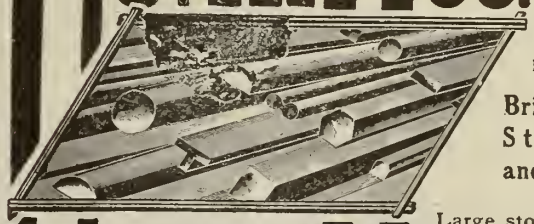

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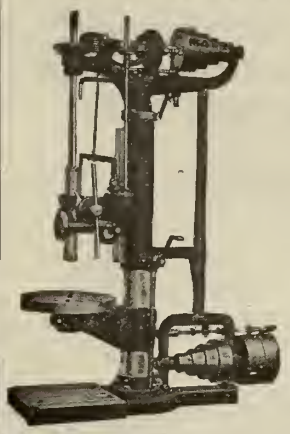

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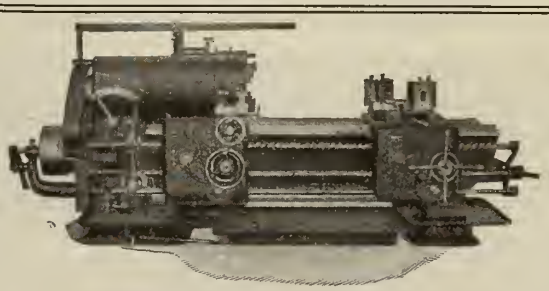

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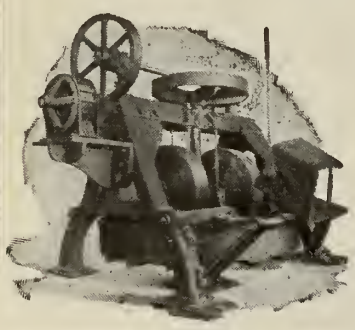

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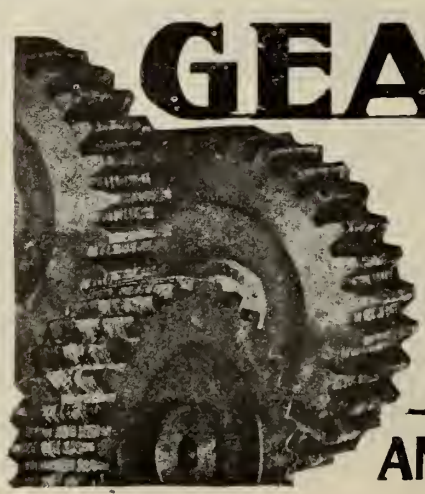

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Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Machinery Co., Toronto
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

ARCHITECTURAL IRON
Page Steel & Wire Co., Adrian, Mich.

ARCHITECTS' SUPPLIES
Hughes, Owens Co., Ltd., Montreal, Que.

ARRESTERS, DUST
Northern Crane Wks., Walkerville, Ont.
Pangborn Corporation, Hagerstown, Md.

ASH HANDLING MACHINERY
Brown Hoisting Machinery Co., Cleveland, Ohio.

AUTOGENOUS WELDING AND CUTTING PLANTS
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

AUTOMATIC MACHINERY
Baird Machine Co., Bridgeport, Conn.
Davis-Bournonville Co., Toronto, Ont.
Garlock-Walker Machy. Co., Toronto.
Gardner & Son, Robert, Montreal.
National Acme Co., Cleveland, Windsor
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Roelofson Machine & Tool Co., Toronto.
Williams Machy. Co., A. R., Toronto.

AUTOMATIC METAL CUTTING-OFF MACHINES
Atkins & Co., E. C., Hamilton, Ont.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros., of Can., Galt, Ont.
Aikenhead Hardware Co., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal
Canada Metal Co., Toronto.
G. F. Foss Mchy. & Sply. Co., Montreal.

AUTO SHEET METAL MACHINERY
Quickwork Co., St. Marys, Ohio.

AUXILIARY HEADS
Hoefer Mfg. Co., Freeport, Ill.

BABBITT METAL
British Smelting & Refining Co., Ltd., Montreal.
Canada Metal Co., Ltd., Toronto, Ont.
Furniss, Clarke & Co., Montreal, Que.
G. F. Foss Mch. & Sply. Co., Montreal.
Hoyt Metal Co., Ltd., Toronto.
Magnolia Metal Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Tallman Brass & Metal Co., Hamilton.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

BAND SAWS
Atkins & Co., E. C., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

BALL BEARINGS
Canadian Fairbanks-Morse Co., Montreal
Can. S K F Co., Toronto, Ont.
Chapman Double Ball Bearing Company, Toronto
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., John, Ingersoll
Williams Mchy Co., A. R., Toronto, Ont.

BALLS, STEEL
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Chapman Double Ball Bearing Co., Toronto
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Gray Ball Bearing Co., Ltd., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

BAROMETERS
Taylor Instrument Co., Rochester, N.Y.

BARRELS, SAND-BLAST
Pangborn Corp., Hagerstown, Md.

BARRELS, STEEL SHOP
Baird Machine Co., Bridgeport, Conn.
Cleveland Wire Spring Co., Cleveland.

BARRELS, TUMBLING
Baird Machine Co., Bridgeport, Conn.
Katie Foundry, Galt, Ont.
Northern Crane Works, Walkerville, Ont.
Petrie, Ltd., H. W., Toronto.

BARS, BORING
Gisholt Machine Co., Madison, Wis.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Williams & Co., J. H., Brooklyn, N.Y.

BARS, CONCRETE REINFORCING
Algoma Steel Corp., Sault Ste. Marie

BARS, MERCHANT
Algoma Steel Corp., Sault Ste. Marie.
Peckovers, Ltd., Toronto, Ont.

BASE FACING MACHINES
Victoria Foundry Co., Ottawa, Ont.

BATTERIES
Northern Electric Co., Ltd., Montreal Que

BEADING MACHINES
Quickwork Co., St. Marys, Ohio.

BELT CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

BEARINGS, DIE CAST
Franklin Mfg. Co., Syracuse, N.Y.

BEARINGS, GRAPHITE BRONZE
Lyman Tube & Supply Co., Montreal, Que.

BEARINGS, ROLLER
Lyman Tube & Supply Co., Montreal, Que.

BELT-LACING MACHINES, HOOKS AND PINS
Clipper Belt Lacer Co., Grand Rapids

BELT LACING LEATHER
Aikenhead Hardware Co., Toronto, Ont.
G. F. Foss Mchy. & Sply. Co., Montreal.
Graton & Knight Mfg., Worcester, Mass.
Rice Lewis & Son, Toronto, Ont.

BELTING, BALATA
Federal Engineering Co., Toronto, Ont.

BELT HOOKS, WIRE
Clipper Belt Lacer Co., Grand Rapids

BELTING, RUBBER
Can. Consolidated Rubber Co., Montreal.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.
Goodyear Tire & Rubber Co., of Canada, Ltd., Toronto.
Gutta Percha & Rubber Ltd., Toronto, Canada.

BELTING, CHAIN
Can. Fairbanks-Morse Co., Montreal.
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Whitney Mfg. Co., Hartford, Conn.
Williams Mchy Co., A. R., Toronto, Ont.

BELTING, CONVEYOR
Can. Consolidated Rubber Co., Montreal.
Can. Link-Belt Co., Ltd., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal
Federal Engineering Co., Ltd., Toronto.
Gutta Percha & Rubber, Ltd., Toronto, Canada.
Graton & Knight Mfg., Worcester, Mass.
International Mchy. Spls., Ltd., Montreal.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
McLaren Belting Co., J. C., Montreal.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Quaker City Rubber Co, Philadelphia, Pa.
Rice, Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Williams Mchy Co., A. R., Toronto, Ont.

BELTING, FRICTION AND SURFACE
Can. Con. Rubber Co., Ltd., Montreal.
Gutta Percha & Rubber, Ltd., Toronto.

BELTING, LEATHER
Can. Graton & Knight Mfg. Co., Montreal
Gutta Percha & Rubber, Ltd., Toronto, Canada.
John Tullis & Son, Glasgow, Scotland.

BELTING, RUBBER
International Mchy. Spls., Ltd., Montreal.
Quaker City Rubber Co, Philadelphia, Pa.

BELTING, STITCHED COTTON DUCK
Dominion Belting Co., Hamilton, Ont.
Gutta Percha & Rubber, Ltd., Toronto.

BELTING, WOVEN
Federal Engineering Co., Ltd., Toronto

BENDING MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.
Bertram & Sons Co., John, Dundas
Brown-Boggs Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Kitchener.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Mach. Co., Toronto.
Petrie, Ltd., H. W., Toronto.

BLAST GATES
W. S. Rockwell Co., New York, N.Y.

BLASTING MACHINES, SAND
Garlock-Walker Machinery Co., Toronto.
Jardine, A. B., & Co., Hespeler, Ont.
National Mach. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont

BILLET MARKERS
Matthews & Co., Jas. H., Pittsburgh, Pa

BILLETS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Swedish Steel & Importing Co., Ltd., Montreal.
Algoma Steel Corp., Sault Ste. Marie
Kayser-Ellison & Co., Ltd., Montreal
Marshall, Son & Bunney, Toronto.

BILLETS, FORGING
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal

BINS, STEEL
Dennis Wire & Iron Works, London, Ont
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Toronto Iron Works, Ltd., Toronto, Ont.
William Hamilton Co., Peterboro, Ont.

BLACKSMITH WORK
The Thos. Pink Co., Ltd., Pembroke

BLOCKS, CHAIN
Oliver Engineering Co., Montreal.

BLOOMS AND SLABS
Algoma Steel Corp., Sault Ste. Marie

BLOWERS
Can. Blower & Forge Co., Kitchener, Ont
Garlock-Walker Machinery Co., Toronto.
MacGovern & Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
U.S. Ordnance, Toronto, Ont.

BLOWING ENGINES
General Combustion Co., Ltd., Montreal, Que.

BLOW PIPES AND REGULATORS
Carter Welding Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

BLUE PRINTING MACHINERY
Commercial Camera Co., Providence, R.I.

BLUE PRINT PAPER
Hughes, Owens Co., Ltd., Montreal, Que

BOARDS, GLASS CUTTING
Lufkin Rule Co., of Can., Windsor, Ont

BOARTZ
Joyce, Koebel & Co., Inc., New York

BOLT CUTTERS
Greenfield Tap & Die Corp., Greenfield Mass

BOILER TUBES
Lyman Tube & Supply Co., Montreal, Que

BOILER BREECHINGS
Que.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
St Lawrence Welding Co, Ltd., Montreal
William Hamilton Co., Peterboro, Ont.

BOLT CUTTERS
Fellows Gear Shaper Co., Springfield, Vt
Greenfield Tap & Die Corp., Greenfield Mass.
Wells Bros., of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.

BOILERS, RANGE
Can. John Wood Mfg. Co., Ltd., Toronto Ont.

BOILERS
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.

BOLT CUTTERS AND NUT TAPERS
Aikenhead Hardware Co., Toronto, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Landis Machine Co., Waynesboro, Pa.
A.B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Wells Bros. Co. of Canada, Galt, Ont.
Petrie, Ltd., H. W., Toronto

BOLTS
Aikenhead Hardware Co, Toronto, Ont.
London Bolt & Hinge Wks., London, Ont.
Morrow Screw & Nut Co., John, Ingersoll.
Peckovers, Ltd., Toronto, Ont.
Rice, Lewis & Son, Toronto, Ont.
Steel Co., of Canada, Ltd. Hamilton.
Wilkinson & Kompass, Hamilton, Ont.
Williams & Co., J. H. Brooklyn, N.Y.

BOLTS, COUPLING
Geat Machine Screw Co., Ltd., Galt, Ont.

BOLTS, STAY
Morrow Screw & Nut Co., John, Ingersoll.

BOLTS, SPRING SHAKLE
Can. Winkley Co., Ltd., Windsor, Ont.
Morrow Screw & Nut Co., John, Ingersoll

BOLTS, PATCH
Morrow Screw & Nut Co., John, Ingersoll.

BOLT AND NUT MACHINERY
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas, Ont
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto
Gardner & Son, Robt., Montreal.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Universal Mach. Co., Bowling Green, O.
Williams Machinery Co., A. R., Toronto

BOLT THREADING MACHINERY
Jardine & Co., Ltd., B., Hespeler.
Landis Machine Co., W nesboro, Pa.
National Acme Co., Cleveland, Ohio.
Victor Tool Co., Waynesboro, Pa.

BONDING MACHINES (Electric Railway)
The Lincoln Electric Co., Toronto, Ont.

BORING MACHINES, PNEUMATIC CYLINDER
Cleveland Pneumatic Tool Co., Toronto.
Canadian Fairbanks-Morse Co., Montreal
Can. Ingersoll-Rand Co., Sherbrooke Que
Garlock-Walker Mach. Co., Toronto.

BORING MACHINES, UPRIGHT AND HORIZONTAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto
Oliver Mach'y Co., Grand Rapids, Mich.
Gisholt Machine Co., Madison, Wis.
Hoefer Mfg., Co., Freeport, Ill.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Rockford Drilling Mche. Co, Rockford, Ill

BORING AND TURNING MILLS
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Foss Mch. & S'ply Co., Geo. F., Montreal
Knight Metal Products, Toronto.
Oliver Mach. Co., Grand Rapids, Mich.
Niles-Bement-Pond Co., New York.

BOXES, CAST IRON
Brown & Sharpe Mfg. Co., Providence, R.I.

BOXES, STEEL SHOP AND TOTE
Cleveland Wire Spring Co., Cleveland.

BRAKES
Brown, Boggs & Co., Hamilton, Can.
Electric Steel & Metals, Ltd., Welland.

BRASS—SHEETS, ROLLS, PLATES, and RODS
Brown's Copper and Brass Rolling Mills, New Toronto.

BRASS ALLOYS
British Smelting & Refining Co., Ltd., Montreal, Que.

BRASS AND COPPER TUBING
Lyman Tube & Supply Co., Montreal, Que.

BRASS FOUNDERS
Canada Metal Co., Toronto.
St. Lawrence Welding Co., Montreal.
Tallman Brass & Metal Co., Hamilton.

BRASS GOODS
Crane, Ltd., Montreal, Que.

BRASS PIPE AND TUBE
Crane, Ltd., Montreal, Que.

BRASS WORKING MACHINERY
Barber Mchy. Co., Ltd., Toronto, Ont.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machinery Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Prest-O-Lite Co., Inc., Toronto, Ont.
Wood Turret Machine Co., Brazil, Ind.
Williams Machy. Co., A. R., Toronto.
Brown's Copper and Brass Rolling Mills, New Toronto.

BRAZING EQUIPMENT
Chicago Flexible Shaft Co., Chicago, Ill.

BRICKS, FIRE
Elk Fire Brick Co., Can., Ltd., Hamilton, Ont.

BRIDGES, RLY AND HIGHWAY
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.

BRINELL MACHINES
U. S. Ordnance, Toronto, Ont.

BRONZE—SHEETS, ROLLS, PLATES, and RODS
Brown's Copper and Brass Rolling Mills, New Toronto.

BRONZE, NAVAL
Canada Metal Co., Toronto.
Tallman Brass and Metal Co., Hamilton.

BRONZE COPPER
Canada Metal Co., Toronto.

BRUSHES, CARBON
Lyman Tube & Supply Co., Montreal, Que.

BUFFING AND POLISHING MACHINERY
Ford-Smith Mach. Co., Hamilton.
Foss Mchy. & S'ply Co., Geo. F. Montreal
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.

BUCKETS, DUMP
MacKinnon Steel Co., Sherbroooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
St Lawrence Welding Co, Ltd , Montreal

BUCKETS, ELEVATOR
Can. Link-Belt Co., Toronto, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
nce **Welding Co, Ltd.**, Montreal

BUCKETS, CLAM SHELL, CRAB, DUMP
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Ltd, Walkerville.
St Lawrence Welding Co, Ltd., Montreal

BULLDOZERS
Bertram & Sons Co., John, Dundas.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.
Williams, White & Co., Moline, Ill.

BURNERS, OIL AND NATURAL GAS
Northern Crane Works, Ltd., Walkerville.
W. S. Rockwell Co., New York, N.Y.

BURRS, IRON AND COPPER
Parmenter & Bulloch Co., Gananoque,.

BUSHINGS, BRONZE
Morrow Screw & Nut Co., John, Ingersoll.
St Lawrence Welding Co, Ltd., Montreal

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R.I.
Pangborn Corporation, Hagerstown, Md.

CABINETS, SAND BLAST
Pangborn Corporation, Hagerstown, Md.

CABLE, ELECTRIC
International Machinery & Supply Co., Ltd., Montreal, Que.

CABLES, TRANSMISSION AND TELEPHONES
Northern Electric Co., Ltd., Montreal.

CALKS, BOOT
Lufkin Rule Co., of Can., Windsor, Ont.

CANNERS' MACHINERY
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Can.

CANNERS' CONVEYORS
Can. Link-Belt Co., Toronto, Ont.

CARBIDE
Union Carbide Co., of Canada, Limited, Weland, nt.

CARBONIZING BOXES
Can. Driver-Harris Co., Ltd., Walkerville
Katie Foundry, Galt, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
Swedish Crucible Steel Co. Windsor.

CARRIERS, PNEUMATIC TUBE
Jones & Glassco, Montreal.

CARS, INDUSTRIAL
Can. Blower & Forge Co., Kitchener, Ont
Can. Fairbanks-Morse Co., Ltd, Montreal
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
St Lawrence Welding Co, Ltd., Montreal

CASES, FILING
Economy Drawing Table Co., Adrian, Mich.

CASTINGS, ALUMINUM, BRASS BRONZE, COPPER, AND GUN METAL
Algoma Steel Corp., Sault Ste. Marie.
Franklin Mfg. Co., Syracuse, N.Y.
Canada Metal Co., Ltd., Toronto, Ont.

CASTINGS, DIE CAST
Canada Metal Co., Ltd., Toronto, Ont.
Franklin Mfg. Co., Syracuse, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Tallman Brass & Metals Ltd., Hamilton, Ont.

CASTINGS, STEEL—ALL KINDS
Can. Elec. Steel Castings, Aurora, Ont
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Electric Steel & Metals Co., Welland.
Mesta Machine Co., Pittsburgh, Pa

CASTINGS, ELECTRIC AND ALLOY STEEL
Can. Elec. Castings Co. Ltd., Orillia, Ont
Dominion Foundries & Steel Ltd., Hamilton, Ont.

CARRIERS COUPLING BOLTS
John Morrow Screw & Nut Co., Ingersoll
Alexander Fleck Ltd., Ottawa.
Greenleafs Ltd., Belleville, Ont.
St. Lawrence Welding Co., Montreal.
Tallman Brass & Metal Co., Hamilton.

CASTINGS, BENCH LEG.
Brown & Sharpe Mfg. Co., Providence, R.I.

CASTINGS, BRASS AND IRON
Algoma Steel Corp., Sault Ste. Marie.
International Machinery and Supply Co., Ltd., Montreal, Que.

CASTINGS, BUILDING
Katie Foundry, Galt, Ont.

CASTINGS, GRAY IRON
Bernard Industrial Co., A., Fortierville, Q
Brown & Sharpe Mfg. Co., Providence, R.I.
Brown Boggs Co., Ltd., Hamilton.
Can. Elec. Castings Co, Ltd., Orillia, Ont
Alexander Fleck, Ltd., Ottawa.
Gardner & Son, Robt., Montreal.
Hull Iron & Steel Foundries, Ltd., Hull
International Malleable Iron Co., Guelph
Kennedy & Sons, Ltd., Wm., Owen Sound.
Katie Foundry, Ltd., Galt, Ont.
Hamilton Co., Wm., Peterboro.

CASTINGS, PLUMBERS'
Katie Foundry, Galt, Ont.

CASTINGS, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville

CASTINGS, HARDWARE
Katie Foundry, Galt, Ont.

CASTINGS, STEEL CHROME AND MANGANESE STEEL
Thos. Davidson Mfg. Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hull Iron & Steel Foundries, Ltd., Hull.
Kennedy & Sons, Ltd, Owen Sound.

CASTINGS, MALLEABLE
International Malleable Iron Co., Guelph

CASTINGS, NICKEL STEEL
Hull Iron & Steel Foundries, Ltd., Hull.

CEMENT, ELASTIC, IRON AND FURNACE
Warminton Co., J. N., Montreal.

CEMENT MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gardner, Robt., & Son. Montreal.

CEMENT HANDLING MACHINERY
Can. Link-Belt Co., Toronto, Ont.

CEMENT TOOLS
Atkins & Co., E. C., Hamilton, Ont.

CENTERING MACHINES
Victoria Foundry Co., Ottawa, Ont.

CENTRE REAMERS
Bertram & Sons Co., John, Dundas.
Butterfield & Co., Inc., Rock Island, Que.
Gardner, Robt. & Son, Montreal.
Hurlburt, Rogers Mch. Co., South Sudbury, Mass.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co., of Canada, Galt, Ont.

CHAIN, WELDED COIL
Morris Crane & Hoist Co., Herbert, Niagara Falls Ont.

CHAIN BLOCKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford Chain Block & Mfg. Co., Phila., Pa.
Garlock-Walker Machy. Co., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & HoistCo., Herbert, Niagara Falls, Ont.
Oliver Engineering Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Jones & Glassco, Montreal, Que.

CHAINS, AGRICULTURAL
Canadian Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.

CHAINS, AUTOMOBILE ENGINE
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.

CHAINS, BICYCLE, DRIVE AND BLOCK
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAINS, FOR ELEVATORS AND CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAIN, MALLEABLE, DETACHABLE AND RIVETED
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAINS, POWER TRANSMISSION
Canadian Link-Belt Co., Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, New York.
Glasgow, N.S

CHAINS, SPROCKET WHEEL
Can. Link-Belt Co., Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAIN DRIVES
Can. Link-Belt Co., Toronto, Ont.
Coventry Chain Co., Coventry, England.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHASERS
National Acme Co., Cleveland, Ohio.
Taylor, J. A. M., 313 Stair Bldg., Toronto, Ont.

CHEMISTS
Toronto Testing Lab'tory, Ltd., Toronto

CHUCKS, AERO, AUTOMATIC
Garvin Machine Co., New York.

CHUCKS, CENTERING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKS, COLLET, AIR
Elliott & Whitehall Mach. & Tool Co. Galt, Ont.
Smalley-General Co., Inc., Bay City, Mich.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, LATHE AND UNIVERSAL
Aikenhead Hardware Co., Toronto, Ont.
Almond Mfg. Co., Ashburnham, Mass.
Bertram & Sons Co., John, Dundas.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt., & Son, Montreal.
Garlock-Walker Mach'y Co., Toronto.
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Chicago, Ill.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Jacobs Mfg. Co., Hartford, Conn.
Ker & Goodwin Machine Co., Ltd., Knight Metal Products, Toronto.
Modern Tool Co., Erie, Pa.
Rice Lewis & Son, Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, AUTOMATIC AND KEYLESS
Aikenhead Hardware Co., Toronto, Ont
Can. Blower & Forge Co., Kitchener.

CHUCKS, FRICTION AND TAP
Victor Tool Co., Waynesboro, Pa.

CHUCKS, MACHINE MILLING
Hoggson & Pettis Mfg. Co., New Haven Conn.

CHUCKS, MAGNETIC
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

CHUCKS, RING WHEEL
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.

CHUCKS, WHEEL, CAR
Hoggson & Pettis Mfg. Co., New Haven Conn.

CHUCKING MACHINES
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Windsor, Vt.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Wood Turret Mach. Co., Brazil, Ind.
Williams Mchy Co., A. R., Toronto, Ont.

CIRCULATING SYSTEMS FOR LUBRICATING OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

CLAMPS, BELT
Hoggson & Pettis Mfg. Co., New Haven Conn.

CLAY FIRE
Elk Fire Brick Co., Can., Ltd., Hamilton, Ont.

CLEANERS, METER, WASTE, GENERAL
Oakley Chemical Co., New York, N.Y.

CLEANING COMPOUND
Oakley Chemical Co., New York.

CLOCK SPRINGS
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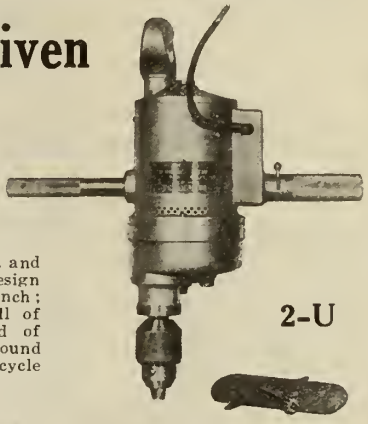

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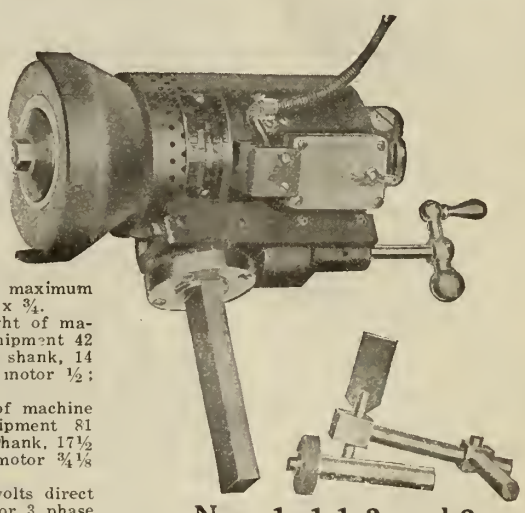

This machine has been designed especially for grinding lathe centers. By their use the centers can be kept in perfect order with the smallest possible time. Entirely self-contained and has no loose parts to get lost or misplaced. It quickly pays for itself.

No. 10—Traverse of wheel 3 inches; weight of machine 15 pounds; weight boxed for domestic shipment 25 pounds; dimensions of machine, not including shank, 12½ x 7¼ x 6¾ inches; maximum horsepower of motor ¼; size of wheel 6 x ½ x ¾.

No. 1½U—Traverse of wheel 13 inches; weight of machine 27 pounds; weight boxed for domestic shipment 42 pounds; dimensions of machine, not including shank, 14 x 7¼ x 6¾ inches; moximum horsepower of motor ½; size of wheel 6 x ½ x ¾.

No. 2U—Traverse of wheel 5 inches; weight of machine 57 pounds; weight boxed for domestic shipment 81 pounds; dimensions of machine, not including shank, 17½ x 10 x 9¼ inches; maximum horsepower of motor ¾⅛ size of wheel 8 x 1 x ⅞.

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If interested tear out this page and place with letters to be answered.

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Where Lincoln Electric Welding Wins!

In foundries and machine shops, where a batch of castings are liable to turn out with slight defects, Lincoln Arc Welding can be depended upon to rectify the inaccuracies with a great saving of time and money.

In great plants where machinery is constantly being discarded because of wear or breakages, Lincoln Arc Welding saves — save equipment that otherwise would be sent to the scrap heap.

Therefore, Lincoln Arc Welding does two things. It saves waste—and, what is much more important—it speeds up and maintains production.

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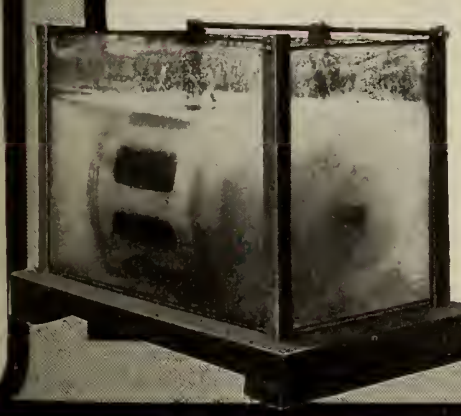
Our engineers will gladly make a thorough investigation of your plant and report exactly what can be saved by Lincoln Electric Welding. Our Welding Plant at the foot of Jarvis Street is entirely at your service, where repairs can be made quickly—or, if necessary, we can send a portable outfit right to you. 'Phone or write us your requirements to-day.



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The Lincoln Electric Company of Canada
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1108 Temple Building - - Toronto

Montreal Branch : Coristine Building

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Garlock-Walker Machinery Co., Toronto.
Henry & Wright Mfg. Co., Hartford,
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Williams Mchy Co., A. R., Toronto, Ont.

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Canada Mach. Corp., Galt, Ont.
Garvin Machine Co., New York.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mach. Co., Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
A. B. Jardine & Co., Hespeler, Ont.
Knight Metal Products, Toronto.
Landis Tool Co., Waynesboro, Pa.
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Nat. Automatic Tool Co., Richmond, Ind
Rockford Drilling Mach. Co., Rockford, Ill
Niles-Bement-Pond Co., New York.
Silver Mfg. Co., Salem, Ohio.
U. S. Ordnance, Toronto, Ont.
A. R. Williams Machinery Co., Toronto.

DRILLING MACHINES, SPECIAL
Hoefer Mfg. Co., Freeport, Ill.

DRILLING POSTS
Aikenhead Hardware Co., Toronto, Ont.
Keystone Mfg. Co., Buffalo, N.Y.
Rice Lewis & Son, Toronto, Ont.
Silver Mfg. Co., Salem, Ohio.

DRILLS, BENCH
Aikenhead Hardware Co., Toronto.
W. F. & John Barnes Co., Rockford, Ill
Can. Blower & Forge Co., Kitchener.
Can. Fairbanks-Morse Co., Montreal.
Geo. F. Foss Mch. & S'ply Co., Montreal
Garlock-Walker Machinery Co., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

DRILLS, CENTRE
Aikenhead Hardware Co., Toronto, Ont
Butterfield & Co., Inc., Rock Island, Que
Cleveland Twist Drill Co., Cleveland.
Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto.
Rice Lewis & Son, Toronto, Ont.
Wilt Twist Drill Co., of Can., Walkerville

DRILLS, BLACKSMITH AND BIT STOCK
Aikenhead Hardware Co., Toronto, Ont
Butterfield & Co., Inc., Rock Island, Que
Can. Blower & Forge Co., Kitchener.
Cleveland Twist Drill Co., Cleveland.
Geo. F. Foss Mch. & S'ply Co., Montreal
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.
Whitman & Barnes Mfg. Co., Akron, O.
Wilkinson & Kompass, Hamilton, Ont.
Wilt Twist Drill Co. of Can., Walkerville

DRILLS, CARBON
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Marshall, Son & Bunney, Toronto.
John Morrow Screw & Nut Co., Ingersoll

DRILLS, ELECTRIC, PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener.
Cincinnati Electrical Tool Co., Cincinnati
Geo. F. Foss Mch. & S'ply Co., Montreal
Haskins Co., R. C., Chicago, Ill.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Pilot Steel & Tool Co., Montreal, Que.
Prest-O-Lite Co., Inc., Toronto, Ont.
U. S. Electrical Tool Co., Cincinnati, O.
A. R. Williams Mach. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLS, HAMMER
Samuel Osborne, Ltd., Montreal, P.Q.

DRILLS, EMERY
Garlock-Walker Mach. Co., Toronto, Ont.

DRILLS, HIGH SPEED TWIST
Aikenhead Hardware Co., Toronto, Ont.
Armstrong-Whitworth of Can., Montreal.
Atkins & Co., Ltd. Wm., Sheffield, Eng.
Butterfield & Co., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Canadian Fairbanks-Morse Co., Montreal
H. A. Drury Co., Montreal.
Geo. F. Foss Mch. & S'ply Co. Montreal
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
W. F. & John Barnes Co., Rockford, Ill
Osborne, Samuel, Montreal, P.Q.
Plewes, Ltd., Winnipeg, Man.
Pratt & Whitney Co., Dundas, Ont.
Petrie, H. W. Toronto.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Taylor J. A. M., Stair Bldg., Toronto.
Wilt Twist Drill Co. of Can., Walkerville
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLS, OIL TUBE
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

DRILLS, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Williams Mchy Co, Ltd., A. R., Montreal
Greenfield Tap & Die Corp., Greenfield, Mass.

DRILLS, PNEUMATIC CORNER
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.

DRILLS, RATCHET AND HAND
Aikenhead Hardware Co., Toronto, Ont.
Armstrong Bros. Tool Co., Chicago, Ill.
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cincinnati Electrical Tool Co., Cincinnati.
Cleveland Twist Drill Co., Cleveland.
Garlock-Walker Mchy. Co., Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilt Twist Drill Co. of Can., Walkerville.

DRILLS, ROCK
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
The Foss Mchy. & Supply Co., Montreal
Samuel Osborne Ltd., Montreal, P.Q.
A. R. Williams Machy. Co., Toronto.

DRILLS, SQUARE & HEXAGON
Globe Engineering Co.

DRILLS, TRACK
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
The Foss Mchy. & Supply Co., Montreal.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Wilt Twist Drill Co. of Can., Walkerville.

DRINKING FOUNTAINS, SANITARY
Crane, Ltd., Montreal, Que.
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

DRIVES, CHAIN
See Belting, Chain.

DRIVING TOOLS
The Thos. Pink Co., Ltd., Pembroke, Ont.

DRY CLEANING SYSTEM
Bowser Co., Ltd., S. F., Toronto, Ont.

DRYERS, SAND
Lyman Tube & Supply Co., Montreal, Que.
Pangborn Corporation, Hagerstown, Md.

DRYING APPLIANCES
Baird Machine Co., Bridgeport, Conn.
Sturtevant Co., B. F., Galt, Ont.
W. S. Rockwell Co., New York, N.Y.

DRUM CONTROLS
Volta Manufacturing Co., Welland, Ont.

DUMP CARS
Canadian Fairbanks-Morse Co., Montreal.
MacKinnon Steel Co., Sherbrooke, Que.
Lawrence Welding Co, Ltd., Montreal

DUST EXHAUSTER, ARRESTER SYSTEM
Pangborn Corporation, Hagerstown, Md.

DUST HANDLING EQUIPMENT
Pangborn Corporation, Hagerstown, Md.
Sturtevant Co., B. F., Galt, Ont.

DUST SEPARATORS
Can. Blower & Forge Co., Kitchener, Ont.
Sturtevant Co., B. F., Galt, Ont.

DYNAMOS AND ELECTRICAL SUPPLIES
Canadian Fairbanks-Morse Co., Montreal.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
MacGovern & Co., Montreal, Que.
A. R. Williams Machy. Co., Toronto.

ELECTRICAL SUPPLIES
Can. General Electric Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Northern Electric Co., Ltd., Montreal Que

ELECTRIC FURNACES
Electric Furnace Construction Co., Philadelpria, Pa.
Hamilton & Hansell, Inc., New York City
Volta Manufacturing Co., Welland, Ont.

EECTRIC FURNACE REGULATORS, WINCHES, ROOF COOLERS AND ELECTRODE HOLDERS
Volta Manufacturing Co., Welland, Ont.

ELECTRICAL RESISTANCE MATERIALS, NICHROME, KROMORE, CHROMAX, CLIMAX, NICKEL, SILVER, ADVANCE.
Can. Driver-Harris Co., Walkerville, Ont.

ELECTRIC HOISTS, STATIONARY AND MONO RAIL
Canadian Link-Belt Co., Ltd., Toronto,
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Volta Manufacturing Co., Welland, Ont.

ELECTRIC MOTORS
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
Sturtevant Co., B. F., Galt, Ont.
Volta Manufacturing Co., Welland, Ont.

ELECTRIC TRUCKS
Cowan Truck Co., Holyoke, Mass.
Goad Engineering Co., Toronto, Ont.

ELEVATOR, ENCLOSURES
Volta Mfg. Co., Welland, Ont.
Canada Wire & Iron Goods Co., Hamilton

ELEVATOR WEIGHTS
Katie Foundry, Galt, Ont.

ELEVATORS AND BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Machy. Co., St. Louis.

ELEVATING AND CONVEYING MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Petrie, Ltd., H. W., Toronto.

EMBOSSING PRESSES
Dom. Steel Products Co., Ltd., Brantford.
Oliver Machinery Co., Grand Rapids, Mich

EMERY GRINDERS (PNEUMATIC)
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.

EMERY CLOTH
Atkins & Co., E. C., Hamilton, Ont.
Atkins & Co., E. C., Hamilton, Ont.
H. H. Barton & Son Co, Philadelphia, Pa
Wausite Abrasives Co., Chicago, Ill.

EMERY PAPER
Atkins & Co., E. C., Hamilton, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Wausau Abrasives Co., Chicago, Ill.

EMERY AND EMERY WHEELS
Atkins & Co., E. C., Hamilton, Ont.
Brantford Emery Wheel Co., Brantford, Canada.
The Foss Mchy. & Supply Co., Montreal.
Garvin Machine Co., New York.
Canadian Fairbanks-Morse Co., Montreal.
Canada Emery Wheels Co., Hamilton.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Wilkinson & Kompass, Hamilton, Ont.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.

ENAMELWARE
Crane, Ltd., Montreal, Que.

EMERY WHEEL DRESSINGS
Dominion Abrasive Co., Ltd., Mimico, Ont.
Wheel Trueing Tool Co., Windsor Ont.

END MILLS
John Morrow Screw & Nut Co., Ingersoll

ENGINEERS—INDUSTRIAL CLEANING (Free Consultation)
Oakley Chemical Co., New York, N.Y.

ENGINEERS
Samuel Osborne (Canada) Ltd., Montreal.

ENGINES—HOISTING, PILE DRIVING, BRIDGE ERECTING, MINING
Canadian Mead-Morrison Co., Limited, Montreal, Que.

ENGINES, STEAM, GAS, GASOLINE
Furniss, Clarke & Co., Montreal, Que.
Canadian Fairbanks-Morse Co., Montreal.
Johnson Mach. Co., Carlyle, Manchester, Conn.
MacGovern & Co., Montreal, Que.
Sturtevant Co., B. F., Galt, Ont.

ENGINES, HORIZONTAL AND VERTICAL
Johnson Mach. Co., Carlyle, Manchester, Conn.
A. R. Williams Machy. Co., Toronto.
Petrie, Ltd., H. W., Toronto.

ENGINES, OIL
Ker & Goodwin Machine Co., Ltd., Brantford, Ont.

ENGINES, HEAVY OIL, DIESEL TYPE
Dom. Steel Products Co., Ltd., Brantford

ENGINES, MARINE
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Sturtevant Co., B. F., Galt, Ont.

ESCUTCHEON PINS
Parmenter & Bulloch, Gananoque, Ont.

EXHAUST HEADS AND HOODS
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Sturtevant Co., B. F., Galt, Ont.

EXHAUSTERS
Can. Blower & Forge Co., Kitchener, Ont.
Pangborn Corporation, Hagerstown, Md.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
St Lawrence Welding Co, Ltd., Montreal

EXTRACTORS, TAP
Walton Co., The, Hartford, Conn.

EYE BOLTS AND NUTS
Can. Foundries & Forgings, Ltd., Welland, Ont.

EYE PROTECTORS
Standard Optical Co., Geneva, N.Y.
Strong, Kennard & Nutt Co., Cleveland.
Willson & Co., Inc., T. A., Reading, Pa.

FACTORY GATES
Page Steel & Wire Co., Adrian, Mich.

FACTORY LOCATIONS
City of St. Johns, Quebec.

FACTORY SITES
City of St. Johns, Quebec.

FANS
Baird Machine Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont.
Sturtevant Co., B. F., Galt, Ont.
Sheldons, Ltd., Galt, Ont.

FENCING, WIRE
Page Steel & Wire Co., New York, N.Y.

FENCE, IRON AND FACTORY
Can. Wire & Iron Goods, Hamilton, Ont.
Page Steel & Wire Co., Adrian, Mich.

FERRO-TUNGSTEN
Vanadium-Alloys Steel Co. Pittsburgh Pa

FIBRE, RODS AND SHEETS
Diamond State Fibre Co., Bridgeport, Pa.

FILES
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., Wm., Sheffield, Eng.
Ingersoll File Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Marshall, Son & Bunney, Toronto, Ont.
Nicholson File Co., Port Hope, Ont.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
Whitman & Barnes Mfg. Co., Akron, O.
Wilkinson & Kompass, Hamilton, Ont.

FILES, COMMUTATOR SLOTTING
Lyman Tube & Supply Co., Montreal, Que.

FILING MACHINES, BENCH AND MOTOR DRIVEN
Barry Mfg. Co., Chicago, Ill.

FILTERING AND CIRCULATING SYSTEMS FOR LUBRICATING OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. Wire & Iron Goods, Hamilton, Ont.

FIRE BRICK
Elk Fire Brick Co., Hamilton, Ont.
General Combustion Co., Ltd., Montreal, Que.

FIRE CLAY
Elk Fire Brick Co., Can., Ltd., Hamil-
General Combustion Co., Ltd., Montreal, Que.

FINISHING MACHINES
Brown & Sharpe Mfg. Co., Providence, R.I.

FIRST AID CABINETS
Strong, Kennard & Nutt Co., Cleveland.

FIRE EXTINGUISHERS
Strong, Kennard & Nutt Co., Cleveland, O.

FITTINGS, CAST IRON, SCREWED, FLANGED
Crane, Ltd., Montreal, Que.

FIXTURES
Brown Engineering Corp., Toronto, Ont.
Crescent Mche. Co., Ltd., Montreal, Que.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Toronto Tool Co., Toronto, Ont.

FLAT SPRINGS
The Dunbar Brothers Co., Bristol, Conn

FLEXIBLE SHAFT EQUIPMENT
R. C. Haskins Co., Chicago, Ill.

FLOODLIGHTS, ELECTRIC
Northern Electric Co., Ltd., Montreal Que

FLOTATION MACHINERY
Elec. Steel & Metals, Welland, Ont.

FLUMES
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
William Hamilton Co., Peterboro, Ont.

FORGES, HAND PORTABLE
Aikenhead Hardware Co., Toronto, Ont
Can. Blower & Forge Co., Kitchener.
A. B. Jardine & Co., Ltd., Hespeler, Ont
Rice Lewis & Son, Toronto, Ont.
Sturtevant Co., B. F., Galt, Ont.
U. S. Ordnance, Toronto, Ont.

FORGE TOOLS
Kimber & Hillier Mfg., Co., St. Catharines, Ont.

FORGES, OIL
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

FORGINGS
Mesta Machine Co., Pittsburgh, Pa
Can. Found. & Forgings, Ltd., Welland
Nova Scotia Steel & Coal Co., New Glasgow, N.S.

FORGINGS, DROP, AUTOMOBILE AND LOCOMOTIVE FORGING AND WELDING
Dominion Bridge Co., Montreal, Que.
Dom. Forge & Stamp'g Co., Walkerville
Steel Co. of Canada, Ltd., St. Catharines
Victoria Foundry Co., Ottawa.
Williams & Co., J. H., Brooklyn, N.Y.

FORGING MACHINERY
John Bertram & Sons Co., Dundas, Ont
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Ont
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machy. Co., Toronto, Ont
National Machy. Co., Tiffin, Ohio
Petrie, Ltd., H. W., Toronto.
Chicago Flexible Shaft Co., Chicago, Ill

"Clipper" Laced Belts Develop Maximum Power

TRANSMISSION Belting loses none of its efficiency when joined with "Clipper" Belt Lacing.

It makes a hinge-joint that is smooth, flush an both sides, so flexible that it hugs the pulley and develops maximum power. No material is cut away; no big holes punched. In the case of fiber belts no strands are cut to fray. Besides making an ideal, dependable joint,

The Clipper Belt Lacer
Laces a Belt in Three Minutes

New belts *will* stretch, and the slack *must* be taken up promptly. Power plant engineers all over the world, in every line of manufacturing, know that shut-downs are but momentary when "Clipper" belt lacing is used.

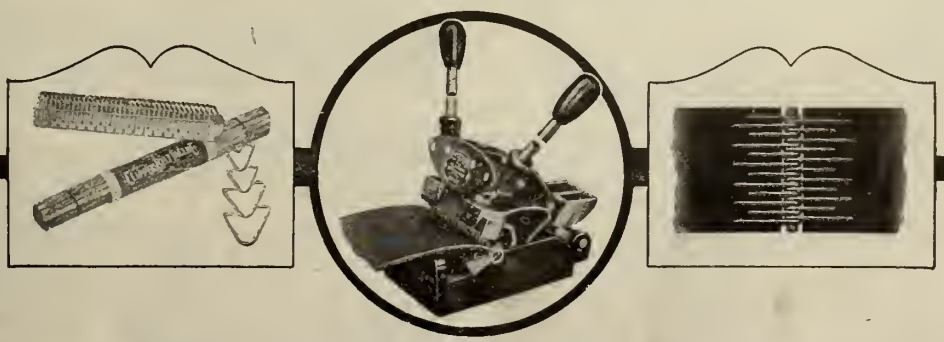
It requires no experts. Any workman can lace a belt the "Clipper" way and do the job well. The cost is negligible, while the saving, by keeping power drives working, is beyond calculation.

The American Museum of Safety gave the "Clipper" the only gold medal ever awarded for metal lacing.

The "Clipper" is backed by an unrestricted guarantee and, upon request, goes to responsible parties for free trial.

Most mill supply houses sell the "Clipper."
Dealers not stocking it write for particulars.

Clipper Belt Lacer Company
GRAND RAPIDS, MICHIGAN, U.S.A.



If interested tear out this page and place with letters to be answered

FORGINGS, SPECIAL
Armstrong-Whitworth of Can., Montreal.
Can. Found. & Forgings, Ltd., Welland.
Williams & Co., J. H., Brooklyn, N.Y.

FORMING
Brown & Sharpe Mfg. Co., Providence, R.I.

FOUNTAINS, DRINKING
Puro Sanitary Drinking Fountain Co. Haydenville, Mass.

FRICTION LEATHERS
Graton & Knight Mfg. Co., Montreal.

FRICTION SURFACE BELTING
Can. Consolidated Rubber Co., Montreal.

FUEL OIL SYSTEMS
Bowser Co., Ltd., S. F., Toronto, Ont.
St Lawrence Welding Co, Ltd., Montreal

FURNACES, ANNEALING, CASE HARDENING AND TEMPERING
Bellevue Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I.
Chicago Flexible Shaft Co., Chicago, Ill.
Gen. Combustion Co, Can., Ltd, Montreal
Mechanical Eng'r'g Co., Three Rivers, Q.
W. S. Rockwell Co., New York, N.Y.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.

FURNACES, BLAST
Bellevue Industrial Furnace Co., Detroit
Chicago Flexible Shaft Co., Chicago, Ill.
W. S. Rockwell Co., New York, N.Y.
Toronto Iron Works, Ltd., Toronto.

FURNACES — BRASS MELTING
General Combustion Co., Ltd., Montreal.

FURNACES — CRUCIBLE
Chicago Flexible Shaft Co., Chicago, Ill.

FURNACES, ELECTRIC
Electric Furnace Construction Co., Philadelpria, Pa.
Hamilton & Hansell, Inc., New York City

FURNACES, FORGING
Chicago Flexible Shaft Co., Chicago, Ill.
Gen. Combustion Co. of Can., Ltd., Montreal.
W. S. Rockwell Co., New York, N.Y.

FURNACES — HIGH-SPEED STEEL
Chicago Flexible Shaft Co., Chicago, Ill.

FUSE BOXES, STEEL
Dom. Forge & Stamp. Co., Walkerville.

FUSE PLUGS AND FUSES
Northern Electric Co., Ltd., Montreal Que

GALVANIZING FLUX
British Smelting & Refining Co., Ltd. Montreal, Que.

GANG PLANER TOOLS
Armstrong Bros. Tool Co., Chicago.

GAS AND STEAM ENGINES
Mesta Machine Co., Pittsburgh, Pa.

GASKETS, LEATHER, ETC.
Graton & Knight Mfg. Co., Montreal.

GASOLINE METERS
Bowser Co., Ltd., S. F., Toronto, Ont.

GASOLINE TANKS
Bowser Co., Ltd., S. F., Toronto, Ont.
St. Lawrence Welding Co., Montreal, Que.

GASOLINE PUMPS, SELF-MEASURING
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.

GAUGES
Crescent Mach. Co., Ltd., Montreal, P.Q.
Elliott & Whitehall Mach. & Tool Co. Galt, Ont.

GAUGE BLOCKS
Wilton Tool & Mfg. Co., Boston 20, Mass.

GAUGERS, CALIPERS
Williams & Co., J. H., Brooklyn, N.Y.

GAUGES, MERCURY COLUMN, DRAFT
Taylor Instrument Co., Rochester, N.Y.

GAUGES, HYDRAULIC
Taylor Instrument Co., Rochester, N.Y.

GAUGES, MANUFACTURERS, LIMIT, THREAD
Greenfield Tap & Die Corp., Greenfield
Wells Bros. of Can., Galt, Ont.
Wilton Tool & Mfg. Co., Boston 20, Mass.

GAUGES, SNAP, THREAD AND CYLINDRICAL
C. E. Johanson, Inc., Toronto, Ont.
Wilton Tool & Mfg. Co., Boston 20, Mass.

GAUGES, THREAD
Wilton Tool & Mfg. Co., Boston 20, Mass.

GAUGES, VACUUM AND PRESSURE
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Rochester, N.Y.

GAUGES, STANDARD
Brown Engineering Corp., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Crescent Mchy. Co., Ltd., Montreal, Que.
Garvin Machine Co., New York.
C. E. Johanson, Inc., Toronto, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Hartford, Conn.
Taylor, J. A. M., 518 Stair Bldg., Toronto
Toronto Tool Works, Toronto, Ont.
Wells Brothers Co. of Canada, Galt, Ont.
Wilton Tool & Mfg. Co., Boston 20, Mass.

GEAR BLANKS
Can. Steel Foundries, Ltd., Montreal.
Dom. Found. & Steel, Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Williams & Co., J. H., Brooklyn, N.Y.

GEAR BLANKS, CAST
Katie Foundry, Galt, Ont.

GEAR BLANKS, RAWHIDE
Lyman Tube & Supply Co., Montreal, Que.

GEAR BOXES ,REDUCTION
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEAR SHAPERS AND CUTTERS
Fellows Gear & Shaper Co., Springfield, V.

GEAR-CUTTING MACHINERY
Bilton Mach. Tool Co., Bridgeport, Conn.
Fellows Gear & Shaper Co., Springfield, V.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
A. R. Williams Machy. Co., Toronto.

GEAR-TESTING MACHINE
Gisholt Machine Co., Madison, Wis.

GEARS, CHAIN
Morse Chain Co., Ithaca, New York.
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, COMPENSATING
Morse Chain Co., Ithaca, New York.
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, CUT, MORTISE, ANGLE, WORM
Can. Link-Belt Co., Toronto, Ont.
Diamond State Fibre Co., Bridgeport, Pa.
Dom. Steel Products Co., Ltd., Brantford.
Dominion Bridge Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Elliott & Whitehall, Galt, Ont.
Gardner, Robt., & Son, Montreal.
Hamilton Gear & Machine Co., Toronto.
Hull Iron & Steel Found., Ltd., Hull, Q.
Jones & Glassco, Montreal.
Wm. Kennedy & Sons, Ltd., Owen Sound, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia.
Victoria Foundry Co., Ottawa.

GEARS, RAWHIDE
Gardner, Robt., & Son, Montreal.
Grant Gear Works, Boston, Mass.
Hamilton Gear & Machine Co., Toronto.
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia.
A. R. Williams Machy. Co., Toronto.

GENERATORS, GEAR
Fellows Gear & Shaper Co., Springfield, V

GEARS, SILENT CHAIN
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, SPRING
Morse Chain Co., Ithaca, New York.

GEARS, SPUN, BENCH, SPIRAL
Brown & Sharpe Mfg. Co., Providence, R.I.

GENERAL MACHINE WORK
Elliott & Whitehall, Galt, Ont.
St Lawrence Welding Co, Ltd., Montreal

GENERATORS AND CONVERTORS
Northern Elec. Co., Ltd., Montreal, P.Q.

GENERATORS, MOTOR
MacGovern & Co., Montreal.
Northern Elec. Co., Ltd., Montreal, P.Q.
Sturtevant Co., B. F., Galt, Ont.
U. S. Ordnance, Toronto, Ont.

GENERATORS, STEAM TURBO
Can. Link-Belt Co., Ltd., Toronto, Ont

GILDING
Brown's Copper and Brass Rolling Mills, New Toronto.

GLOVES, ASBESTOS, ACID PROOF WATERPROOF, ETC.
Strong, Kennard & Nutt Co., Cleveland

GLUE HEATERS
Oliver Machinery Co., Grand Rapids, Mich

GLASSES, SAFETY
Strong, Kennard & Nutt Co., Cleveland.
Willson & Co., Inc., T. A., Reading, Pa.

GRAPHITE
Aikenhead Hardware, Ltd., Toronto.
Rice Lewis & Son, Toronto.

GOGGLES
Consolidated Optical Co., Toronto.
Standard Optical Co., Geneva, N.Y.
Strong, Kennard & Nutt Co., Cleveland.
Welding & Supplies Co., Montreal.

GRAB BUCKETS—CLAMSHELL and ORANGE PEEL
Canadian Link-Belt Co., Ltd., Toronto, Ont.
Canadian Mead-Morrison Co., Limited, Montreal, Que.

GRAVITY CARRIERS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

GREASE CUPS, PRESSED STEEL, BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES (See Lubricants)

GRINDERS, AUTOMATIC KNIFE
Canada Machinery Corp., Galt, Ont.
Foss Mchry. & S'ply Co., G. F., Montreal
Garlock-Walker Machinery Co., Toronto.

GRINDERS, BENCH
Superior Machinery Co., London, Ont.

GRINDERS, CENTRE COLUMN, PEDESTAL AND BENCH
Can. Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Haskins & Co., R. C., Chicago, Ill.
Wisconsin Electric Co., Inc., Racine, Wis
Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto.
Katie Foundry, Galt, Ont.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford.
Niles-Bement-Pond Co., New York, N.Y.
Perfect Machine Co., Galt, Ont.
United States Elec. Tool Co., Cincinnati.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Brown & Sharpe Mfg. Co., Providence, R.I
Cincinnati Milling Mach. Co., Cincinnati.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Globe Engineering Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield, M.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Norton Co., Worcester, Mass.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, DIE AND CHASER
Haskins & Co., R. C., Chicago, Ill.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
National-Acme Co., Cleveland, Ohio.

GRINDERS, DISK
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., E. C., Hamilton, Ont.
Ford-Smith Mach. Co., Hamilton.
Gardner Machine Co., Beloit, Wis.
Heald Machine Co., Worcester, Mass.

GRINDERS, FLEXIBLE CASTING
Manhattan Machine & Tool Co., Grand Rapids, Mich.

GRINDERS, DRILL
Aikenhead Hardware Co., Toronto.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield,
Petrie, Ltd., H. W., Toronto.
United States Elec. Tool Co., Cincinnati.
Wells Bros. of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

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Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I
Foss Mchy. & S'ply Co., G. F., Montreal.
Greenfield Machine Co., Greenfield, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
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Baird Machine Co., Bridgeport, Conn.
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Ford-Smith Mach. Co., Hamilton, Ont.
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Grant Mfg. & Mach. Co., Bridgeport, Conn
Garlock-Walker Machinery Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Independent Pneumatic Tool Co., Chicago
Petrie, Ltd., H. W., Toronto.
United States Elec. Tool Co., Cincinnati
Wisconsin Electric Co., Inc., Racine, Wis.
Williams Mchy Co., A. R., Toronto, Ont.
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Bryant Chucking Grinder Co., Springfield, Vermont.
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Cleveland Pneumatic Tool Co., Toronto.
Garlock-Walker Machinery Co., Toronto.
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Independent Pneumatic Tool Co., Chicago
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Blount & Co., J. G., Everet, Mass.
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Ford-Smith Machine Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield.
National-Acme Co., Cleveland, Ohio.
Tabor Mfg. Co., Philadelphia, Pa.
Wells Bros. of Canada, Galt, Ont.

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Barber Mchy. Co., Ltd., Toronto, Ont.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Modern Tool Co., Erie, Pa.
Norton Co., Worcester, Mass.
Williams Mchy Co, Ltd., A. R., Montreal

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Brown & Sharpe Mfg. Co., Providence, R.I
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Garvin Machine Co., New York.
Garlock-Walker Machy. Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Haskins & Co., R. C., Chicago, Ill.
Hall & Sons, John H., Brantford, Ont.
Niles-Bement-Pond Co., New York, N.Y.
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Wisconsin Electric Co., Racine, Wis.
Williams Mchy Co., A. R., Toronto, Ont.

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Brown & Sharpe Mfg. Co., Providence, R.I.
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Ford-Smith Machine Co., Hamilton, Ont
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Kayser-Ellison & Co., Ltd., Montreal.
Lyman Tube & Supply Co., Montreal, Que
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Can. Link-Belt Co., Ltd., Toronto, Ont.

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Ford-Smith Machine Co., Hamilton, Ont
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Victor Saw Works, Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
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Atkins & Co., E. C., Hamilton, Ont.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Wks., Buffalo
Foss Mchy. & S'ply Co., G. F., Montreal
Ford-Smith Machine Co., Hamilton.
Perfect Machine Co., Galt, Ont.
Starrett Co., L. S., Athol, Mass.
Victor Saw Works, Hamilton, Ont.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., A. R., Toronto, Ont

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If interested tear out this page and place with letters to be answered

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Williams Mchy Co, Ltd., A. R., Montreal

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Williams Mchy Co, Ltd., A. R., Montreal

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HAMMERS, POWER
Nazel Eng. & Mach. Wks., Philadelphia

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Niles-Bement-Pond Co., New York.

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Oliver Mchry. Co., Grand Rapids, Mich.

HAND PLANING AND JOINTING MACHINERY
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HAND LEATHERS OR PADS
Graton & Knight Mfg. Co., Montreal.

HANDLES, FIBRE
Diamond State Fibre Co., Bridgeport, Pa.

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Algoma Steel Corp., Sault Ste. Marie.
Chapman Double Ball Bearing Co., Toronto.
Gray Ball Bearing Co., Ltd., Toronto.
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Shore Instrument & Mfg. Co., New York

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Strong, Kennard & Nutt Co., Cleveland

HIGH SPEED STEEL
See Steel.

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Butterfield & Co., Inc., Rock Island, Que.
London Bolt & Hinge Wks., London, Ont.

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Greenfield Tap & Die Co., Greenfield, Mass
Pratt & Whitney Co., Dundas, Ont.
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Wells Bros. of Canada, Galt, Ont.

HOISTING MACHINERY
Canadian Mead-Morrison Co., Limited, Montreal, Que.

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Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

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Garlock-Walker Machinery Co., Toronto.
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Independent Pneumatic Tool Co., Chicago
Lyman Tube & Supply Co., Montreal, Que.
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Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.
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U. S. Ordnance, Toronto, Ont.
Williams Mchy Co, Ltd., A. R., Montreal

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Oliver Engineering Co., Montreal.
Volta Mfg. Co., Welland, Ont.

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Electric Steels & Metals Ltd., Welland
Kennedy & Sons, Owen Sound, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

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HOLDERS, STEEL DIE FOR MARKING
Matthews & Co., Jas. H., Pittsburgh, Pa.

HOLDERS, ELECTRIC
Electric Steels & Metals, Ltd., Welland

HOOKS, BELT LACING
Clipper Belt Lacer Co., Grand Rapids.

HOPPERS
MacKinnon Steel Co., Ltd., Sherbrooke.
Dominion Bridge Co., Montreal, Que.
William Hamilton Co., Peterboro, Ont.
Toronto Iron Works, Ltd., Toronto, Ont.

HOSE, FIRE PROTECTION
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal

HOSE, PNEUMATIC
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Gutta Percha & Rubber, Ltd., Toronto.
Independent Pneumatic Tool Co., Chicago.
Quaker City Rubber Co., Philadelphia, Pa.
Wells Bros. Co. of Canada, Galt, Ont.

HOSE, ALL KINDS
Goodyear Tire & Rubber Co., of Canada, L..., Toronto.
Gutta Percha & Rubber, Ltd., Toronto.
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.

HOSE, SAND BLAST
Pangborn Corporation, Hagerstown, Md.
Goodyear Tire & Rubber Co. of Can., Ltd. Toronto
Quaker City Rubber Co., Philadelphia, Pa.
Intern'l. Machine Tool Co., Indianapolis.

HOSE, STEAM, SUCTION AND WATER
Gutta Percha & Rubber, Ltd., Toronto.
Quaker City Rubber Co, Philadelphia, Pa
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Dunlop Tire & Rubber Goods Co., Ltd., Toronto.

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Sturtevant Co., B. F., Galt, Ont.

HYDRAULIC ACCUMULATORS
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HYDRAULIC MACHINERY
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Machinery Co., Toronto.
Dom. Steel Products Co., Ltd., Brantford.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
West Tire Setter Co., Rochester, N.Y.
Victoria Foundry Co., Ottawa.

HYDRAULIC TURBINES
Que.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,

HYDROMETERS, HYGROMETERS, HYGRODNIKS
Taylor Instrument Co., Rochester, N.Y.

INDICATORS, SPEED
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol, Mass.

INDEX CENTRES
Brown & Sharpe Mfg. Co., Providence, R.I.
Dickow, Fred. C., Chicago, Ill.
Ford-Smith Machine Co., Hamilton, Ont.
Garvin Machine Co., New York.
Petrie, Ltd., H. W., Toronto

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Taylor Instrument Co., Rochester, N.Y.

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Can. Kron Scale Co., Montreal.

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City of St. Johns, Quebec.

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Thomas Moore & Son, Montreal.

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Electric Steel & Metals Co., Welland.

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Robertson Co., Ltd., H. H., Sarnia, Ont.

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IRON ORE
Hanna & Co., M. A. Cleveland, O.

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Swedish Steel & Impt. Co., Ltd., Montreal

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Aikenhead Hardware Co., Toronto, Ont.
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Globe Engineering Co.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Norton, A. O., Coaticook, Que.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.

JACKS, PIT AND TRACK
Canadian Fairbanks-Morse Co., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Northern Crane Works, Walkerville.

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Cushman Chuck Co., Hartford, Conn.
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Gray Ball Bearing Co., Ltd., Toronto.

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Crescent Mach. Co., Ltd., Montreal, P.Q.
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Gisholt Machine Co., Madison, Wis.
Globe Engineering Co., Ltd., Hamilton.
Homer & Wilson, Hamilton, Ont.
Jones & Lamson, Springfield, Vt.
Toronto Tool Co., Toronto, Ont.

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Williams Machy. Co., A. R., Toronto.

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Kennedy & Sons, Wm., Owen Sound, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
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Williams Mchy Co., A. R., Toronto, Ont.

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Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
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Rae Mach. Tool Co., Ramilton.
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Foss Mchy. & S'ply Co., G. F., Montreal.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Toronto, Ont.
Hardinge Bros., Inc., Chicago, Ill.
Hepburn Ltd., John T., Toronto, Ont.
Lehman Machine Co., St. Louis, Mo.
Niles-Bement-Pond Co., New York.
Rae Mach. Tool Co., Ramilton.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
U. S. Ordnance, Toronto, Ont.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.
Williams Machy. Co., A. R., Toronto.
Wood Turret Machine Co., Brazil, Ind.
Worcester Lathe Co., Worcester, Mass.

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Knight Metal Products, Toronto.
Lehman Machine Co., St. Louis, Mo.
Rae Mach. Tool Co., Ramilton.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Worcester Lathe Co., Worcester, Mass.

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LATHES, TURRET
Hardinge Bros., Chicago, Ill.
Acme Machine Tool Co., Cincinnati, Ohio

LEAD, PIG AND BAR
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LEAD BURNING
St. Lawrence Welding Co., Montreal.

LEAD BURNING OUTFITS
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Standard Optical Co., Geneva, N.Y.

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Can. Winkley Co., Ltd., Windsor, Ont.

LINK BELTING
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Rae Mach. Tool Co., Ramilton.

MACHINERY, CORNER AND BENDING
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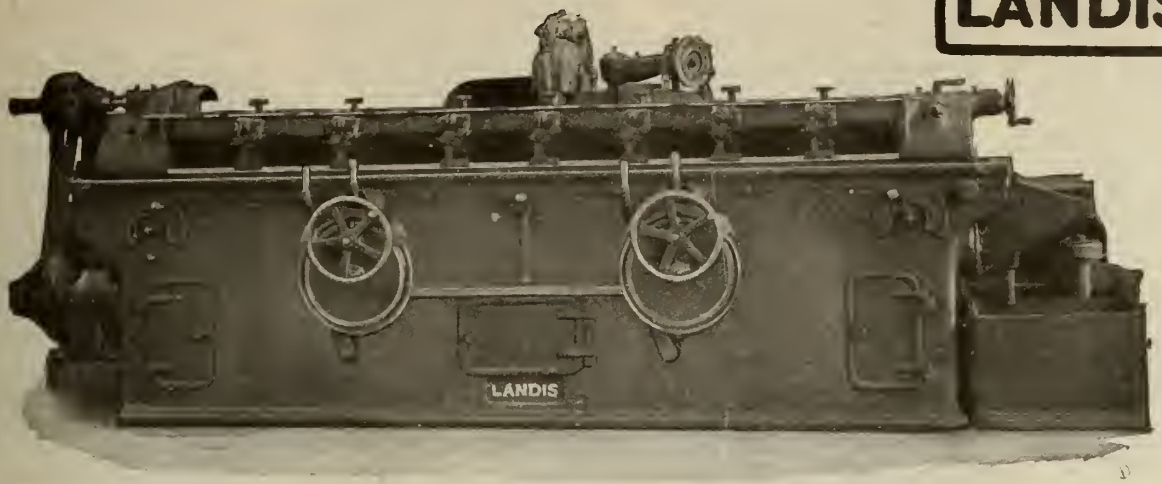
LANDIS



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We do not have to convince you that our **traveling grinding** wheel makes the **Landis** a desirable machine for cylindrical grinding——to see it is to realize this instantly.

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The entire range from ¼ inch to 2¾ inch for standard threads, and to 3 inches for 8 pitch or finer, is covered by three sizes of dies, whose ranges overlap.
And any of these dies, even the large No. 9, will thread pitches as fine as 32 per inch on its largest diameter without danger of stripping.

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Williams Machy. Co., A. R., Toronto.
Foss Mchy. & S'ply Co., G. F., Montreal.
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Globe Engineering Wks., Hamilton, Ont.
Knight Metal Products, Toronto.

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Morse Twist Drill & Mach. Co., New Bedford, Mass.
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Matthews & Co., Jas. H., Pittsburgh, Pa.

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Quaker City Rubber Co., Philadelphia, Pa
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Hinckley Machine Works, Hinckley, Wis.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles-Bement-Pond Co., New York.
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Taft-Peirce Mfg. Co., Woonsocket, R.I.

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Betts Machine Co., Rochester, N.Y.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.

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Kearney & Trecker Co., Milwaukee, Wis.
Marshall, Son & Bunney, Toronto.
Petrie, Ltd., H. W., Toronto.
Wilt Twist Drill Co., Walkerville, Ont.

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Garlock-Walker Machy. Co., Toronto, Ont.
Gooley & Edlund, Cortland, N.Y.
Hardinge Bros., Inc., Chicago, Ill.
Kearney & Trecker Co., Milwaukee, Wis
Knight Metal Products, Toronto.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Rockford Milling Mach. Co., Rockford, Ill
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Williams Machy. Co., A. R., Toronto.

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Cleveland Milling Machine Co., Cleveland.
Cincinnati Milling Machine Co., Cincinnati
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
National Machy. Co., Tiffin, Ohio.
Gooley & Edlund, Inc., Cortland, N.Y.
Hardinge Bros., Inc., Chicago, Ill.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Knight Metal Products, Toronto.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
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Garvin Machine Co., New York.
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Petrie, Ltd., H. W., Toronto.
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MacKinnon Steel Co., Sherbrooke, Que.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.

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Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., A. R., Toronto, Ont

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Gray Ball Bearing Co., Ltd., Toronto.

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Northern Elec. Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
U. S. Ordnance, Toronto, Ont.
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Hoggson & Pettis Mfg. Co., New Haven, Conn.

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Graton & Knight Mfg. Co., Worcester, M.

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Nat. Automatic Tool Co., Richmond, Ind.

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Turner Brass Works, Sycamore, Ill.

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Pilot Steel & Tool Co., Montreal, Que.

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National Machy. Co., Tiffin, Ohio.

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See Guards

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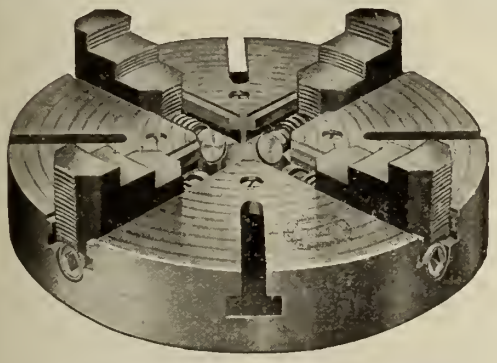

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It will hold the work down so it won't raise. The jaws are so arranged that we can easily change from the straight to the taper holds. That Skinner Planer Chuck is heavy and powerful. It's the chuck for holding down tough jobs like this one—" There's much more to be said about these chucks, their design, construction, finish, the material in them, etc.

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New York Office:
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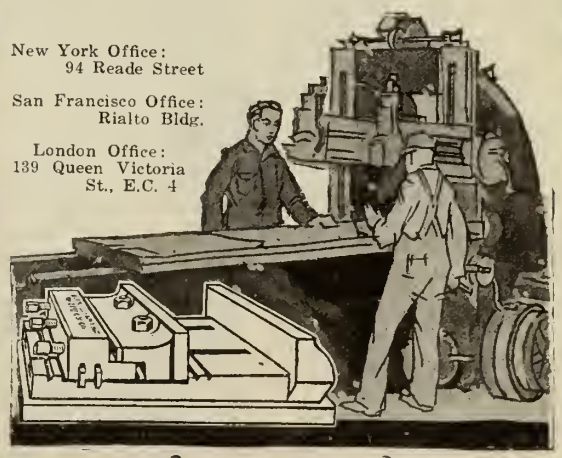
San Francisco Office:
Rialto Bldg.

London Office:
139 Queen Victoria St., E.C. 4



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Wells Bros. of Canada, Galt, Ont.

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Wells Bros. of Canada, Galt, Ont.

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Gardner & Son, Robt., Montreal.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Morton Mfg. Co., Muskegon Heights, Mich
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Garvin Machine Co., New York.
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MacGovern & Co., Montreal, Que.
Niles-Bement-Pond Co., New York.
Sturtevant Co., B. F., Galt, Ont.

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PLATING, PLANTS & SUPPLIES
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Can. Billings & Spencer, Ltd., Welland.
Peck, Stow & Wilcox Co., Southington, Ct.
Rice Lewis & Son, Toronto, Ont.

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Cleveland P'matio Tool Co., Can., Toronto.
Curtis Pneumatic Machy. Co., St. Louis.
Garlock-Walker Machy. Co., Toronto.
Int. Mech. & Supply Co., Ltd., Montreal.
Independent Pneumatic Tool Co., Chicago

POWER CRANES, HAND
MacKinnon Steel Co., Sherbrooke, Que.

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Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont
Petrie, Ltd., H. W., Toronto.

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Greenfield Tap & Die Corp., Greenfield.
Petrie, Ltd., H. W., Toronto.
Wells Bros. of Canada, Galt, Ont.

POLISHING PAPER
H. H. Barton & Son Co., Philadelphia

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Elec. Steel & Metals, Welland, Ont.

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PORTABLE MACHINERY
Haskins & Co., R. C., Chicago, Ill.

POWER TRANSMISSION MCHY
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Petrie, Ltd., H. W., Toronto.

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Gray Ball Bearing Co., Ltd., Toronto.

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Metalwood Mfg. Co., Detroit, Mich.
Petrie, Ltd., H. W., Toronto.

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Barber Mchy. Co., Ltd., Toronto, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Dom. Steel Products Co., Ltd., Brantford
Metalwood Mfg. Co., Detroit, Mich
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
Stoll Co., D. H., Buffalo, N.Y.
Williams Mchy Co., Ltd., A. R., Montreal

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Bliss Co., E. W., Brooklyn N.Y.
Toledo Machine & Tool Co., Toledo.
Stoll Co., D. H., Buffalo, N.Y.

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Smalley-General Co., Inc., Bay City, Mich.

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Dom. Steel Products Co., Ltd., Brantford.
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Toledo Machine & Tool Co., Toledo.

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Bertram & Sons Co., John, Dundas.
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Dom. Steel Products Co., Ltd., Brantford.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
Stoll Co., Inc., D. H., Buffalo, N.Y.
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Bliss Co., E. W., Brooklyn, N.Y.
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Garlock-Walker Machinery Co., Toronto.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
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U. S. Ordnance, Toronto, Ont.
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Petrie, Ltd., H. W., Toronto.
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Bliss Co., E. W., Brooklyn, N.Y.
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Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
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Positive Clutch & Pulley Works Ltd., Toronto.
Petrie, Ltd., H. W., Toronto.
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Darling Bros., Ltd., Montreal, Que.
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Metalwood Mfg. Co., Detroit, Mich.
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Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.
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A. B. Jardine & Co., Hespeler, Ont.
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Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
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Toledo Machine & Tool Co., Toledo, O.
Williams Mchy Co., A. R., Toronto, Ont.

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Garlock-Walker Machinery Co., Toronto.
A. B. Jardine & Co., Hespeler, Ont.
Long & Allstatter, Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
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Garlock-Walker Mach'y. Co., Toronto.
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Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Shore Instrument & Mfg. Co., New York
Taylor Instrument Co., Rochester, N.Y.
U.S. Ordnance, Toronto, Ont.

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Ingersoll Machy. Co., Ingersoll, Ont.
Morse Twist Drill & Mach. Co., N
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Plowes, Ltd., Winnipeg, Man.
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Morse Twist Drill & Mch. Co., Ne Bedford, Mass.
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Morse Twist Drill & Mach. Co., Ne Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

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Butterfield & Co., Inc., Rock Island, Qu
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Ingersoll Machy. Co., Ingersoll, Ont.
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J. Morrow Screw & Nut Co., Ingersoll, On
Wells Bros. of Canada, Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

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Butterfield & Co., Inc., Rock Island, Qu
Elliott & Whitehall, Galt, Ont.
Greenfield Tap & Die Corp., Greenfield
J. Morrow Screw & Nut Co., Ingersoll, On
Wells Bros. of Can., Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

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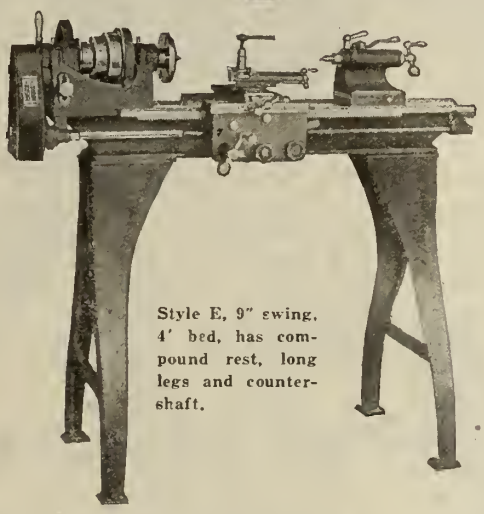

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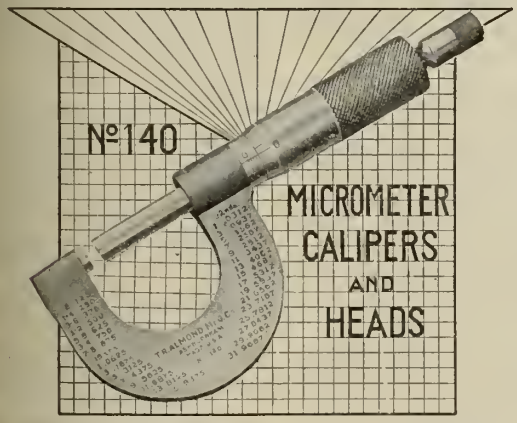

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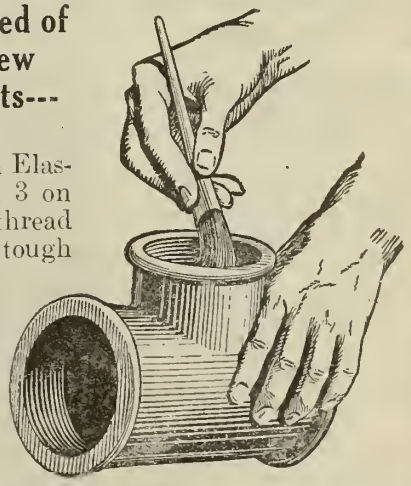

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Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Ltd., Toronto
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield.
A. B. Jardine & Co., Hespeler.
National Acme Co. Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
U. S. Ordnance, Toronto, Ont.
Warner & Swasey Co., Cleveland, O.
Wells Bros. of Can., Galt, Ont.
Wood Turret Mach. Co., Brazil, Ind.

SCREWS, MACHINE, SET, CAP AND SPECIAL
Galt Machine Screw Co., Galt.
John Morrow Screw & Nut Co., Ingersoll.
National Acme Co. Montreal.
Rice Lewis & Son, Toronto.
Steel Co. of Canada, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.

SCREW COLLARS
Galt Machine Screw Co., Ltd., Galt, Ont.
John Morrow Screw & Nut Co., Ingersoll.

SCREW MACHINES, PLAIN WIRE FEED
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.

SCREW PLATES
Butterfield & Co., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
A. B. Jardine & Co., Hespeler.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto.
J. A. M. Taylor, Stair Bldg., Toronto.
Wells Bros. of Can., Galt.
Wilkinson & Kompass, Hamilton.

SCREWS, SAFETY SET
Galt Machine Screw Co., Ltd., Galt, Ont.

SCREW SLOTTERS
Butterfield & Co., Inc., Rock Island, Que.
Garvin Machine Co., New York.
National Acme Co., Cleveland, O.
Pratt & Whitney Co., Dundas, Ont.

SEPARATORS, MOISTENERS AND OIL FOR COMPRESSED AIR
Pangborn Corporation, Hagerstown, Md.

SELF-OPENING DIES
See Dies.

SEPARATORS, SAND
Pangborn Corporation, Hagerstown, Md.

SET SCREWS, SAFETY
Aikenhead Hardware Co., Toronto.
Bristol Co., Waterbury, Conn.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wilkinson & Kompass, Hamilton

SHANKS, STRAIGHT AND TAPER
Jacobs Mfg. Co., Hartford, Conn.

SHAPERS
Barber Mchy. Co., Ltd., Toronto, Ont.
John Bertram & Sons Co., Dundas.
Can. Fairbanks-Morse Co., Montreal
Canadian Machinery Corp., Galt.
Geo. F. Fox Mchy. & Sply. Co., Montreal
Robt. Gardner & Son, Montreal.
Garlock-Walker Mach'y. Co., Toronto.
Hendey Machine Co., Torrington, Conn.
Milwaukee Shaper Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto.
Rae Mach. Tool Co., Hamilton.
Standard Equipment & Tool Wks., Montreal.
U. S. Ordnance, Toronto, Ont.
Walcott Lathe Co., Jackson, Mich.
Williams Mchy Co., A. R., Toronto, Ont.

SHAPERS, GEAR
Fellows Gear & Shaper Co., Springfield, V.
Knigh Metal Products, Toronto.

SHAFTING
Algoma Steel Corp., Sault Ste. Marie, O.
Can. Fairbanks-Morse Co., Montreal.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Jones & Glassco, Montreal.
Niles-Bement-Pond Co., New York.
Can. Drawn Steel Co., Hamilton.
Peckovers, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas.
Rice, Lewis & Son, Toronto.
A. R. Williams Machy. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

SHARPENING STONES
Norton Co, Worcester, Mass.
Rice, Lewis & Son, Toronto.

SHEARING MACHINES, ANGLE IRON, BAR AND GATE
John Bertram & Sons Co., Dundas.
Bertrams Ltd., Edinburgh, Scotland.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
A. B. Jardine & Co., Hespeler, Ont.
Long & Allstatter Co., Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo, O.

SHEARS, POWER
John Bertram & Sons Co., Dundas.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton.
Can Blower & Forge Co, Kitchener.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Long & Allstatler, Hamilton, Ohio.
A. B. Jardine & Co., Hespeler, Ont.
National Machy. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
H. D. Stoll Co., Inc., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Williams, White & Co., Moline, Ill.
Williams Mchy Co., A. R., Toronto, Ont.

SHEARS, ROTARY
The Quickwork Co., St Mary's, Ohio.

SHEARS, PNEUMATIC
Toledo Machine & Tool Co., Toledo, Ohio

SHEARS, PLATE CUTTING, SLITTING
Dom. Steel Products Co., Ltd., Brantford.
Quickwork Co., St. Mary's, Ohio.

SHEARS, SPLITTING
Dom. Steel Products Co., Ltd., Brantford.
Peck, Stow & Wilcox Co., Southington.

SHEARS, IRREGULAR AND CIRCLE CUTTING
The Quickwork Co., St. Mary's, Ohio.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEET METAL MACHINERY
Peck, Stow & Wilcox Co., Southington, C.

SHEARS, SERPENTINE
The Quickwork Co., St. Mary's, Ohio.

SHEARS, SQUARING
Brown, Boggs & Co., Hamilton, Ont.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEETS, STEEL, BLACK AND GALVANIZED
Benjamin & Co., M. & L., Samuel, Toronto, Ont.
Dominion Sheet Metal Corp., Hamilton.

SHEET METAL WORKING MACHINERY
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEET METAL WORKING TOOLS
Baird Machine Co., Bridgeport, Conn.
Barber Mchy. Co., Ltd., Toronto, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton.
Peck, Stow & Wilcox Co., Southington C.
Petrie, Ltd., H. W., Toronto.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEETS, CRUCIBLE, CAST
British Smelting & Refining Co., Ltd., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.

SHEETS, BLACK AUTO AND GALVANIZED
Peckovers, Ltd., Toronto, Ont.

SHEETS, NICKEL, RESIST. ALLOY
Can. Driver-Harris Co., Ltd., Walkerville

SHELVING, STEEL
Dennis Wire & Iron Works, London.

SHIPYARD MACHINERY, SHOP FURNITURE
Dennis Wire & Iron Works, London.

SIDE TOOLS
Armstrong Bros. Tool Co., Chicago
T. H. Williams & Co., Brooklyn, N.Y

SILENT CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.

SLEDGES
Aikenhead Hardware Co., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont

SLEDGES, CAST IRON
Katie Foundry, Galt, Ont.

SLICING CLAMPS
Peck, Stow & Wilcox Co., Southington Conn.

SLINGS, CHAINS
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

SLOTTERS
Bette Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
National-Acme Co., Cleveland, Ohio.
Niles-Bement-Pond Co., New York.

SMOKESTACKS
William Hamilton Co., Peterboro, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
St Lawrence Welding Co, Ltd., Montreal

SNIPS, TINNERS AND SHEET METAL WORKERS
Kearney & Trecker Co., Milwaukee, Wis.
J. Morrow Screw & Nut Co., Ingersoll, Ont.

SOCKETS
Brown & Sharpe Mfg. Co., Providence.
Butterfield & Co., Inc., Rock Island, Que
Cleveland Twist Drill Co., Cleveland.
Keystone Mfg. Co., Buffalo, N.Y.
Modern Tool Co., Erie, Pa.
J. Morrow Screw & Nut Co., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

SOIL PIPE FITTINGS, CAST IRON
Katie Foundry, Galt, Ont.

SOLDERING IRONS
Aikenhead Hardware Co., Toronto, Ont.
Brown, Boggs & Co., Hamilton, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.

SOLDER
British Smelting & Refining Co., Ltd., Montreal, Que.
Aikenhead Hardware Co., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Tallman Brass & Metal Co., Hamilton.

SPELTER
British Smelting & Refining Co., Ltd., Montreal, Que.

SPEED REDUCING GEARS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.

SPRINGS, MACHINERY
Barnes, Wallace Co., Bristol, Conn.
Can. Steel Foundries, Ltd., Montreal
Cleveland Wire Spring Co., Cleveland.
Dunbar Bros. Co., Bristol, Conn.
Garlock-Walker Machinery Co., Toronto.

SPECIAL MACHINERY
Baird Machine Co., Bridgeport, Conn.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram, John, & Sons Co., Dundas.
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada
Brown Engineering Corp., Toronto, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
Globe Engineering Co., Ltd., Hamilton.
Gooley & Eglund, Inc., Courtland, N.Y.
John H. Hall & Sons, Brantford.
A. B. Jardine & Co., Hespeler, Ont.
Katie Foundry, Galt, Ont.
Ker & Goodwin Machine Co., Ltd., Brantford, Ont.
National-Acme Co., Cleveland, Ohio.
Mesta Machine Co., Pittsburgh, Pa.
Rae Mach. Tool Co., Hamilton.
Stoll Co., D. H., Buffalo, N.Y.
Victoria Foundry Co., Ottawa, Ont.
William R. Perrin, Ltd., Toronto.

SPECIAL TOOLS, MACHINERY
Crescent Mche. Co., Ltd., Montreal, Que.
Globe Engineering Co., Ltd., Hamilton.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Wilton & Mfg. Co., Boston, Mass.

SPRING COILING AND WINDING MACHINERY
Baird Machine Co., Bridgeport, Conn.
Garvin Machine Co., New York.

SPRING MAKING MACHINERY (AUTOMATIC)
Baird Machine Co., Bridgeport, Conn.

SPRINGS, SPIRAL, TOOL
The Dunbar Bros. Co., Bristol, Conn.

SPROCKETS, COMPENSATING
Morse Chain Co., Ithaca, New York.

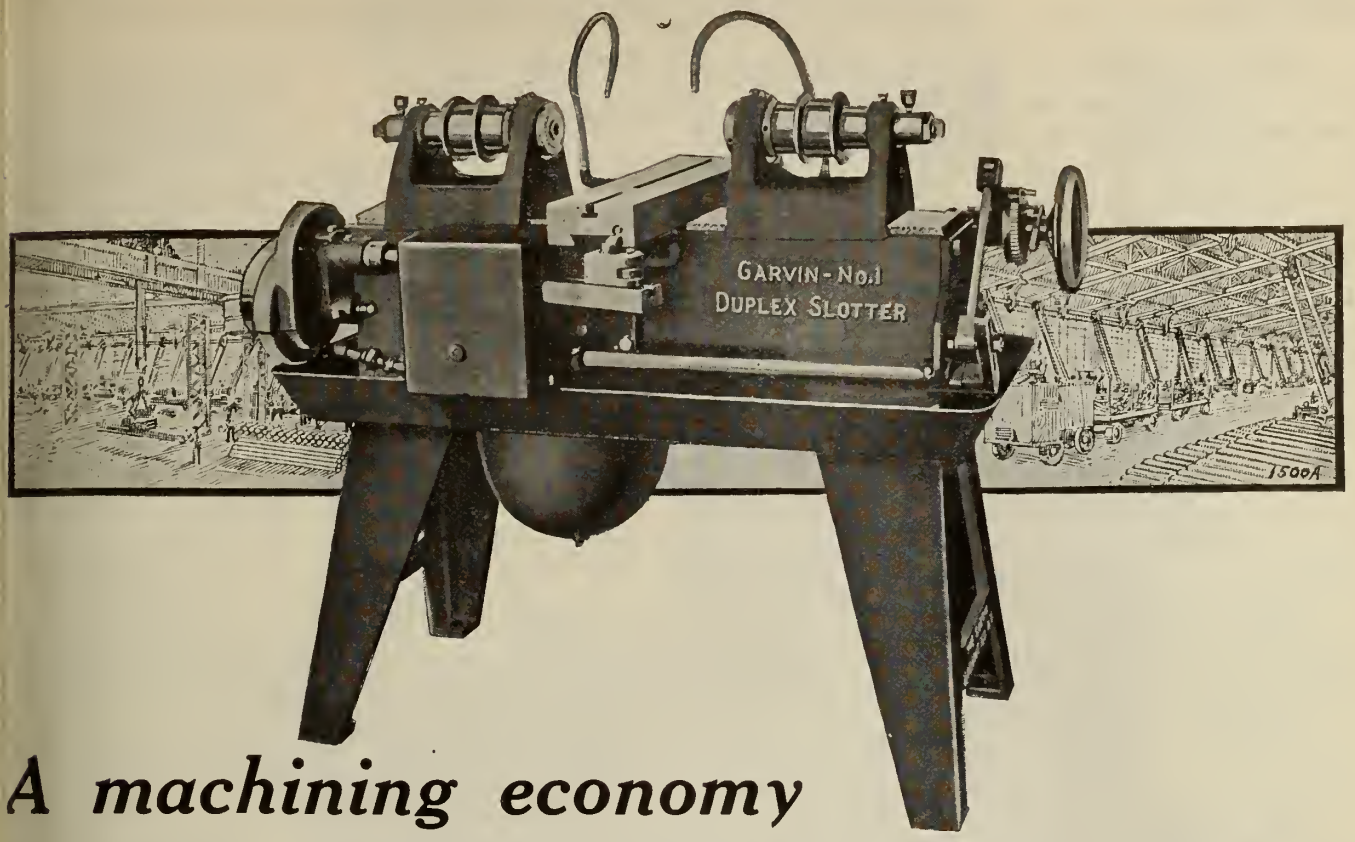
SPROCKETS, SPRING
Morse Chain Co., Ithaca, New York.

SPROCKETS, CHAIN
Can Link-Belt Co., Toronto, Ont.
Grant Gear Works, Boston, Mass.
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia

SPRINGS FOR TOYS AND ELECTRIC DEVICES
The Dunbar Bros. Co., Bristol, Conn.

SPROCKET WHEELS, CAST
Can. Link Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Ltd., Montreal

SQUARES
Peck, Stow & Wilcox Co., Southington Conn.



A machining economy you cannot afford to ignore

A full-automatic Garvin Duplex Slot Miller is the most inexpensive workman you could employ for milling slots, keyways or elongated holes. All that is required of the operator is placing the piece—the machine does the rest. It makes the cut without any attention and stops itself when finished.

Duplex Slot Milling is the ideal way to machine cuts in both ends of a piece to be in line. The method is accurate and the rate of production high. This method is far ahead of the obsolete practice of jig-drilling and slotting out, partial sawing or slowly butt-milling. Slot milling out a succession of light cuts has been proven a much faster operation than taking the whole cut at once.

Working from both sides of a piece halves the time otherwise required or two pieces can be mounted side by side and both machined at one setting. In milling a through slot automatic provision is made to back away one head and let the other cut clear through.

The work table is moved back and forth by a cam and adjustable lever. You can readily set it for any length of stroke desired.

The milling heads are automatically fed into the cut. The depth of feed is adjustable and the machine can be set to stop feeding and lift out when the required depth has been machined.

Each head is independently adjustable along the bed to accommodate the position of the work on the table or cutters of varying degrees of wear.

Let the Garvin Catalogue tell you more of these machines—and the several sizes from which to choose. Ask your dealer or address

The GARVIN MACHINE COMPANY, Spring & Varick Streets, New York, N.Y.

GARVIN

BUILDER OF BETTER MACHINE TOOLS 6-34

If interested tear out this page and place with letters to be answered

SAFETY CYLINDERS
Oliver Mach. Co., Grand Rapids, Mich.

SANDERS
Oliver Mach. Co., Grand Rapids, Mich.

SAW BENCHES
Oliver Mach. Co., Grand Rapids, Mich.

SAW GUARDS
Oliver Mach. Co., Grand Rapids, Mich.

SAWS SWING
Oliver Mach. Co., Grand Rapids, Mich.

STAYBOLT TOPS
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

STAIRS, IRON
Canada Wire & Iron Goods Co., Hamilton, Ont.

STAMPINGS, SHEET BRASS, COPPER, ALUMINUM AND STEEL
Dom. Forge & Stamping Co., Walkerville
Globe Engineering Co., Hamilton, Ont.
Homer & Wilson, Hamilton, Ont.

STAMPING MACHINERY
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs, & Co., Hamilton, Can.
Canada Machinery Corp., Galt, Ont.

STAMPS AND DIES, STEEL
Hoggson & Pettis Mfg. Co., New Haven, Conn.

STAMPS, STEEL ALPHABET, FIGURES
Hoggson & Pettis Mfg. Co., New Haven Conn.
Matthews, Jas. H & Co., Hartford, Conn.

SAFETY CYLINDERS
Oliver Mach. Co., Grand Rapids, Mich

STEAM APPLIANCES
Darling Bros., Ltd., Montreal, Quebec.

STEAM SEPARATORS AND TRAPS
Can. Fairbanks-Morse Co., Montreal

STEAM HOISTING ENGINES
Canadian Mead-Morrison Co., Limited, Montreal, Que.

STEAM TURBINES
General Combustion Co., Ltd., Montreal Que.
Sturtevant Co., B. F., Galt, Ont.

STEEL BALLS
See Balls Steel.

STEEL, CRUCIBLE TOOL
Atkins & Co., Ltd. Wm. Sheffield, Eng
Baines & David, Toronto.
Illingworth Steel Co., John, New York
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.

STEEL, CARBON, FERRO-TUNGSTEN
Armstrong, Whitworth of Can., Montreal
Atkins & Co., Ltd., Wm., Sheffield, Eng
Baines & David, Toronto.
Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal
Latrobe Electric Steel Co., Latrobe, Pa
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
Marshall, Son & Bunney, Toronto.
Peckovers, Ltd., Toronto, Ont.
Samuel Osborne (Can.), Ltd., Montreal.
Vanadium-Alloys Steel Co., Pittsburgh

STEEL, CHROME VANADIUM
Kayser-Ellison & Co., Ltd., Montreal.
Norton, Ralph B., Agent, Montreal.
Atkins & Co., Ltd., Wm. Sheffield, Eng
Marshall, Son & Bunney, Toronto.

STEEL CHROME NICKEL
Firth & Sons, Ltd., Thos., Montreal.
Kayser-Ellison & Co., Ltd., Montreal.
Lyman Tube & Supply Co., Ltd., Montreal
Norton, Ralph B., Agent, Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng
Marshall, Son & Bunney, Toronto.

STEEL CASTINGS
Can. Elec. Steel Casting Co., Aurora Ont
Davidson Mfg. Co., Ltd., Montreal, Que
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Dom. Iron & Steel, Sydney, N.S.
Jollette Steel Co., Montreal, Que.
Kennedy & Sons, Wm., Owen Sound
Electric Steel & Metals Co., Welland.
Nova Scotia Steel & Coal Co., Windsor
Swedish Crucible Steel Co., Windsor.

STEEL, COLD ROLLED
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Drawn Steel Co., Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co. Ltd., Montreal.
Union Drawn Steel Co., Hamilton, Ont

STEEL FJAB
Lincoln Electric Co., of Canada, Ltd., Toronto, Ont.

STEEL, NICKEL
Atkins & Co., Ltd., Wm., Sheffield, Eng
Kayser-Ellison & Co., Ltd., Montreal
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Peckovers, Ltd., Toronto, Ont.

STEEL, HIGH SPEED
Armstrong-Whitworth of Can., Montreal
Baines & David, Toronto.
Wm. Atkins & Co., Sheffield, Eng.
Bolter & Co., Inc., H., Montreal, Que.
Can. Fairbanks-Morse Co., Montreal
Deloro Smelting & Refining Co., Ltd. Toronto, Ont.
H. A. Drury Co., Ltd., Montreal.
Firth & Sons, Thos., Montreal, Que.
Hawkridge Bros. Co., Boston, Mass.
Illingworth Steel Co., J., New York.
Kayser Ellison & Co., Sheffield, Eng.
Latrobe Electric Steel Co., Latrobe, Pa
Marshall, Son & Bunney, Toronto, Ont.
Osborne, Samuel, Montreal, P.Q.
Plewes, Ltd, Winnipeg, Man.
Pilot Steel & Tool Co., Montreal, Que.
Ralph B. Norton, Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co., Ltd., Montreal.
Vanadium-Alloys Steel Co., Pittsburgh

STEEL, CHROME, MANGANESE
Joilette Steel Co., Montreal, Que.

STEEL, OPEN HEARTH
Illingworth Steel Co., John, New York

STEEL PLATES
Dominion Foundries & Steel Ltd., Hamilton, Ont.

STEEL PRODUCTS AND MACHINERY
Dom. Steel Products Co., Ltd., Brantford

STEEL, ROCK DRILL
Armstrong, Whitworth of Canada, Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal
Lincoln Electric Co. of Canada, Ltd Toronto, Ont.

STEEL, SPRING AND REINFORCING
Peckovers, Ltd., Toronto, Ont.

STEEL, STRUCTURAL
Algoma Steel Corp., Sault Ste. Marie
Dom. Iron & Steel Co., Sydney, N.S.
MacKinnon Steel Co., Sherbrooke, Que.
Peckovers, Ltd., Toronto, Ont.

STEEL, TOOL
Armstrong, Whitworth of Can., Montreal
Atkins & Co., Wm., Sheffield, Eng.
Baines & David, Toronto.
Can. Fairbanks-Morse Co., Montreal.
Drury Co., H. A., Montreal, Que.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.
Firth & Sons, Thos., Montreal, Que.
Hawkridge Bros. Co., Boston, Mass.
Kayser-Ellison & Co., Ltd., Montreal.
Lincoln Electric Co., of Canada, Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Ltd., Montreal
Marshall, Son & Bunney, Toronto, Ont
Latrobe Electric Steel Co., Latrobe, Pa.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son Toronto, Ont.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL TUBING
Tube Co. of Canada, Ltd., Toronto, Ont.

STEEL, VANADIUM
Wm. Atkins & Co., Ltd., Sheffield, Eng.
Armstrong, Whitworth of Can., Montreal
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Drury, H. A., Co., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.
Wells Bros. of Can., Galt, Ont.

STEEL WELDING
Peckovers, Ltd., Toronto, Ont.

"STELLITE"
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.

STENCILS
Hoggson & Pettis Mfg. Co., New Haven. Conn.

STOCK RACKS FOR BARS, PIPING, ETC.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

STOCKS AND DIES
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros., of Can., Galt, Ont.

STOCKS, PIPE
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Wells Bros. Co., of Canada, Galt, Ont.

STONES, COMMUTATORS
Lyman Tube & Supply Co., Ltd., Montreal

STRAIGHTENING MACHINERY
Baird Machinery Co., Bridgeport, Conn.
Bertrams, Ltd., Edinburgh, Scotland.

STRAND
Dom. Steel Products Co., Ltd., Brantford.
Page Steel & Wire Co., Adrian, Mich.

STRIP STEEL
Peckovers, Ltd., Toronto, Ont.

SURFACE PLATES
Brown & Sharpe Mfg. Co., Providence, R.I.

STRUCTURAL STEEL WORKS
William Hamilton Co., Peterboro, Ont.

SUPPLIES, RUBBER MFRS.
Hoggson & Pettis Mfg. Co., New Haven, Conn.

SWITCHBOARDS
Northern Electric Co., Ltd., Montreal Que

SWITCHES, RAILWAY
Can. Steel Foundries, Ltd., Montreal.

TABLES, DRAWING
Economy Drawing Table Co., Adrian, Mich.

TABLES, SAND-BLAST
Panghorn Corporation, Hagerstown, Md.

TAPPING MACHINES (PNEUMATIC)
Cleveland Pneumatic Tool Co., Toronto.

TANKS, AIR, EXPANSION
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, GASOLINE, KEROSENE AND OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. John Wood Mfg. Co., Ltd., Toronto
Dominion Bridge Co., Montreal, Que.
Dom. Forge & Stamping Co., Walkerville.
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
U. S. Ordnance, Toronto, Ont.

TANKS, LEAD LINED
Can. Hanson Van Winkle Co., Ltd.,

TANKS, LUBRICATING, OIL STORAGE
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, PNEUMATIC AND CLOSET
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, RUBBER CEMENT
Bowser Co., Ltd., S. F., Toronto, Ont.
St. Lawrence Welding Co, Ltd., Montreal

TANKS, STEEL, WATER PRESSURE
Bowser Co., Ltd., S. F., Toronto, Ont.
Dominion Bridge Co., Montreal, Quebec.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal, Que.
Toronto Iron Works, Ltd, Toronto.

TANK WAGONS
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal.
Toronto Iron Works, Ltd., Toronto.

TANKS, WELDED
Can. John Wood Mfg. Co., Ltd., Toronto
Can. Hanson Van Winkle Co., Ltd., Liucoln Electric Co. of Canada, Ltd., Toronto, Ont.

TANKS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
William Hamilton Co., Peterboro, Ont.

TAPER PINS
Galt Machine Screw Co., Ltd., Galt, Ont.

TAPES, MEASURING
James Chesterman & Co., Ltd., Sheffield, Eng.
Rice Lewis & Son, Toronto, Ont.

TAPPING MACHINES AND ATTACHMENTS
Bertram, John & Sons Co., Dundas.
Canada Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garvin Machine Co., New York.
The Geometric Tool Co., New Haven.
J. H. Hall & Sons, Brantford, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchy Machine & Tool Co., Detroit.
Niles-Bement-Pond Co., New York.
Rickert-Shafer Co., Erie, Pa.
National-Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto.
L. S. Starrett Co., Athol, Mass.
Whitney Mfg. Co., Hartford, Conn.

TAPES, MEASURING, STEEL AND WOVEN
Lufkin Rule Co. of Can., Windsor, Ont.

TAPES, POCKET
Lufkin Rule Co. of Can., Windsor, Ont.

TAPS, ADJUSTABLE
Butterfield & Co., Rock Island, Que.
Geometric Tool Co., New Haven.
Ingersoll Mach. Co., Ingersoll, Ont.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Pilot Steel & Tool Co., Montreal, Que.
Victor Tool Co., Waynesboro, Pa.

TAPS, GUN, HAND, BOILER
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, MACHINE RELIEVED
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, MACHINE SCREW
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, PIPE
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Mach. Co., Ingersoll, Ont.
Marshall, Son & Bunney, Toronto.
Wells Bros. of Can., Galt, Ont.

TAPS, SPECIAL
Elliott & Whitehall, Galt, Ont.

TAPS, STAYBOLT, TAPPER
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

TAPS, DIES AND WRENCHES
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Foss Mchy. & Sply. Co., G. F., Montreal.
Geometric Tool Co., New Haven.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Mach. Co., Ingersoll, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Morse Twist Drill & Mchy. Co., New Bedford, Mass.
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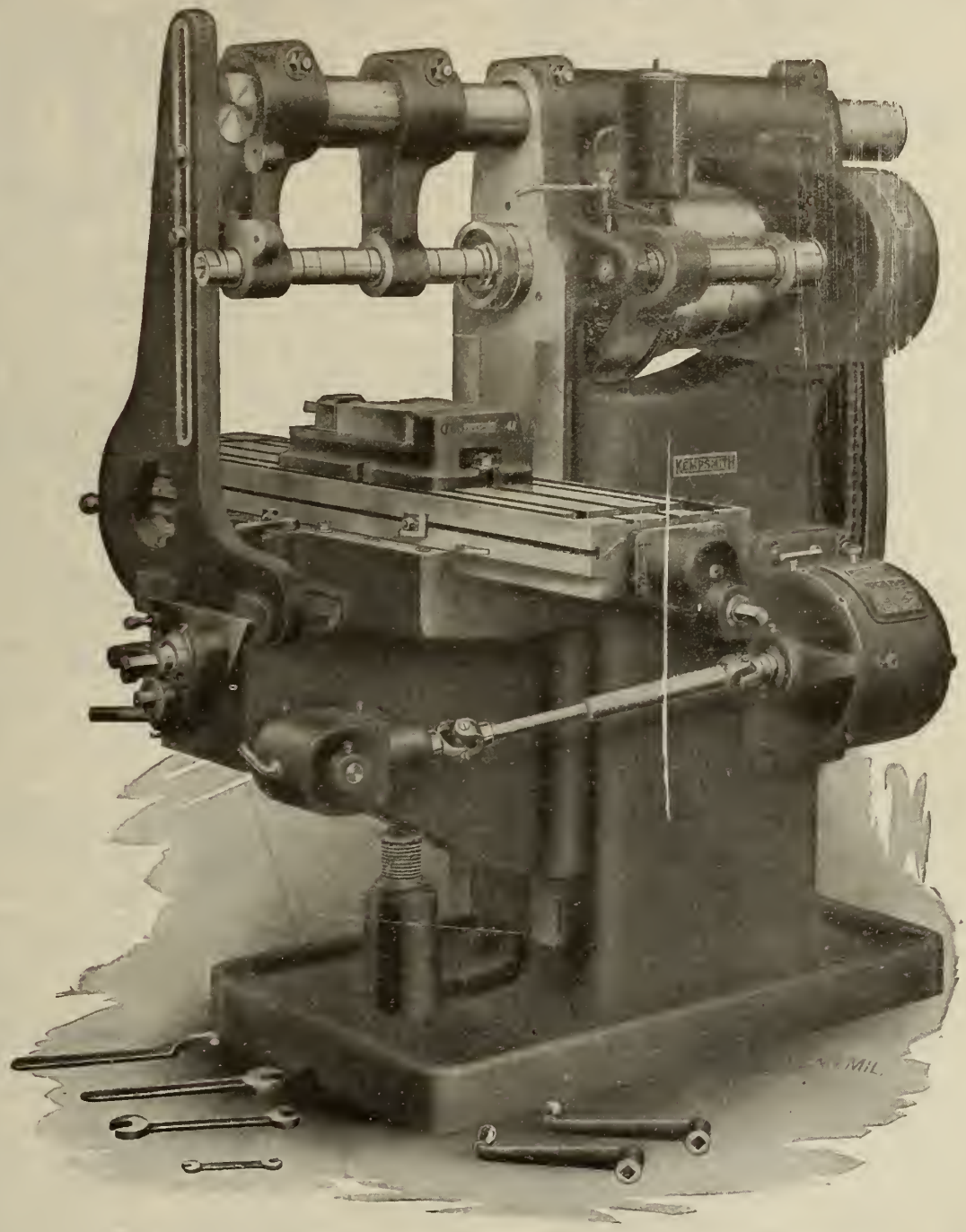

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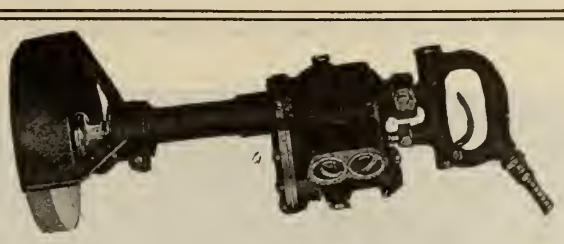

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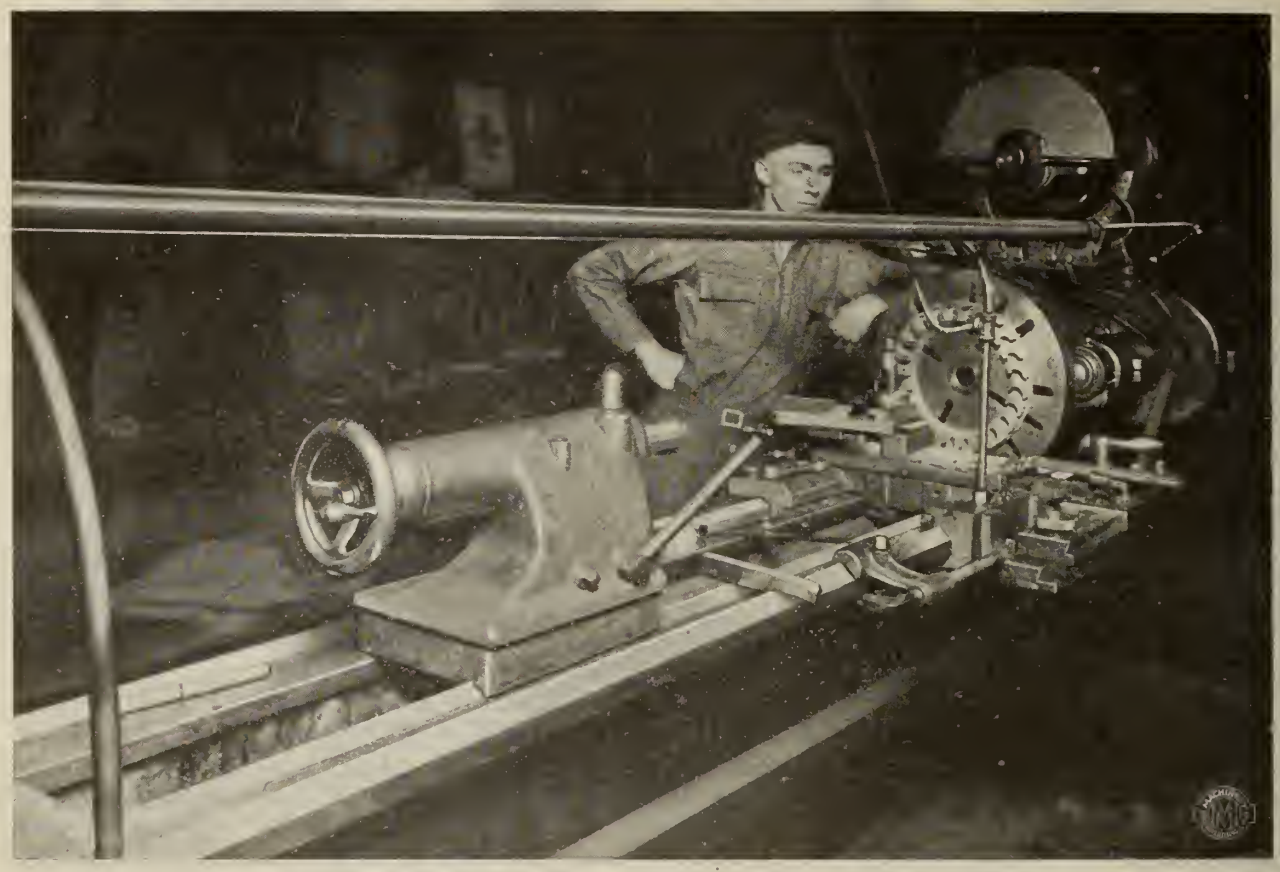

A Hendey Lathe Was Chosen!

Its reputation for accuracy and ease of operation, placed this lathe in the toolroom of the Platt Iron Works, Dayton, Ohio. For a while it was used on general tool work. This was some seven years ago.

Occasion arose requiring a lathe capable of taking care of the exacting requirements of brass pattern making. The Hendey was chosen.

The photograph shows this Hendey turning out a Dyneto flywheel. Outside diameter of the pattern is 12.234 in., diameter outside lug being 12.083 in., inside diameter is 9.417 in. The twenty-four lugs are turned at an angle of 5 degrees 45 minutes. The pattern, which is to be used for very close electrical work, is held within limits of plus or minus .001 in., and is finished all over.

THE HENDEY MACHINE COMPANY

TORRINGTON, CONN., U.S.A.

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HENDEY

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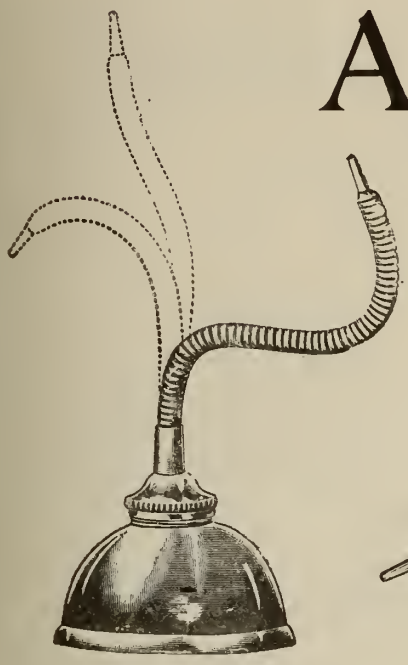
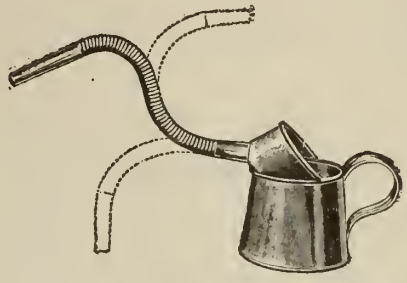


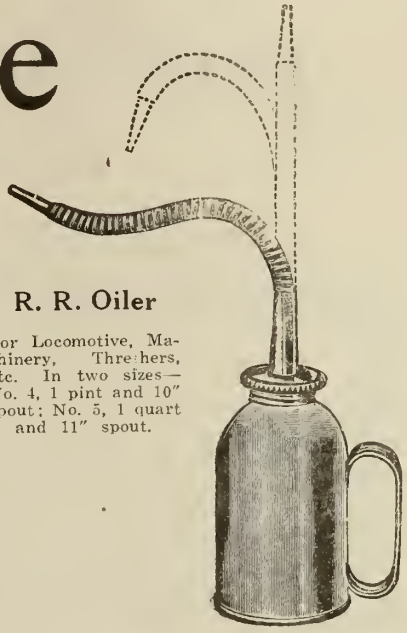
General Purpose Oiler

Made with steeel spring bottom, in three sizes—No. 1, 1/3 pint, No. 2, ½ pint, and No. 3, 1 pint. A 7" spout to each.



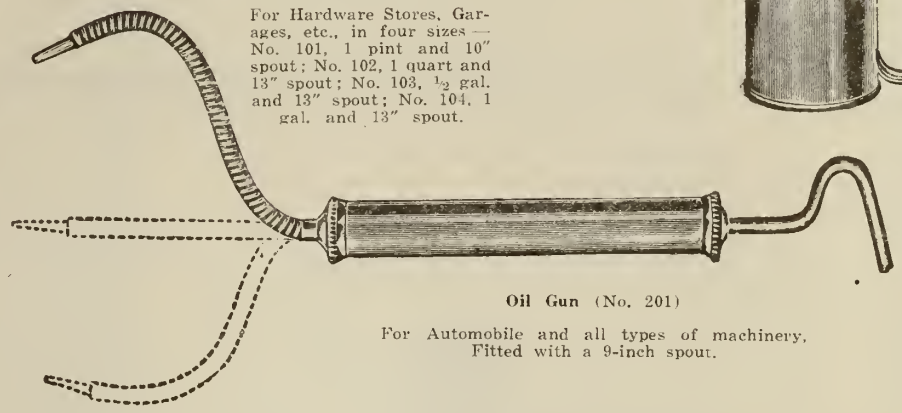
Combination Filler and Funnel

For Hardware Stores, Garages, etc., in four sizes—No. 101, 1 pint and 10" spout; No. 102, 1 quart and 13" spout; No. 103, ½ gal. and 13" spout; No. 104, 1 gal. and 13" spout.



R. R. Oiler

For Locomotive, Machinery, Threshers, etc. In two sizes—No. 4, 1 pint and 10" spout; No. 5, 1 quart and 11" spout.



Oil Gun (No. 201)

For Automobile and all types of machinery. Fitted with a 9-inch spout.

Why the All-way Oiler Sells

The All-Way Oiler reaches anywhere by means of a flexible spout that may be bent to suit any place that must be reached. In using the ordinary oiler much oil is lost in attempting to reach awkwardly situated oil holes. The saving of oil from this feature reduces oil bills 50%. All-way Oilers have a special cleaning device at the end of the spout which insures their being always ready for use.

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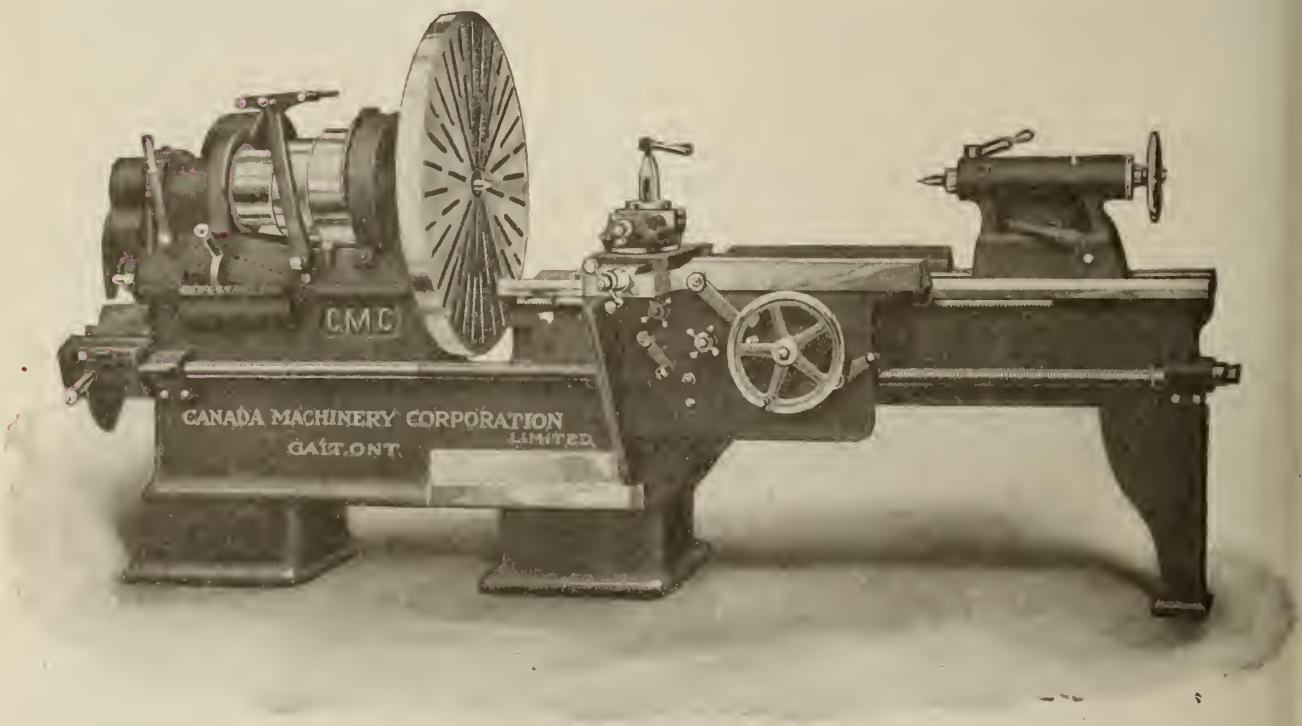

20" Gap Lathe With Quick Change Gears

EXPORT NUMBER

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CANADIAN MACHINERY AND MANUFACTURING NEWS

A weekly newspaper covering in a practical manner the mechanical power, foundry and allied fields.
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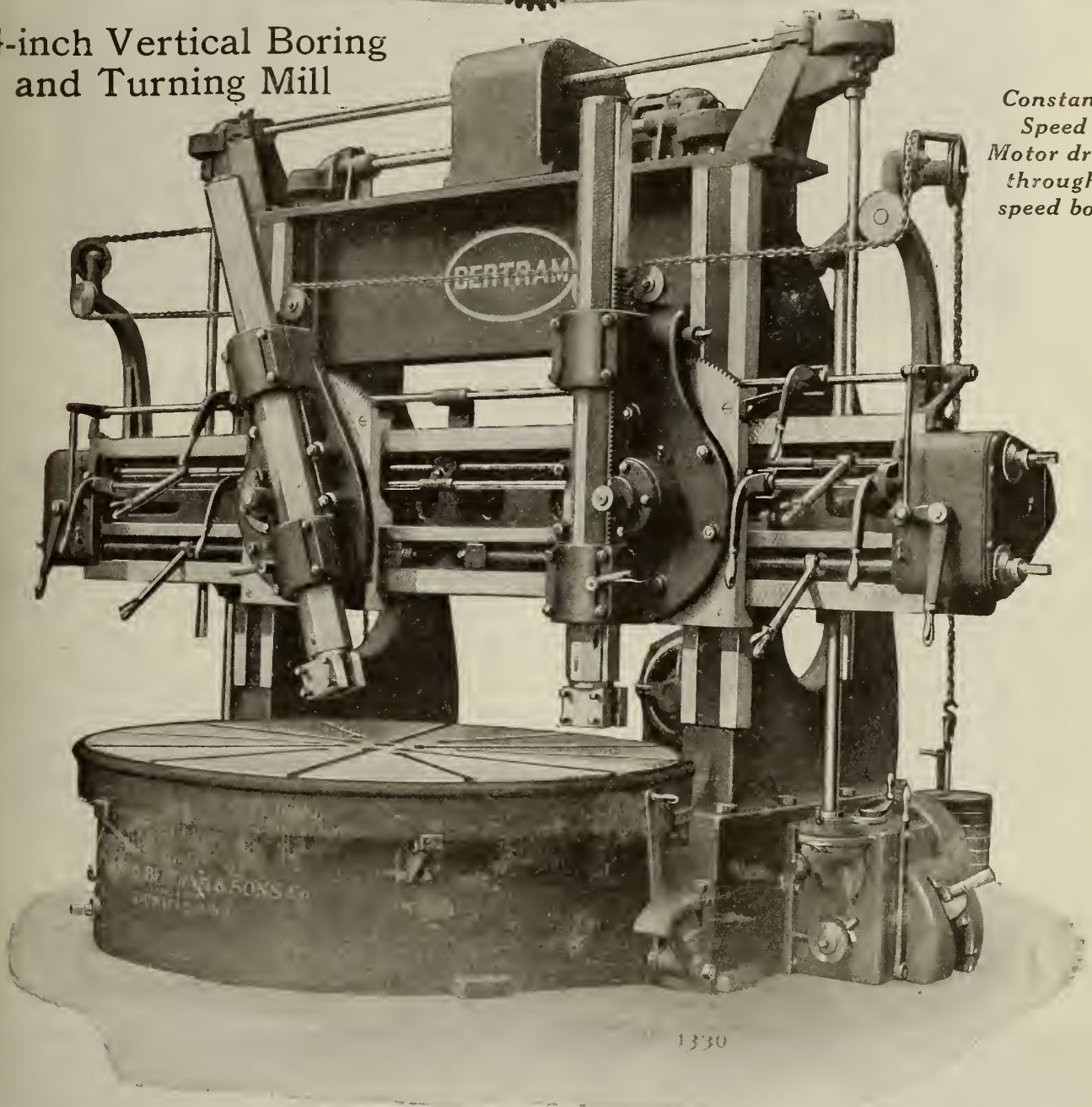

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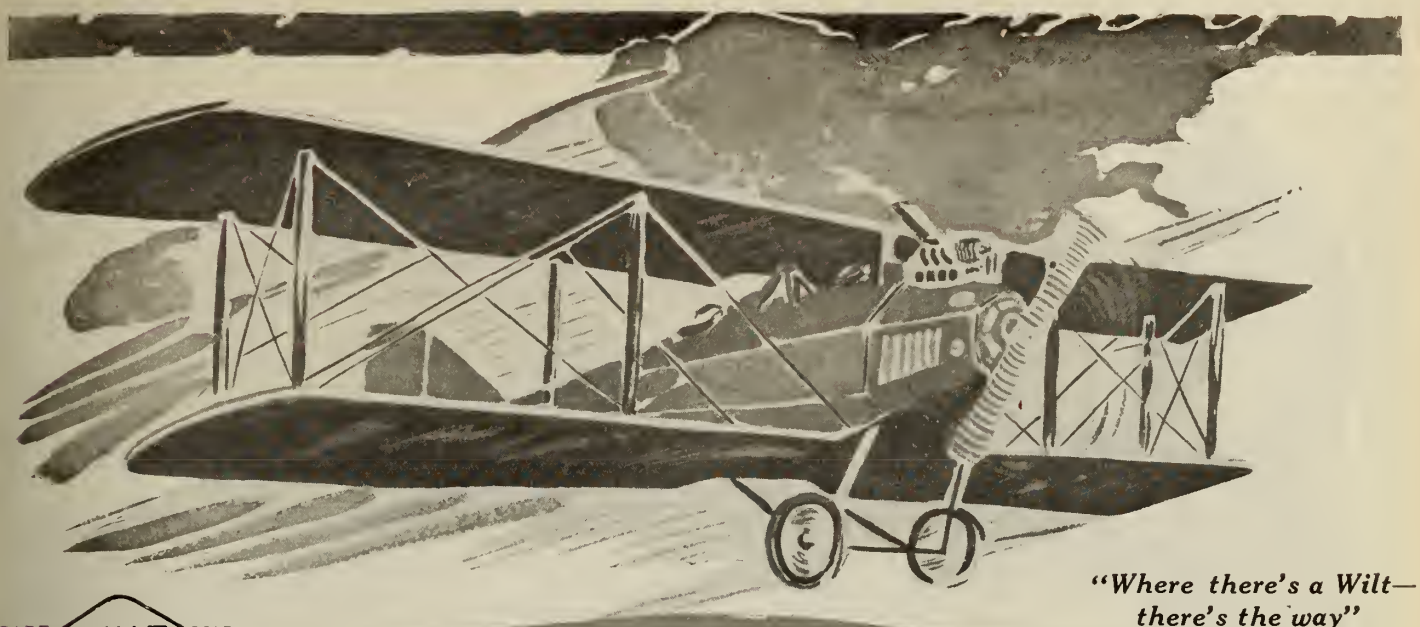

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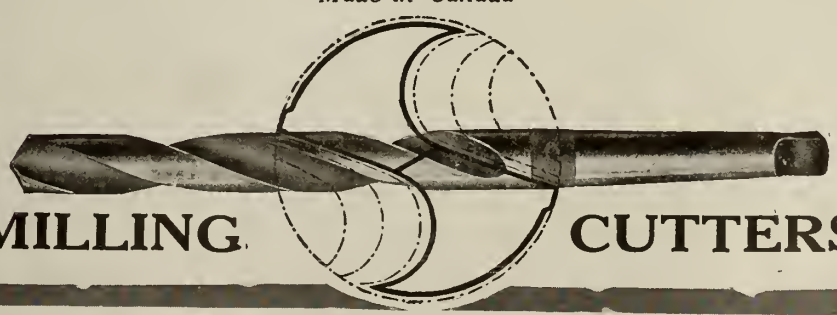

MILLING CUTTERS

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THE HIGH SPEED STEEL

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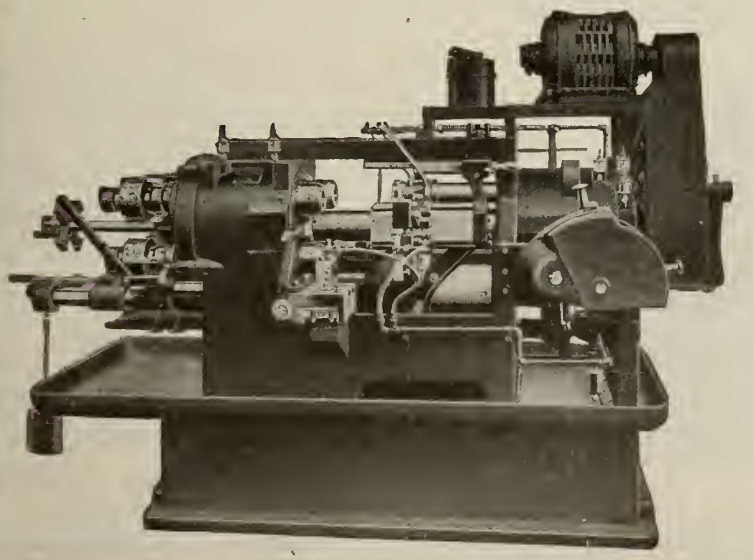

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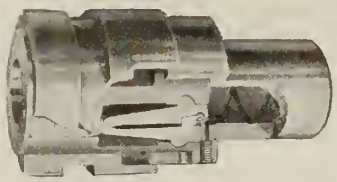

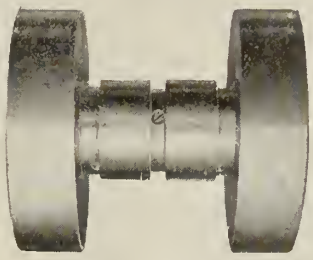

That's what you get in the Johnson Clutch. A clutch that you can rely on — that has proven its merits—and still one that can be applied to your own requirements, just as well as if you built it yourself. If your drive comes within the rating of Johnson Clutches, we can develop the most satisfactory clutch to handle it.

Johnson Clutches are adaptable to high speed and low speed, to all conditions of service, from the most delicate to the most strenuous. They are exceptionally serviceable in machine installations. Our booklet, "Clutches as Applied to Machine Building" shows what they are accomplishing in this line.

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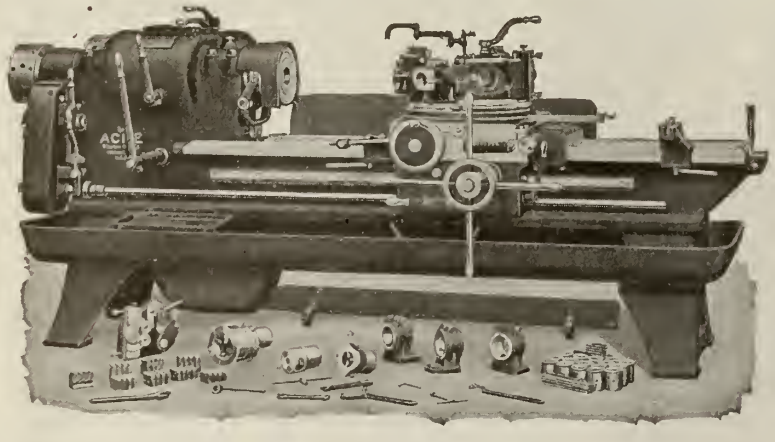

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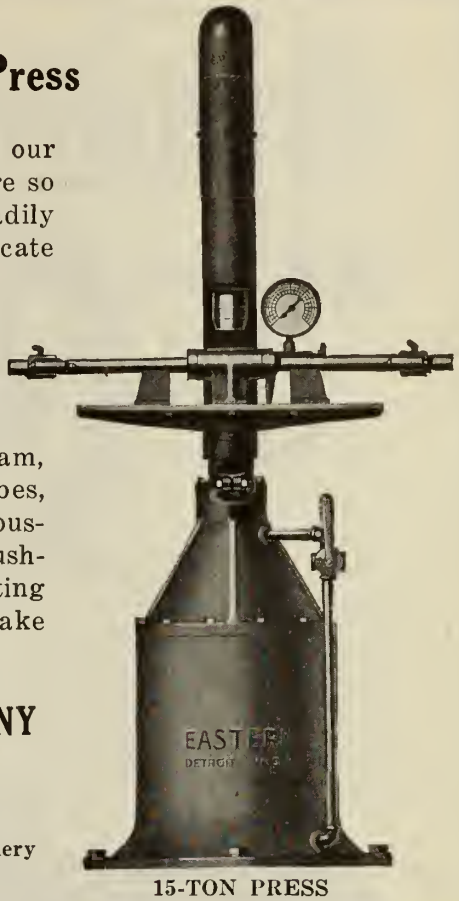

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Machine Tools of Quality, Canadian Made

A Canadian-made machine with a distinguished record for power, speed and unfailing accuracy.

Plain and Universal types, built in a suitable range of capacities for almost every class of milling.

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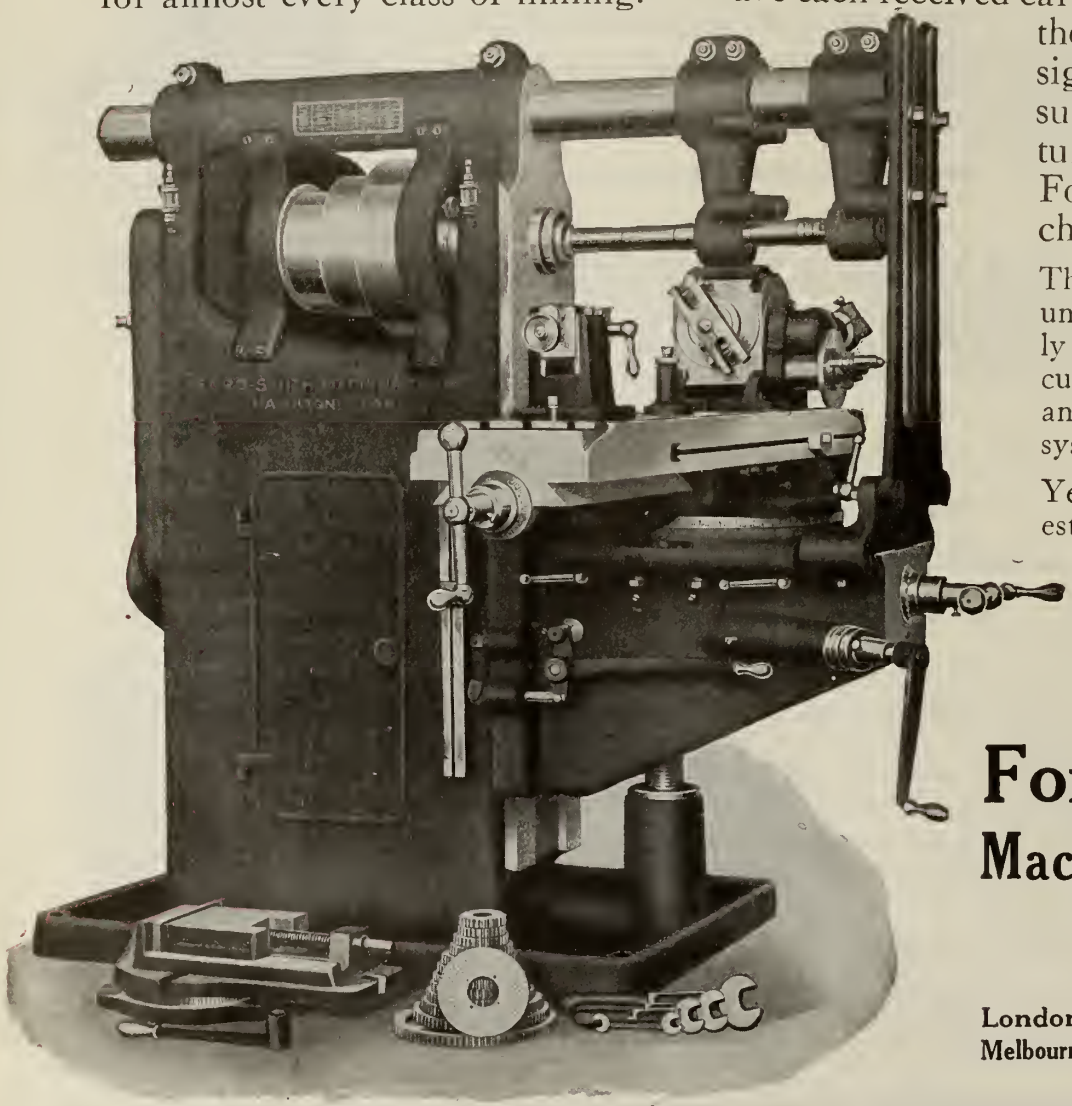

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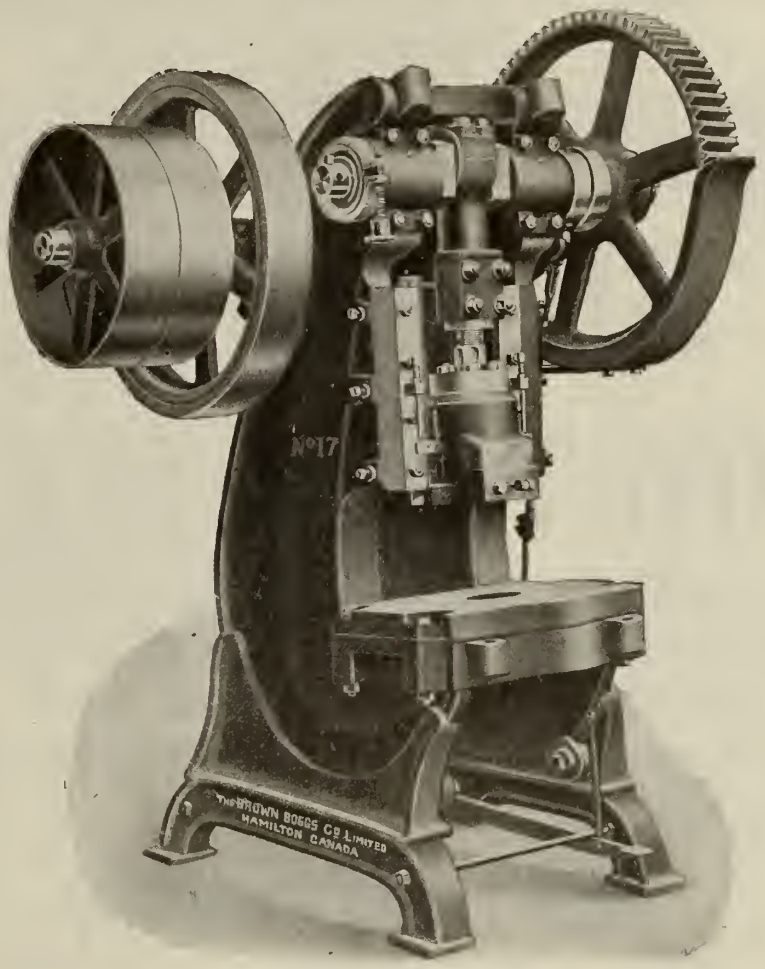

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Manufacturers of Sheet Metal Working Machinery, Presses, Shears, Rolls, etc.

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KE

BRANDS OF ALLOY & TOOL STEELS

In Billets, Bars, Sheets, Hot and Cold Rolled Strips, Cold Drawn Cast Steel, Wire and Drill Rods

HIGH GRADE STEEL FOR ALL PURPOSES

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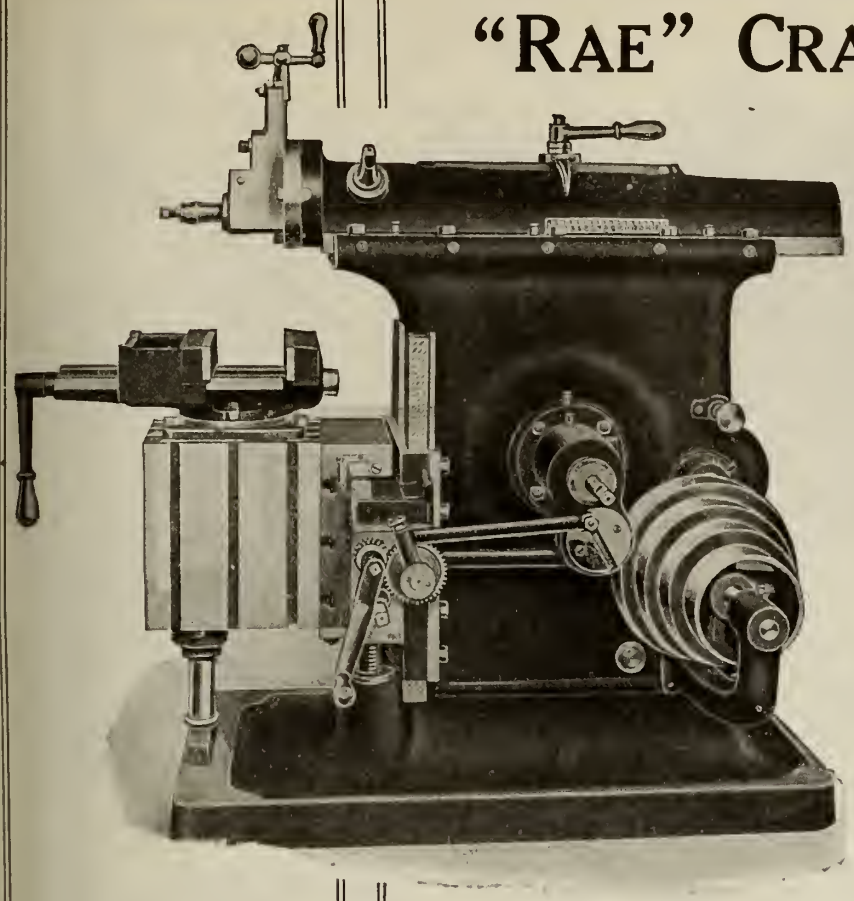

Where Accuracy is Most Important

THE design of Rae shapers embodies every necessary essential for obtaining maximum production with accuracy on all work.

The column is ribbed internally, providing absolute rigidity. The ram is also constructed to withstand heavy duty and can be adjusted to any position while machine is in motion.

There are other features we would like to tell you about. All you need do is write us. Complete information will reach you by return mail.

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LIMITED
Hamilton, Canada

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HIGH SPEED AND CARBON TOOL STEEL

MISCELLANEOUS SHOP TOOLS
MADE IN CANADA

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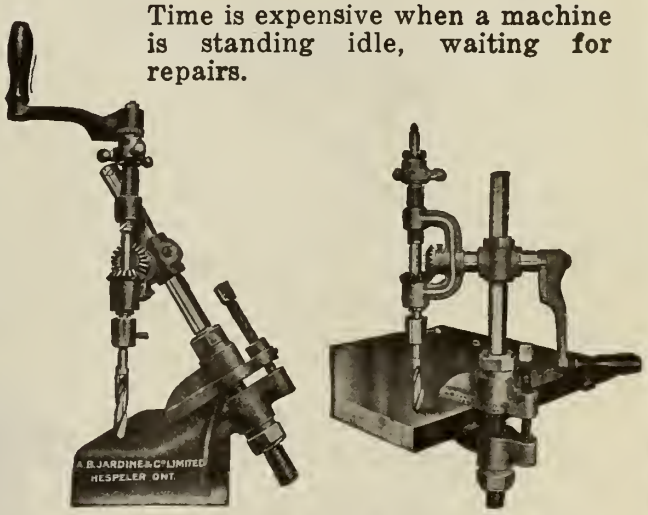
Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.



On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

Weight, 40 lbs. Price, $26.50 net.
Sold by all Machinery and Supply Houses

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HESPELER, ONTARIO

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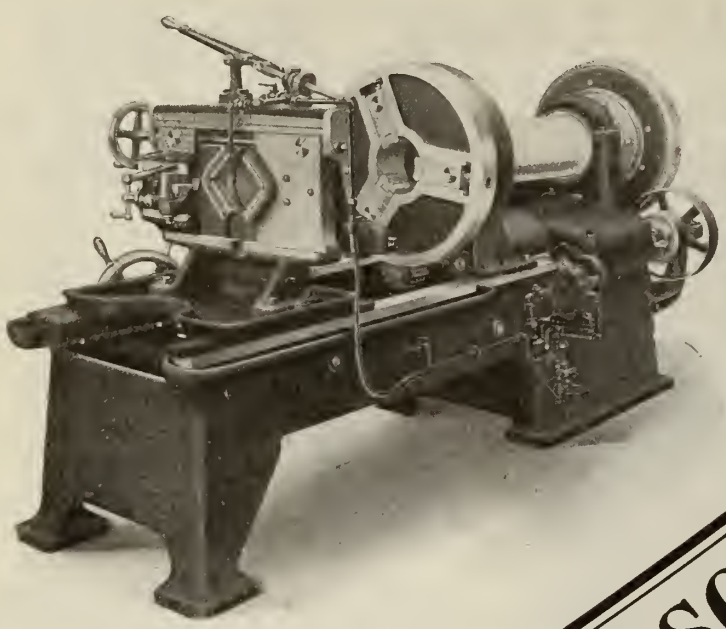

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Built to
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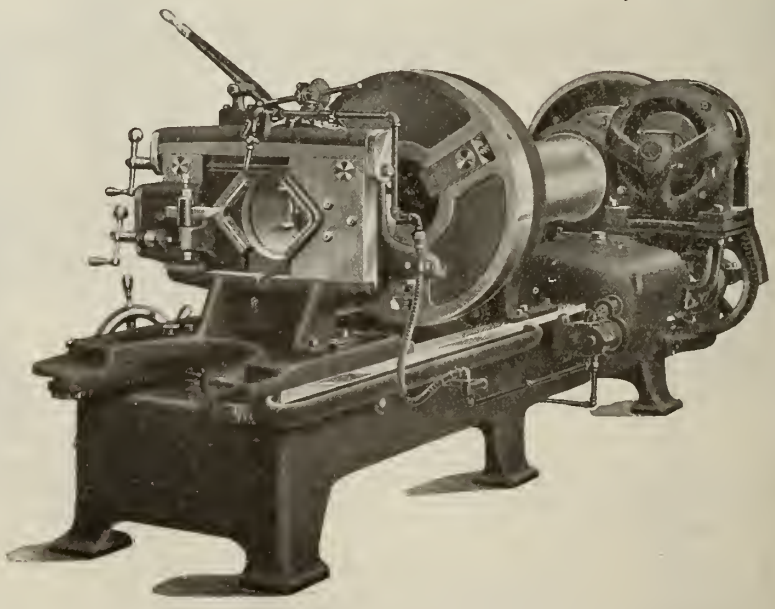

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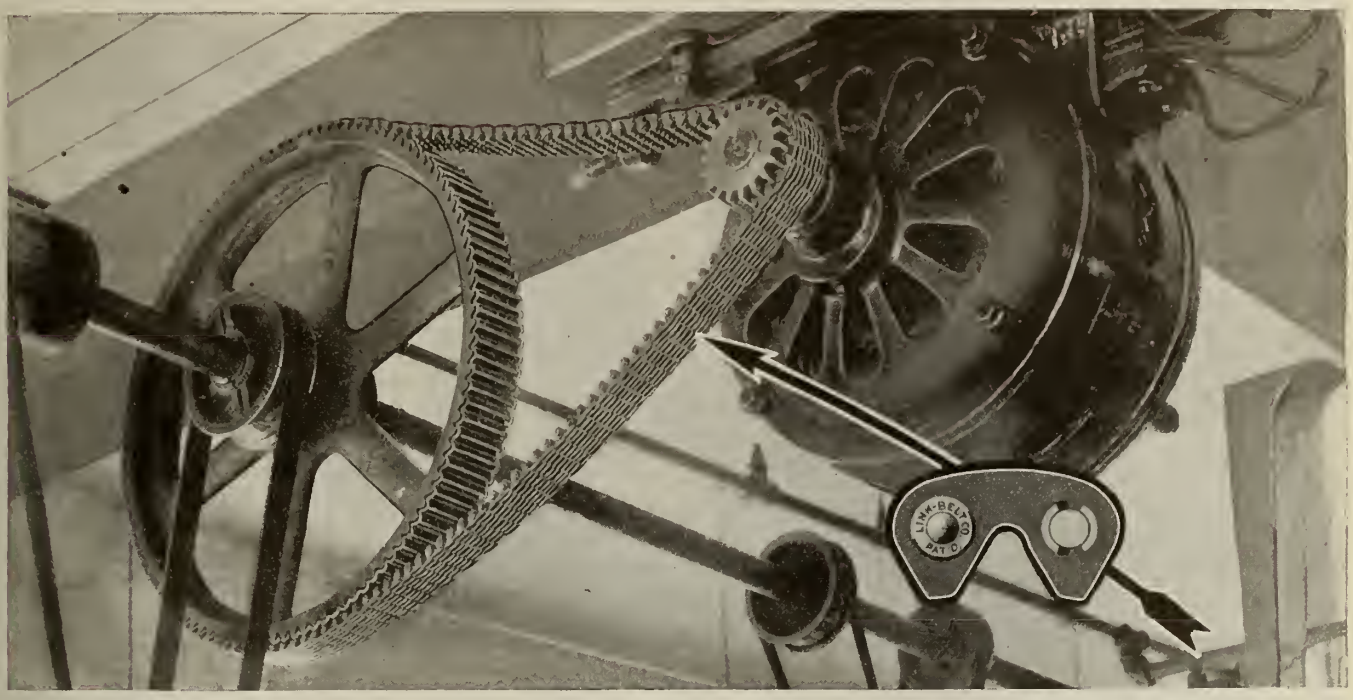

HERE is the EFFICIENT drive for lineshafts and machinery of every character—in every line of industry.

It is 98.2% efficient (on actual test). It is flexible as a belt—positive as a gear—more efficient than either. Made in various sizes to transmit power from ¼ H. P. to 1,000 H. P. and over. Thousands of successful installations testify to its unrivaled success.

Link-Belt Silent Chain is practically a flexible gear. It cannot slip. Tension is on the pulling side of the chain only; hence journal friction is much less than with belt drives. No power is lost due to bearing friction; 98.2% of the energy of the motor is transmitted to your shaft or machine to perform useful work. This means increased production.

The drive is not affected by atmospheric conditions, operating equally well in hot, cold or damp places; it permits economy of space because you are able to arrange for centers to suit the convenient location of your driving unit. It combines in one drive the best points of leather belts and cut gears, minus their disadvantages. You should use Link-Belt Silent Chain on all important drives in your plant.

Look at the illustration, think over these statements and then send for one of our experienced Power Transmission Engineers to study your conditions. He will explain the results of various tests which have proved the superiority of the Link-Belt Silent Chain Drive. This service we render without obligation.

Link-Belt Silent Chain is the EFFICIENT means of transmitting power, and we welcome the opportunity of proving it to you in your own plant, under your individual conditions. We sell each drive complete and guarantee its successful operation.

Send for 128-page Link-Belt Silent Chain Price List Data Book No. 125. It completely illustrates and describes the drive.

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SILENT CHAIN DRIVES

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Locomotive Cranes and Buckets

are used in all parts of the world. They make an excellent combination for handling bulk materials, such as coal, coke, stone, etc. Each is strongly built, as the users will tell you. And they will give continuous service, day and night, if necessary.

Bulk materials are easily handled

It is simply a question of selecting the type of equipment best suited to your particular needs. Brownhoist Locomotive Cranes equipped with the proper Brownhoist Bucket are giving excellent results in handling such bulk material as ore, limestone, coal, etc. And the Brownhoist Bucket does not have to be dropped on the material with pile-driver force to get its full bite. This means a big saving to the bucket and cars, and in the breakage of materials.

These are not the only advantages. The crane and bucket also save time, money and men. The firms who use the Brownhoist Crane have a decided advantage over those who have no Brownhoist. Can you afford to compete with such lowered production costs? Catalog K shows how many firms have solved their handling problems to great advantage. Write for it.

The Brown Hoisting Machinery Company

40 Years in Crane Business **CLEVELAND, OHIO, U.S.A.**

Engineers and Manufacturers of Heavy Dock Machinery Bridge Cranes, etc., as well as Smaller Cranes and Hoists.

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The operator is loading one fixture while the cutter operates on the other. No lost time due to Machine Idleness, therefore INCREASED PRODUCTION.

The finished work is never returned under the cutter, thus avoiding all marks or scratches on the milled surface.

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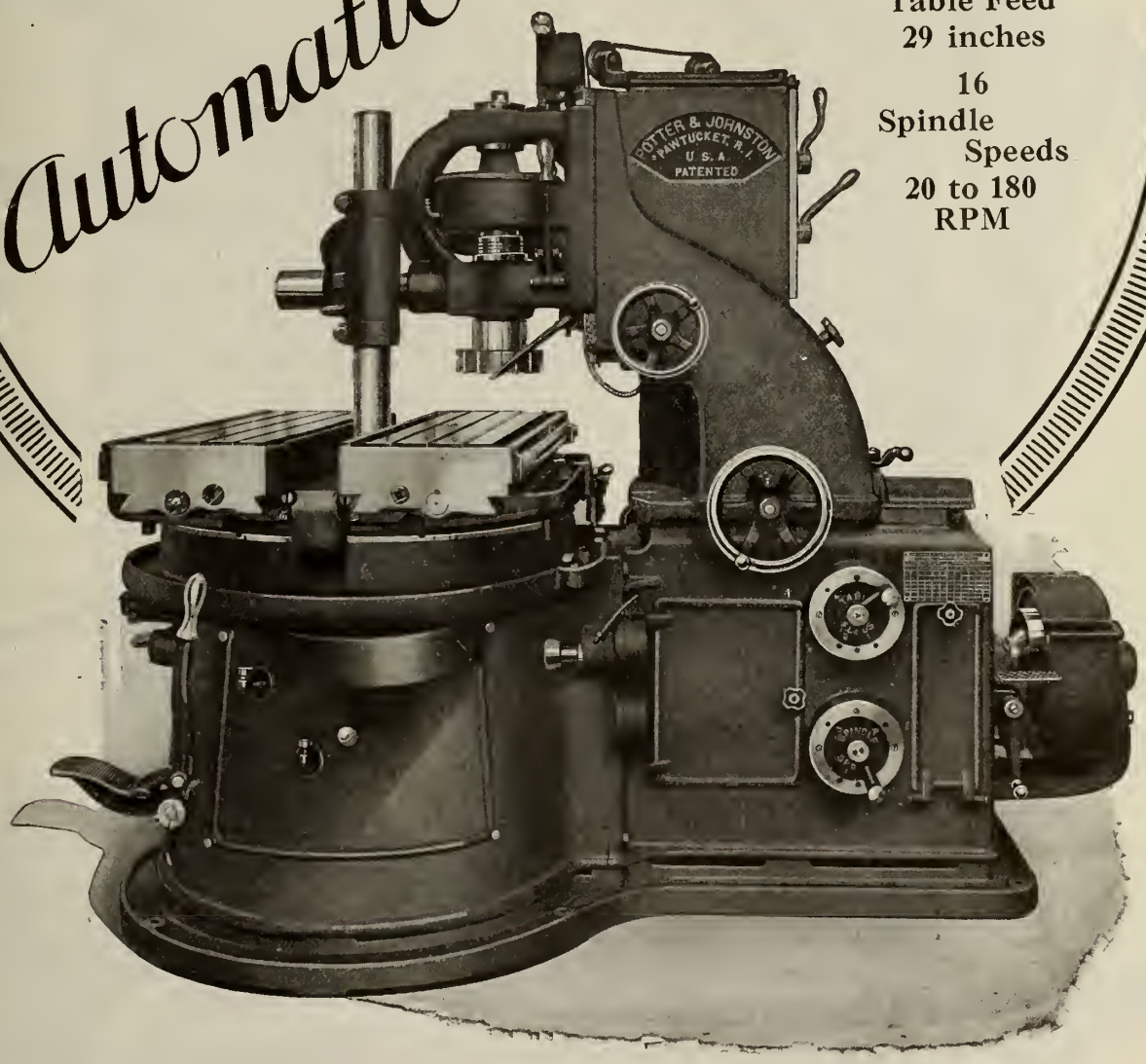
16 Table Feeds 7/8 to 12 5/16"

Length of Table Feed 29 inches

16 Spindle Speeds 20 to 180 RPM

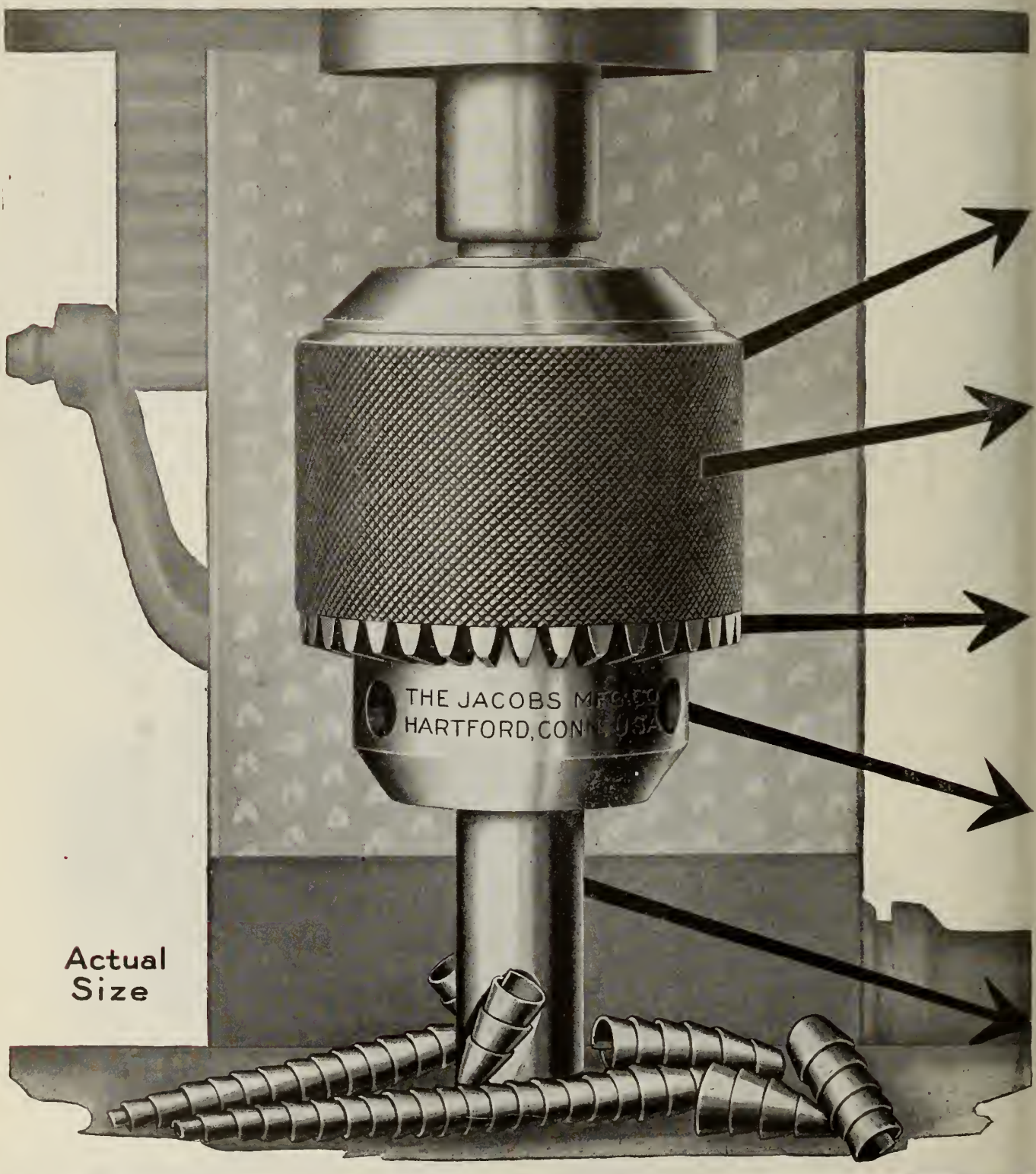


Canadian Office : POTTER & JOHNSTON MACHINE CO.

ROELOFSON MACHINE & TOOL CO., LIMITED

Head Office : 1501 Royal Bank Building, Toronto, Canada
Works and Warehouses: Galt, Canada

The JACOBS "Big Five"



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The JACOBS "Big Five"

Reason 1

Balance of weight is in the back of the chuck near the bearings of drilling machine, and being evenly distributed from center of chuck eliminates vibration on these bearings.

Reason 2

The shape and construction of the chuck permit the operator to see at all times exactly how and where he is drilling, and allow unusual ease of operation within narrow confines.

Reason 3

Regardless of size of drill used, the chuck is perfectly symmetrical. *This means safety in handling.* The three jaws grip the drill the full length of the jaws, giving a positive grip to prevent slippage of drills.

Reason 4

A simple and easy turn of the key which may be inserted in any of the three holes in the body, one of which is always in position, quickly changes the capacity, and tightens or loosens the grip on the drill.

Reason 5

Guaranteed to run true within 0.003", two inches distant from end of jaws when operated at maximum capacity. This means greater accuracy, in addition to the unusual ease of operation.

Distinctive Points of Superiority and Five Reasons Why

UP to one-half inch capacity, drills have been developed to run at great speed. Drill manufacturers have found it essential to adopt Jacobs Chucks on these high speed drills because of the absolute accuracy and balance required.

While the need of an accurate and well balanced chuck on drills of greater capacity is not so apparent, it is nevertheless just as important. Its use prevents vibration, with its constant wear and tear and breakage of drills.

The Jacobs Manufacturing Co.

Hartford, Conn., U. S. A.

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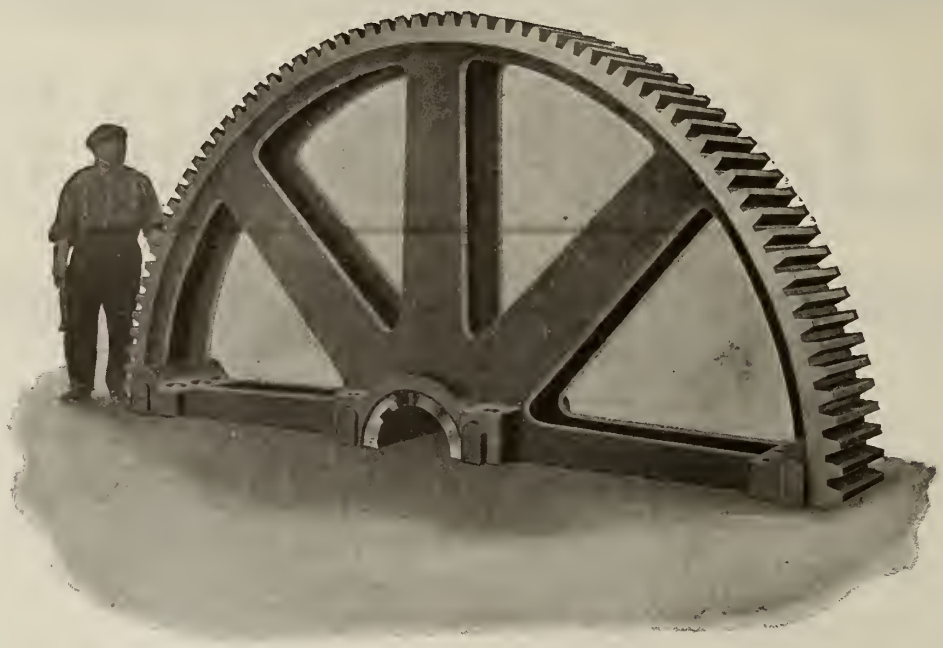
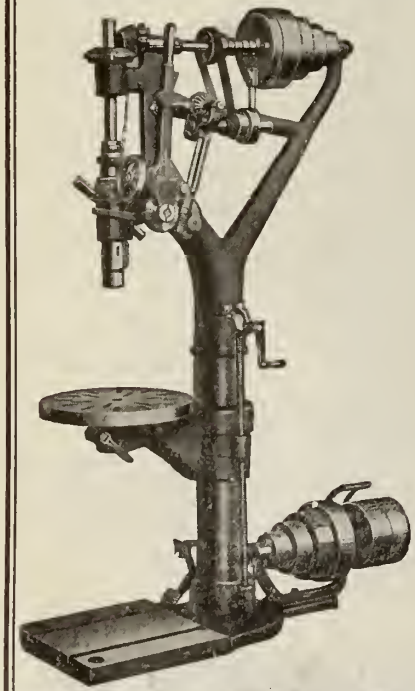


Fourteen Foot Diameter Half Section Cast-Steel Gear

DOMINION FOUNDRIES & STEEL, LIMITED

HAMILTON ONTARIO

Silver Drills



Simplicity, Convenience and Strength mark every feature

—and these factors are essential in a drill intended for economical work, for the speedy production of high grade parts where accuracy and finish are important. Silver Drills rigidly retain their accuracy under the heaviest and fastest work. The result is fewer rejects and broken tools.

—20-in. drills in four styles—plain lever feed, lever and wheel feed, power feed, automatic stop, back gearing. Singly, or in gangs of 2, 3 or 4.

—25-in. drills with eight spindle speeds and six positive geared feeds.

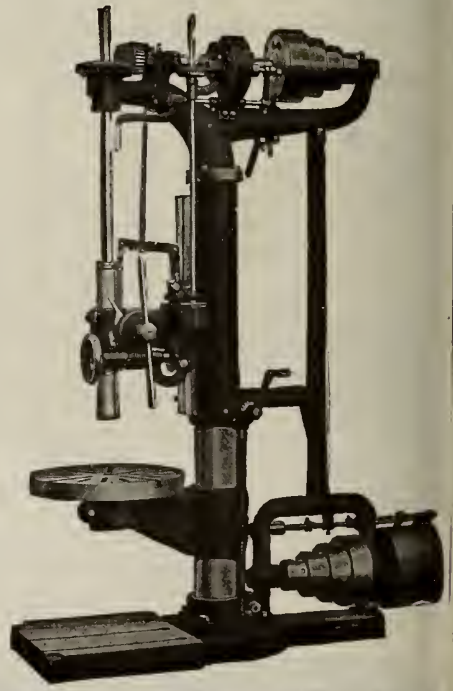
—Compact, Efficient, Economical.

New catalogue containing detailed information on request.

The Silver Mfg. Co.

290 Broadway, Salem, Ohio

Manufacturers also of the Silver Radials



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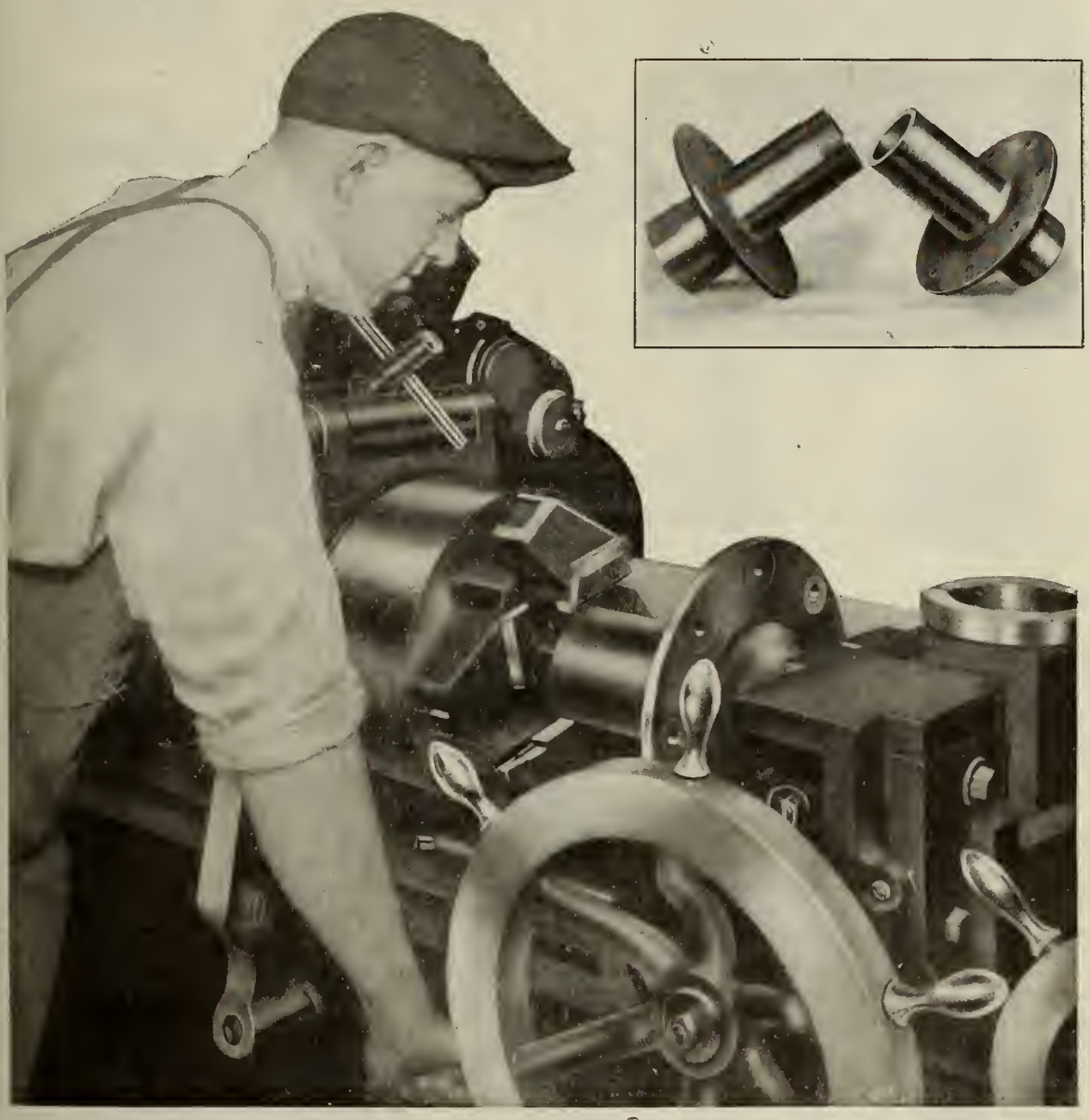
Threading Hubs for 5-ft. Wheels on a Landis

1 threads to the inch. Limits of accuracy are +.002. Finished size of hole 4⅞ in. Material is steel. This machine turns out 15 pieces an hour. The hubs are for go.. ernment gun carriages. A Landis was selected not only for its speed and economy, bt also because of its accuracy and versatility.



What are your Threading requirements? Our engineers will show you how a Landis can meet them. Catalogue 24?

LANDIS MACHINE COMPANY, INC.

Waynesboro, Pennsylvania, U. S. A.

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This Bank has 665 Branches, of which 570 are located in Canada from the Atlantic to the Pacific Coast. Write for a complete list of Branches and for terms respecting a Canadian account.

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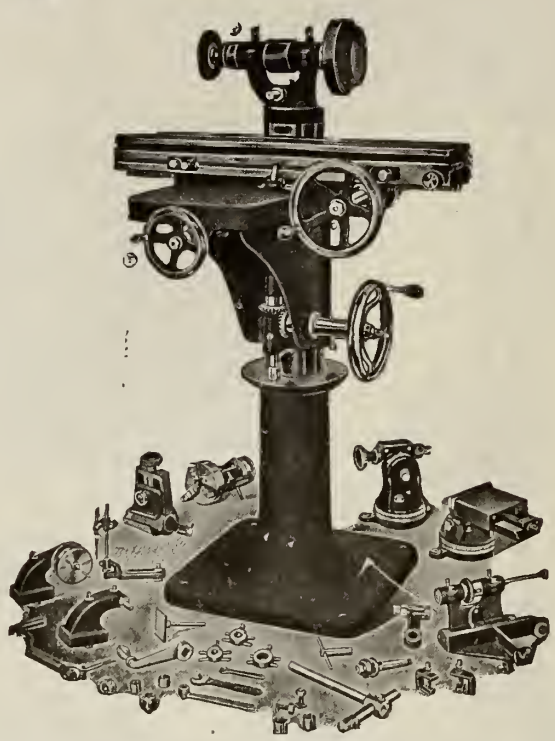
Greenfield



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The Greenfield is equipped with all attachments for the grinding of milling cutters, reamers, taps, lathe centres, etc., and capable of handling all this work with the accuracy and convenience essential in the modern tool room.

The Greenfield is a simple necessity in the tool room for routine grinding work, but has a versatility outside this line that is astonishing. It is truly universal and handles all varieties of cylindrical, internal and surface grinding within its capacity with a consistent accuracy and finish that adapts it to the making of intricate jigs and gauges.

Greenfield Machine Co.
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OILGAS FOR HEAT
INDUSTRIAL FURNACES FOR EVERY DUTY

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"Experts in Economical Combustion of Liquid Fuels"

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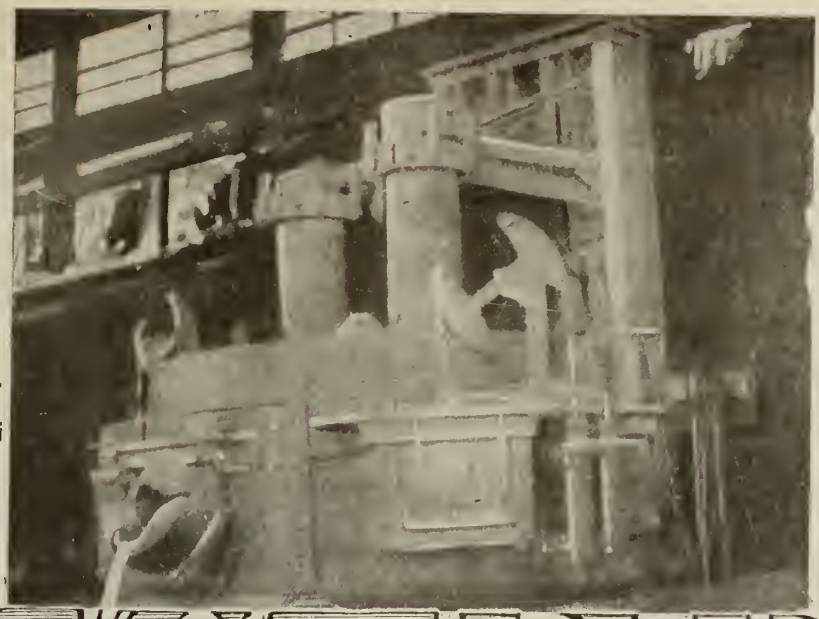
ALLOY STEEL GRAY IRON

High grade steel castings of every description. Send us your drawings for estimates.

Our motto is quality and quick service.

Canada Electric Castings Co., Limited, Orillia, Ontario



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High Speed Steel

SEVERAL factors combine to make this high-speed steel a triumph of the steel-maker's art; Electric Furnaces — entirely infallible, automatically regulated, delivering the same result time after time.

Uranium — This rare element, cousin to Radium, effects a profound change in the texture and quality of the steel.

Added to these, the constant care and skill of years of steel-making experience make the result of each melt a foregone conclusion.

Latrobe Electric Steel Co.

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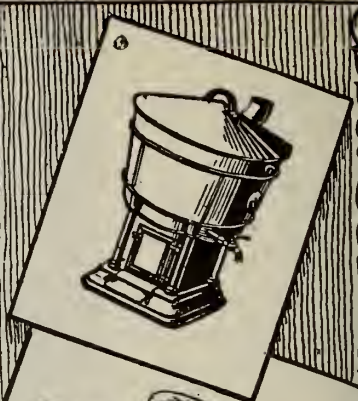
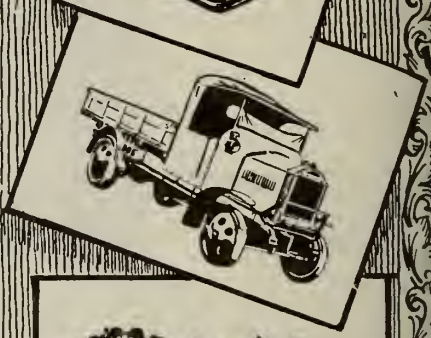
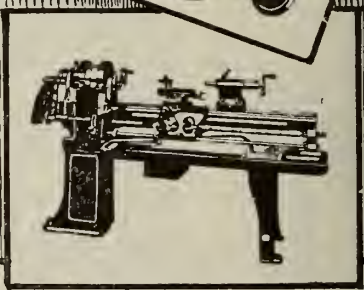
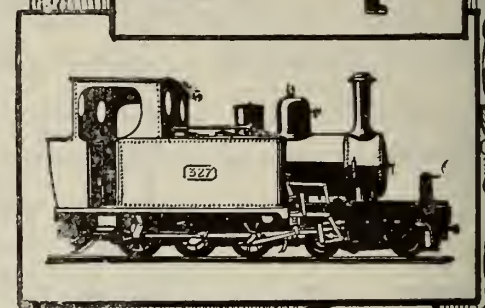
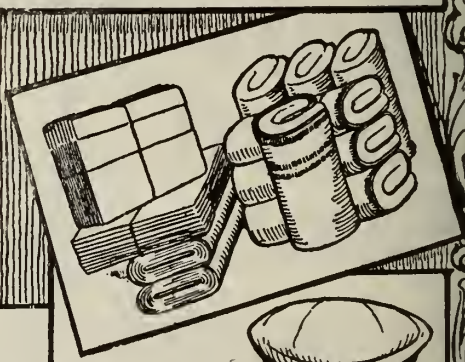

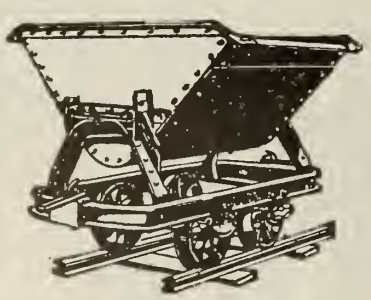
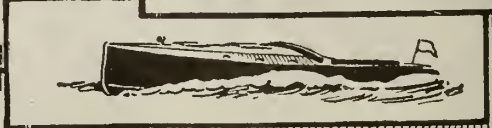

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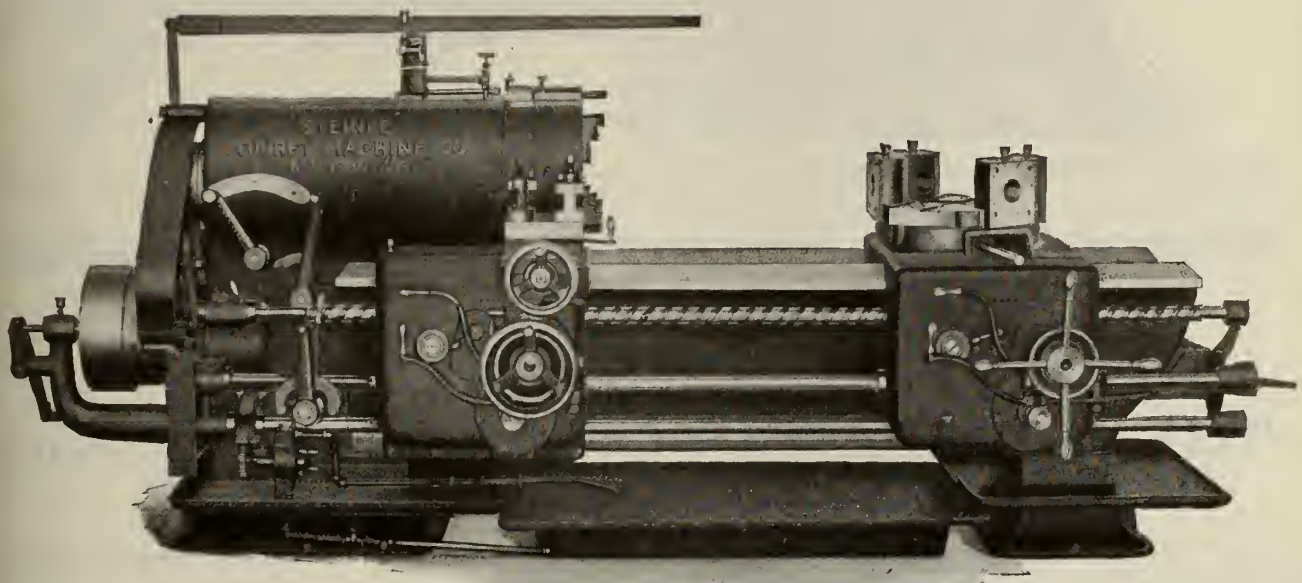
Full Swing Side Carriage Turret Lathe



"Potential Production"

"Potential Production—production which is possible, but not actual."

This would be Webster's explanation of the phrase, but applied to your own particular case it means: Are you obtaining the greatest production possible from your present machines? Are you using equipment which permits you to reach that actual peak of output which is so necessary for profitable operation?

The Steinle Heavy Duty Full Swing Side Carriage Turret Lathe is essentially a manufacturing machine especially designed for the rapid, accurate, and economical duplication of machine parts.

The STEINLE lathes are widely and satisfactorily used by many leading manufacturers where rapid production, accurate work and economical operation are leading factors in their original selection and subsequent additions to equipment.

Why not send us your blue prints and let our engineering department determine what can be done on your own work?

Steinle Turret Machine Company

Madison, Wis., U. S. A.

AGENTS: Machine Tool Engineering Company, Singer Building, New York; Cadillac Tool Company, Dodge Power Building, Detroit, Michigan; L. G. Henes, 75 Fremont Street, San Francisco, California; and Title Insurance Building, Los Angeles, California. FOREIGN: Leo. C. Steinle, 53 Victoria Street, London, England.

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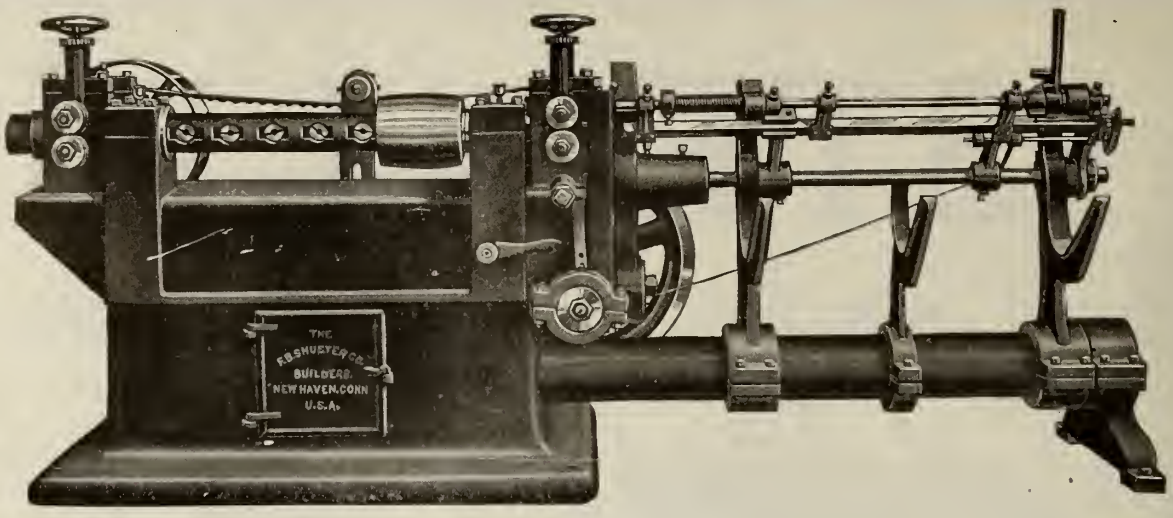

Perfect Wire Straightening Quickly and Profitably Done on Our

Automatic Wire Straightening and Cutting Machine

Just put your coil of wire on the reel, adjust the rolls and dies, and set the gauge for the length you want. The machine does the rest—thousands of feet per day, perfectly straight and cut to accurate lengths.

Catalogue tells more about them, and we will be glad to send you a copy.

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FORMERLY JOHN ADT & SON ESTABLISHED 1886

ALSO MAKERS OF STRAIGHTENERS FOR SQUARES, HEXAGONS, FLATS, ETC.

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Save Tap Breakage

The *smooth drive* reduces the strain on the taps—they wear longer—and there are fewer delays from taps breaking in the work.

R-S Tappers ensure faster tapping and quicker assembling.

Friction drive, absorbing all the shock, allows a chuck speed of 140 r.p.m. on ⅝-in. work—50 per cent. faster than the usual tapping speed for that size. Uses but 1 h.p.

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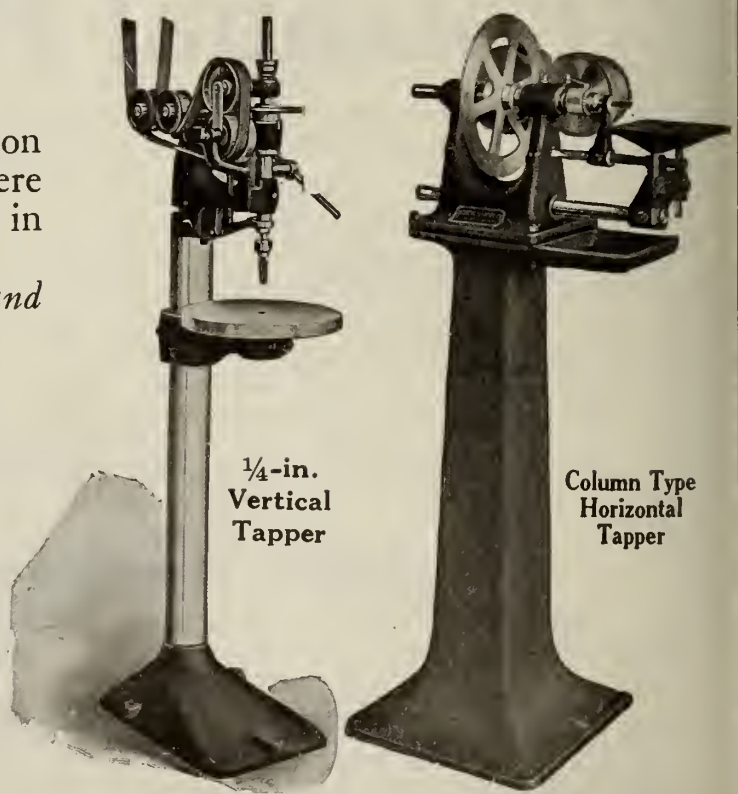

¼-in. Vertical Tapper

Column Type Horizontal Tapper

The Rickert-Shafer Co.

ERIE, PA., U.S.A.

FRED HERBERT, Foreign Agent, Coventry, England.

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STELLITE

Not a steel---but its master

Stellite will increase your output without increasing your expenses or investments—figure it out—this increase would be all profit Would it not? A small per cent of increase in output would therefor increase your profits by a very large per cent.

Stellite high speed tools can be operated at a much greater speed and can take a heavier cut than high speed steel tools, consequently a great increase in production is attained.

We will send a demonstrator on request.

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Branch Warehouses:

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74 Corporation St., Birmingham, Eng.
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THE MASTER METAL ◎ THE MASTER METAL

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LIMITED

Works: · Summerfield St., Sheffield

Telephones: London City 2660. Sheffield - 712. 710. Code ABC 5th. Edition

LONDON OFFICE: Suffolk House, 5, Laurence Pountney Hill, London, E.C. 4.

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DORMER BRAND

High-class Drills with IRRESISTIBLE PIERCING FUNCTIONS that stand the WEAR and TEAR — in other words, the DRILLS that are EFFICIENT and ECONOMICAL — are the DRILLS with the "DORMER" Brand.

We are manufacturing SPECIALISTS—Carry large STOCKS — Give PROMPT deliveries, and rely upon our products for REPEATS.

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SPEEDICUT High Speed Steel
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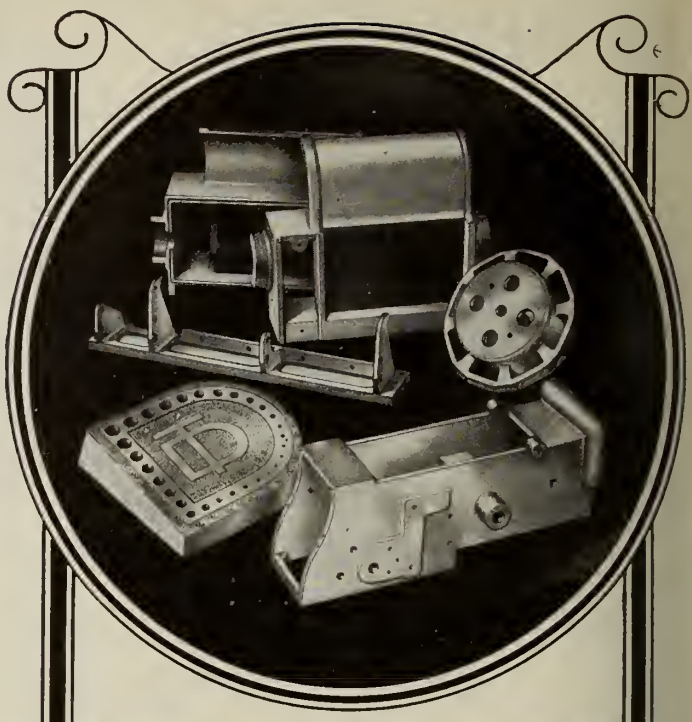


FRANKLIN DIE-CASTINGS

Their Place in the Development of Industry

Since 1892, the development of many fields of industry has been hastened by the use of Franklin Die Castings.

The elimination of numerous and and extensive machine processes with their resulting waste of material, and a further speeding up or increase of production, are all made possible by the Franklin Die-Casting process. Moreover, Franklin Die-Castings have made commercially practical many devices whose parts would have been too expensive to machine.

For nearly thirty years we have helped manufacturers save time, labor and equipment through the correct application of Die-Castings.

THE FRANKLIN-DIE CASTING CORPORATION
Gifford and Magnolia Street, SYRACUSE, N.Y.

We cast in Aluminum, Tin, Lead, and Zinc base alloys. Estimates made from samples, drawings or blueprints.

It Cuts

That's the Secret of the Efficiency of Aloxite Cloth

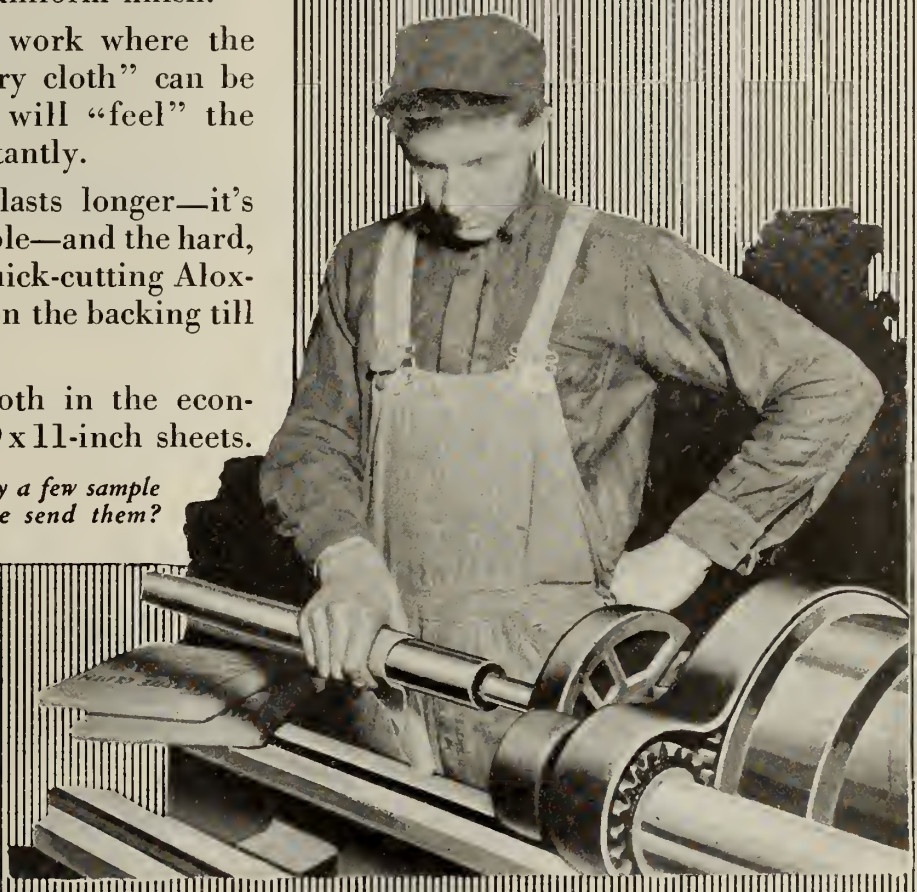
IT isn't a case of slow, time-killing rubbing when you are using Aloxite Cloth, because it cuts clean and fast, always leaving a smooth, uniform finish.

Use it on any work where the ordinary "emery cloth" can be used and you will "feel" the difference—instantly.

Aloxite Cloth lasts longer—it's extremely flexible—and the hard, sharp, tough, quick-cutting Aloxite grains stay on the backing till worn off.

Get Aloxite Cloth in the economy rolls—or 9 x 11-inch sheets.

Will you try a few sample sheets if we send them?



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The Cloth that cuts

The Carborundum Company, Niagara Falls, New York

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Detroit Pittsburgh Grand Rapids Milwaukee

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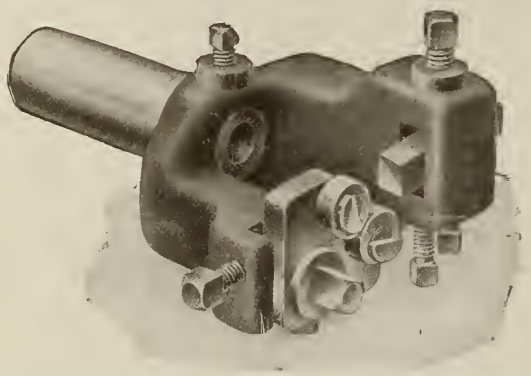
TOOLS & HOLDERS



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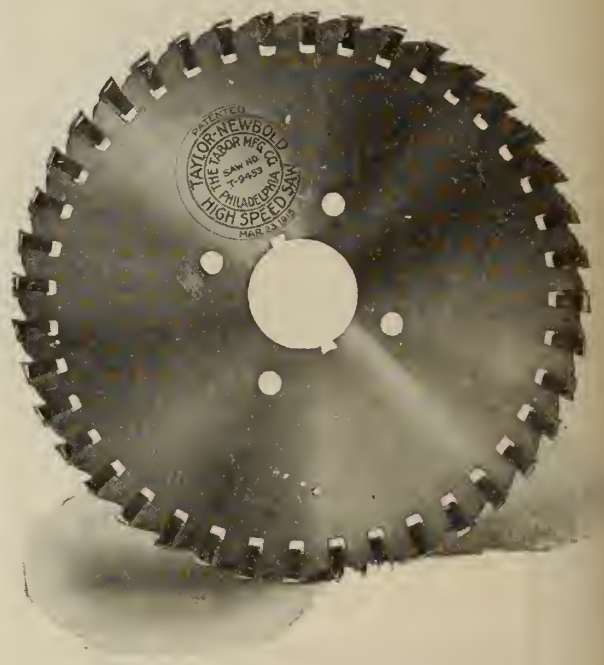

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WRITE FOR BULLETIN T-S
Tabor Mfg. Co., Philadelphia, Pa., U.S.A.

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Do Your Castings Cost Too Much?

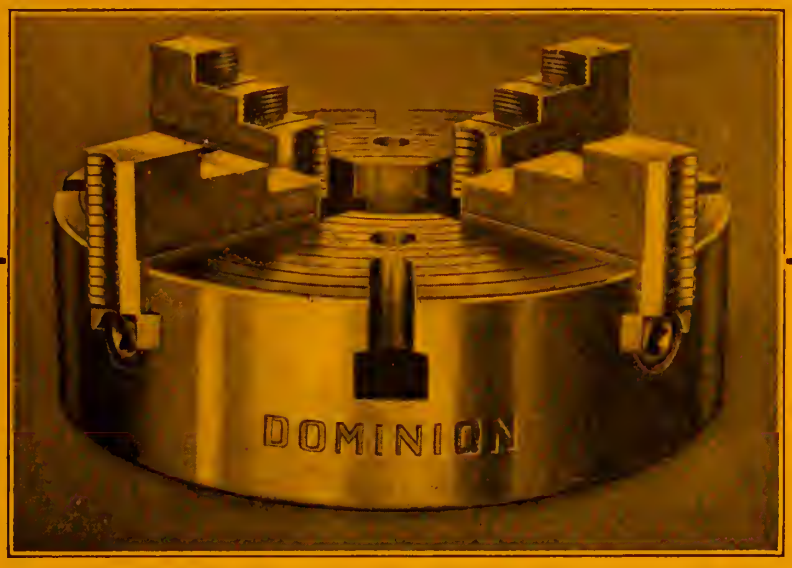
A rearrangement of your patterns might cut their cost 25%; a different method of molding them might double your production at no increase in molding cost. *We can advise you* and we have expert metal and wood patternmakers who are able to make any changes that may commend themselves to you.

If you need some new Patterns send us a sample, blueprint or sketch, and ask for our advice. It won't cost you anything. If our advice is good and commends itself to you, it is only fair to assume that our work will be equally satisfactory, and we need the work as badly as you need the patterns.

We are in a position to do turning, boring, drilling or other semi-finishing operations on castings supplied by us.

ASK US

DOMINION CHUCKS



Especially Adapted for Severe and Heavy Duty Work

BODY—The body is of heavy cross section and so designed to give broad and deep bearings for the jaws.

JAWS—The jaws are drop forgings, heat treated. The jaw is so designed that the threaded portion makes 180° contact with the screw.

SCREWS—The screws are large in diameter, broached at both ends and are reversible.

Dominion Chucks can be furnished in crucible steel or cast iron bodies

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Engineers and Manufacturers

Brantford, Ontario

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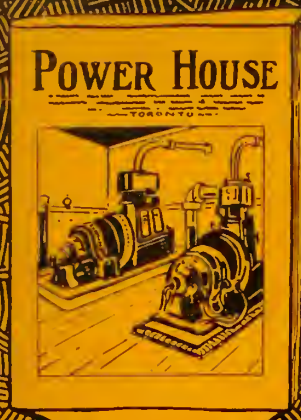

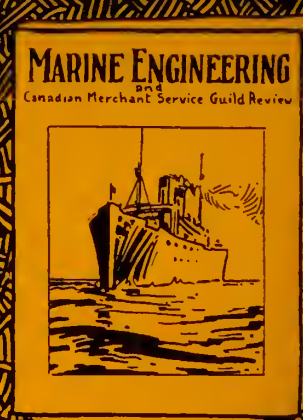

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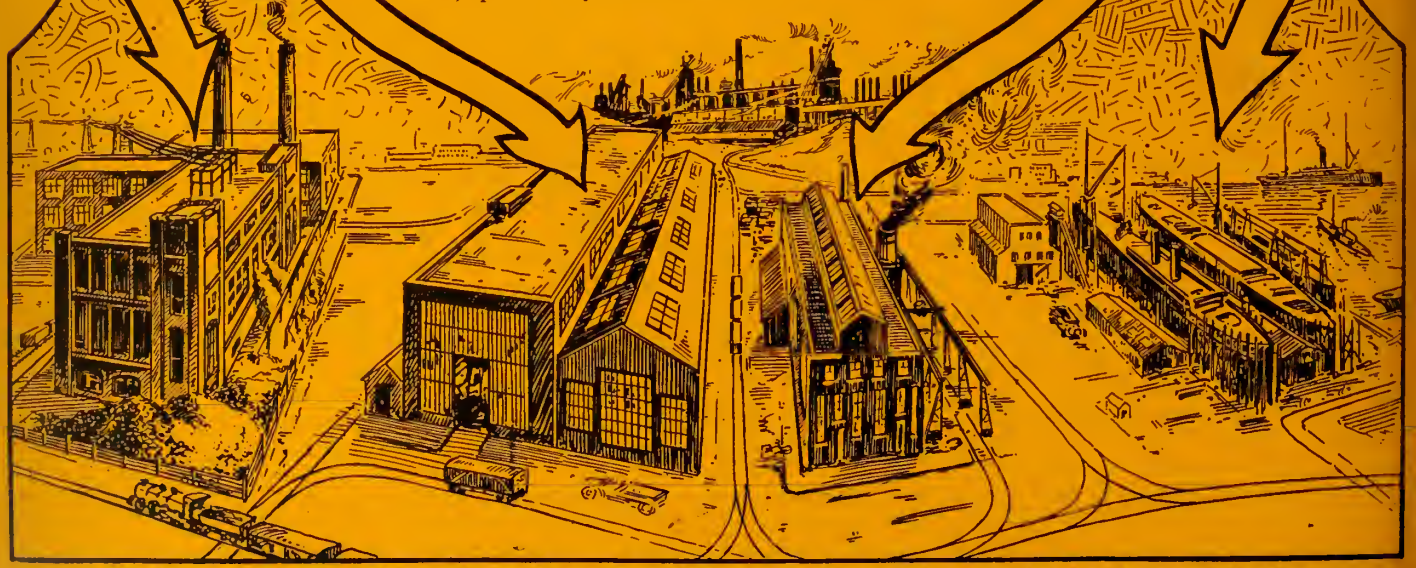

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USE ARMSTRONG TOOL HOLDERS

No heavy "stub-ends" to throw away. No time lost with men at the grinder while lathes stand idle. No stock of heavy sizes of steel to carry, and the blacksmith as a tool-dresser is eliminated entirely.

Armstrong Tools are great favorites with the men— a good thing to consider from a production standpoint.

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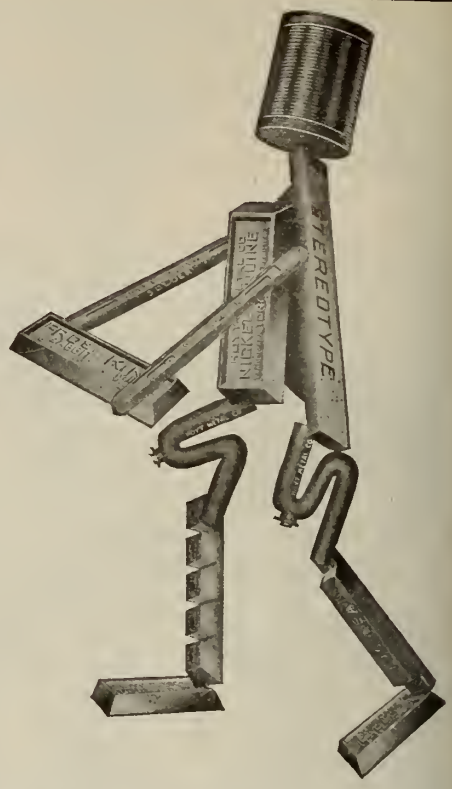
will withstand heavy pressure without increasing its temperature

For general machinery bearings it is without a peer.

If you are from Missouri try a sample lot and be convinced.



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Sizes—½ lb. to 5,000 lbs. each

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OWEN SOUND, ONTARIO.
ESTABLISHED 1860

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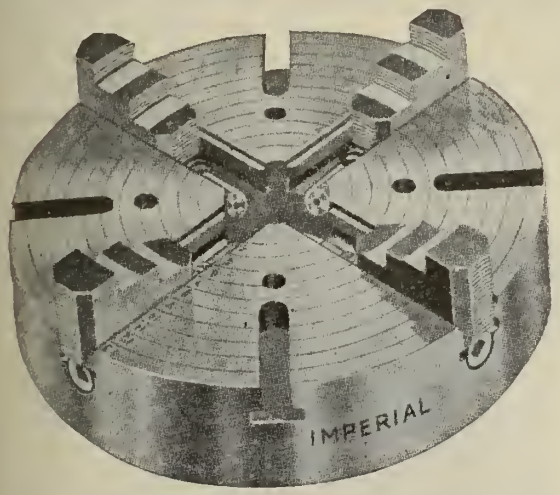
Highly Endorsed by Canada's Best Manufacturers

Study long-wearing "Made-in-Canada" Chucks that are making good everywhere.

Specify them in your next order.



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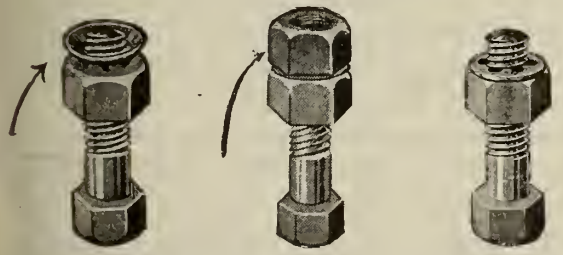
HOLD TITE NUT LOCK

See How Easily Applied



Knowing the size Bolt—use same size Nut Lock. Place over Bolt—as shown above.

Screw another Nut onto Nut Lock and Depress it — as shown above.

Remove Second Nut and Nut Lock will Look — as shown above.

The Hold Tite Nut Lock cannot come loose when it is compressed into the thread of the Bolt. Compressing will not destroy the thread.

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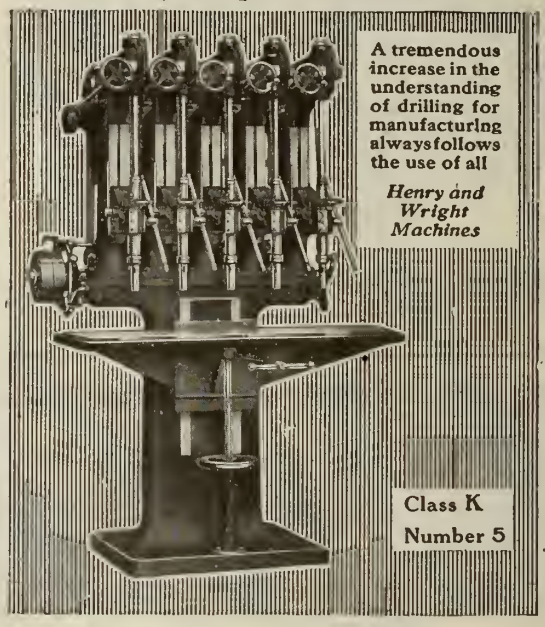
A tremendous increase in the understanding of drilling for manufacturing always follows the use of all
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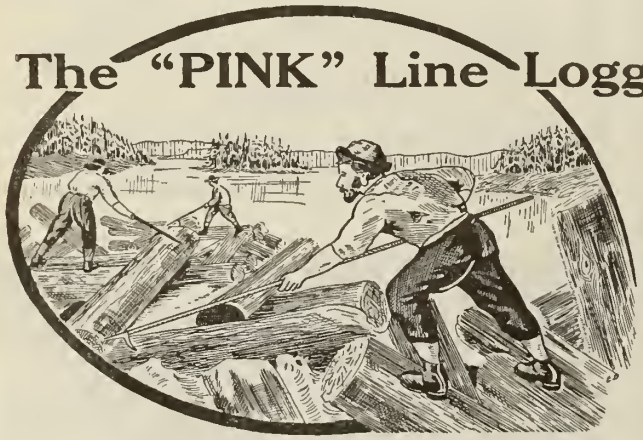

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In every lumber camp in Canada you'll find PINK'S famous lumbering tools. They are the favorites there and have won the esteem of all woodsmen through their superior merit. They are world-renowned and are extensively used in Australia, New Zealand and other countries where the lumbering industry thrives.

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We export the same good quality of lumbering tools that have made PINK'S TOOLS a by-word in the matter of good tools in all Canadian lumber camps. Enquiries cordially solicited.

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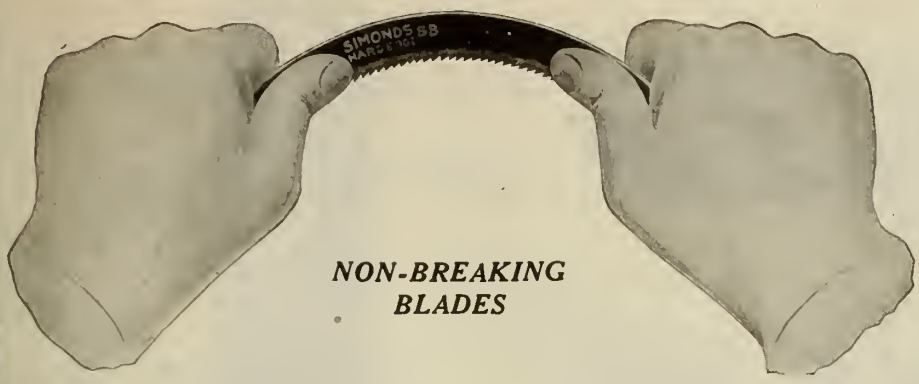

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CUT CUTTING COST

For Machine or Hand Use
Any Size or Length

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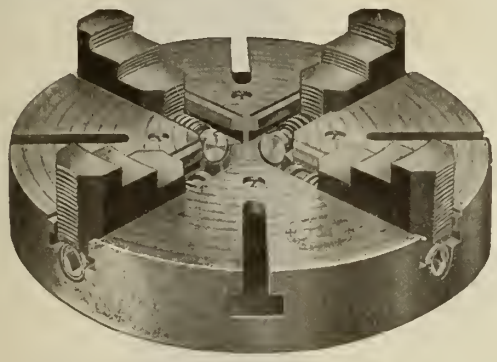
are not an experiment—they have come to stay. They are a necessity with the modern machinery and high-speed steel cutting tools.



THE UNION STEEL BODY CHUCKS

are well designed and have all the elements of strength and durability for which they are designed. We make other types in steel also, including the Geared Scroll Chucks and the Geared Scroll Combination—all designed for heavy work and hard usage.

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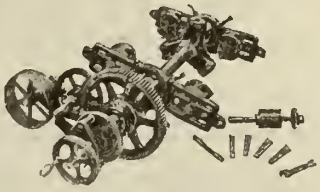
Makers of a complete line of chucks



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This bar, which is regularly made in any size, with cutter heads to bore diameters of various sizes, is similar to our other standard portable bars.

Fixtures are furnished to rebore, the cylinders when both heads are removed or with the guide head remaining in place. The equipment is complete with tools, wrenches and pulley, ready for installation when unpacked from the boxes.

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The Range of Size is Wide—

But the Range of Utility is Wider.

From Tubular Retorts Weighing 2500 Pounds

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Nichrome gives Thousands of Hours of Service at 1800 degrees Fahrenheit.

Manufactured Under Henderson Patents

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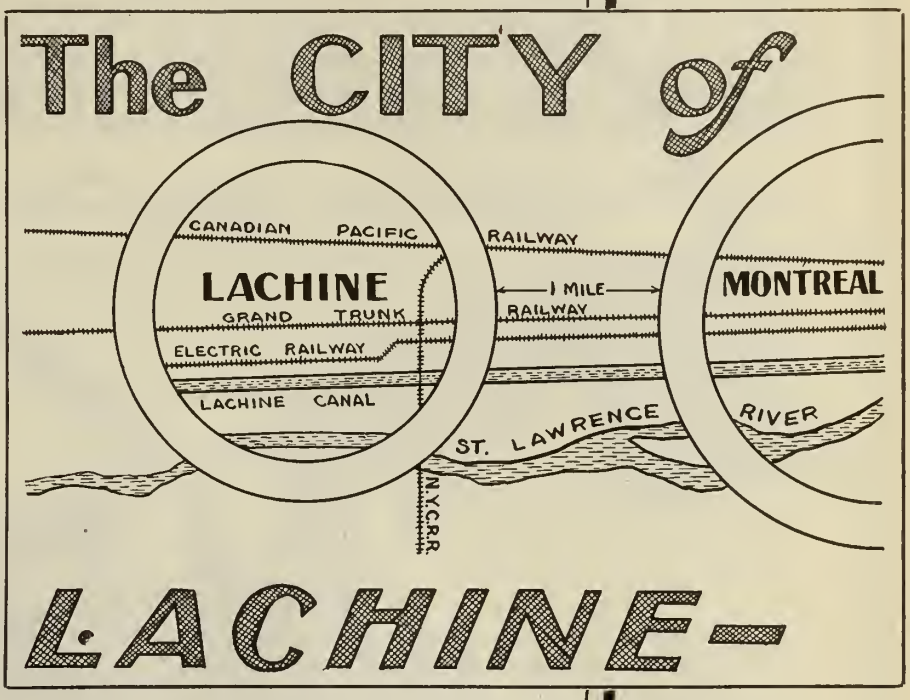
The finest industrial opportunity in Canada

The manufacturer located in Lachine possesses all of the advantages of Montreal with none of its disadvantages. He has its excellent shipping facilities, its financial houses and banking accommodations, its market of three-quarters of a million people, its cheap electric power, and its large supply of labor in all degrees of skill. He reaps the benefits of cheap land, both industrial and residential, and a satisfactory absence of labor troubles and discontent.



Que.

His commanding position on the trunk lines of the C.P.R. and the G.T.R., the St. Lawrence River, and the Lachine Canal ensures low freight rates and a first-class transportation service. He is in an excellent location to serve the important markets of Canada and the United States, and has fine opportunities for ocean trade with any part of the world.

The manufacturer is surrounded by economic conditions that mean a steady gain in prosperity, that allow him to produce at the lowest cost and meet competition successfully.

On several occasions a large firm has chosen Lachine as the most suitable location for its factory. It now contains some of the most important engineering establishments in Canada.

For full information write

E. Leduc, Sec.-Treas., City of Lachine

Investigate Lachine. There are a number of industrial sites available that possess excellent water and rail facilities. There are certain to be advantages in Lachine peculiarly adapted to your industry. Ask about them. The most detailed information given cheerfully on request.

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Gear Cutting With the "IFS" Left Out

The Gear Shaper Way

A production manufacturer knows that he will secure good gears IF he has an accurate cutter, an accurate machine and a machine working on the correct principle. The whole question of good gears is resolved in this one little word "IF."

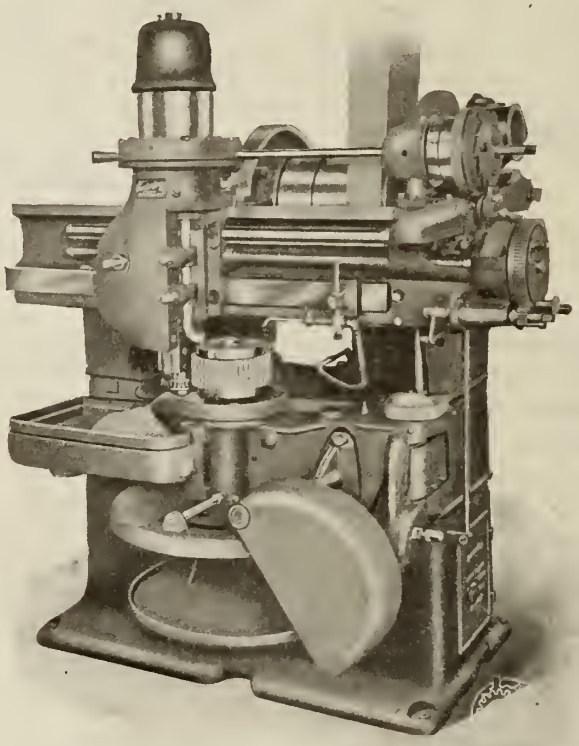
When the Gear Shaper was originally designed, the question of "IF" was taken into consideration and every possible means known to mechanical engineering was employed to eliminate the "IFS" from gear cutting.

That we have been successful in solving the problem is evidenced by the fact that each ensuing year sees a larger number of manufacturers adopting the Gear Shaper method.

How the Gear Shaper has accomplished this is clearly explained in our general catalog "Commercial Gear Cutting," which is a treatise on the subject of:—

Gear Cutting with the "IFS" Left Out.

Send for your copy to-day.



The Fellows Gear Shaper—the machine which has taken the "IFS" out of gear cutting

The Fellows Gear Shaper Company

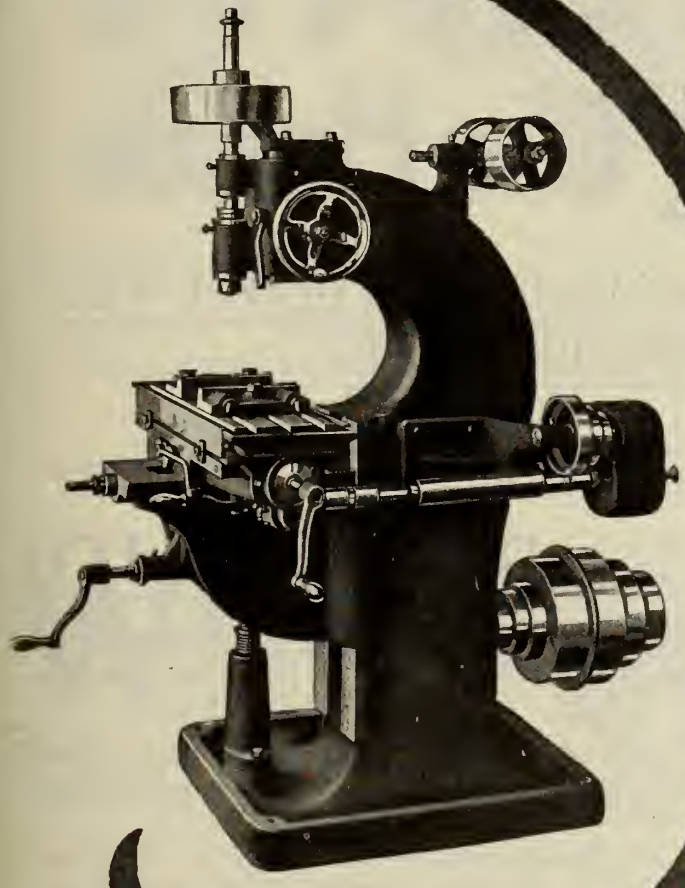
Springfield, Vermont, U.S.A.

FOREIGN AGENTS:—Alfred Herbert, Limited, Coventry, England; Société Anonyme Alfred Herbert, Paris, France; Societa Anonima Italiana Alfred Herbert, Milan, Italy; Alfred Herbert, Limited, Yokohama, Japan; Societe Anonyme Alfred Herbert, Barcelona, Spain; Societe Anonyme Belge Alfred Herbert, Brussels, Belgium; Alfred Herbert, Limited, Calcutta, India.

BRISTOOL

Bristol Vertical Milling Machine

A Tool of Large Capacity



Ball Bearings are used at the most important points making it a free running tool, which, combined with its being a belt-driven machine, makes it capable of turning out work on which an extra smooth finish is desired.

The longitudinal table feed is controlled by the gear change box which gives six different feeds for each change of spindle speed. A stop to gauge with micrometer adjustment is used on the head to regulate the depth of cuts.

Learn all about its production capacity.

Write for bulletin giving fullest particulars.

BRISTOL MACHINE TOOL CO.
SUCCESSORS TO C. G. GARRIGUS MACH. CO.
BRISTOL, CONN.

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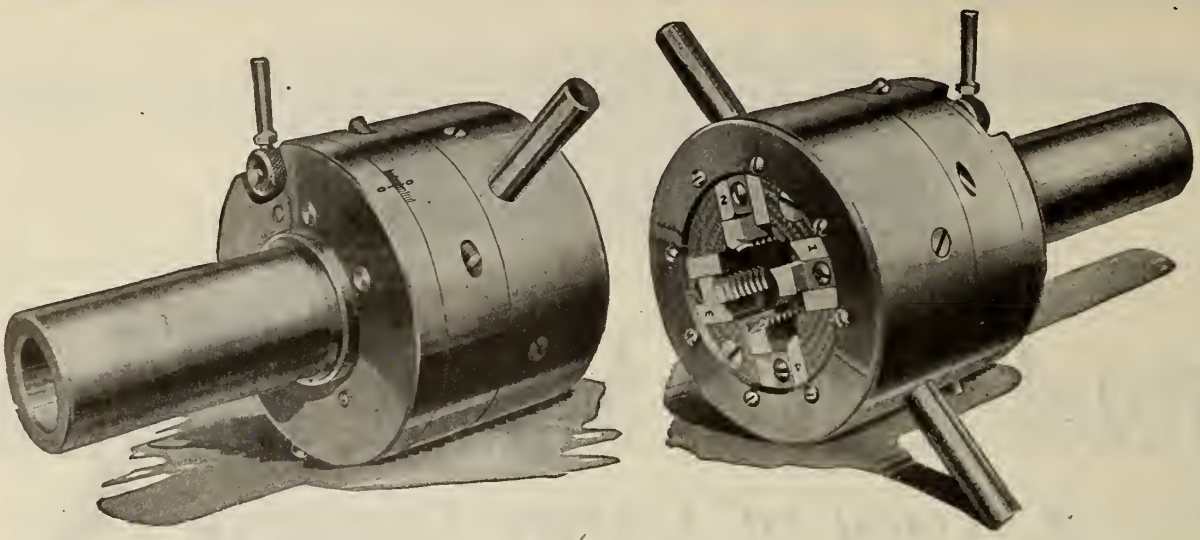

MODERN
Self-Opening Die Heads

THROUGH FEWER "SPOILS" AND INCREASED OUTPUT WILL LOWER YOUR THREADING COSTS

Modern Self-Opening Die Heads, made in 17 sizes, are noted for the two big things requisite to economy and efficiency:—

ACCURACY :: DEPENDABILITY

Chasers are held in position through proper support. That's a distinctive element of Modern design. They can't change position during work, and do not touch threads after cutting.

Other "Modern" Tools

Universal Grinders
Plain Grinders
Chaser Grinders
Internal Grinders
"Magic" Chucks
Collapsible Taps
Tapping Attachments

There are no complex adjustments, no fragile parts to get out of order. Moderns stay on the job and do their work continuously with unequalled accuracy.

The 17 sizes have a threading range 1/16 in. to 7 in., each size having capacity for a wide range of diameters which may be cut in a single head.

Send for complete Technical Bulletin.

MODERN TOOL CO., ERIE, PA.
Main Office and Works: State and Peach Streets

Canadian Agents:
RUDEL-BELNAP MACHINERY CO., LTD., Toronto and Montreal

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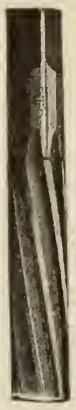

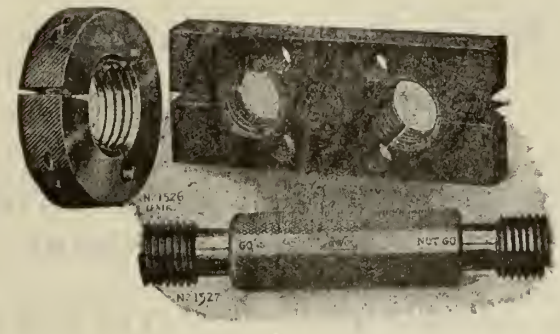

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SCREW PLATES
UNEXCELLED FOR REPAIR WORK

TAPS
LONG-WEARING --- EASY CUTTING

REAMERS
FOR ALL PURPOSES

GAGES
THREAD LIMIT---PLUG and TEMPLET
FINEST ACCURACY and FINISH

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Canadian Plant of the Greenfield Tap & Die Corp.

CANADA

World's Largest Manufacturers of Screw Cutting Tools.

Fill in the Coupon or instruct your Stenographer to write us

WELLS BROS. OF CANADA, GALT, ONTARIO

I am interested in the following Tools. Please send me information on

SMALL TOOLS ☐
PIPE TOOLS - ☐
GAGES - - - ☐

Name..... Position.....
Firm .....
Address.....

C.M. 1004

If interested tear out this page and place with letters to be answered

DOMINION BRIDGE COMPANY LIMITED

MONTREAL, QUE.

STRUCTURAL STEEL

FOR

Bridges Buildings Tank Work

Transmission Towers Penstocks

ALSO

Electric Hand Power Travelling Cranes

Steam Turbines

Main Office and Works: LACHINE, QUE.

Phone - Westmount 6800

BRANCH PLANTS: TORONTO OTTAWA WINNIPEG

DOMINION ENGINEERING AND MACHINERY COMPANY, LIMITED

MONTREAL - QUE.

Pulp and Paper Making Machinery

Fourdrinier and Cylinder Paper Machines

Pulp Drying Machines

Barking Drums, Sulphite, Sulphate, Paper, Screens,

Granite Rolls, Millspaugh Patent Suction Couch and Press Rolls

WORKS: LACHINE, QUE. PHONE WESTMOUNT 6800

Let's Use the Right Name

The name "Screw Machine" is no longer appropriate when applied to the modern Turret Lathe. It is seldom used for making screws — (automatics serve the purpose better for large quantities). Its field of work is as universal now as that of the engine lathe. Where bar work was almost the only product ten years ago, chucking work is now in the majority. Then, too, the modern Turret Lathe has in its design and construction, characteristics and power to handle tough forgings and alloy steel parts, that would be superfluous for making screws.

A natural reluctance to change a trade name so long used may be wise for a time, but we think the mechanical world prefers to call a machine by the name acquired by its evolution into a wider field, and not by the name of the limited field it occupied years ago.

The Screw Machine of yesterday is a Turret Lathe to-day. Let all users and manufacturers join with us in dropping the old term "Screw Machine" when applied to Turret Lathes.

The Warner & Swasey line consists of the

No. 2—A Universal Hollow Hexagon Turret Lathe
(Bar Capacity—2½" x 29" or 3¼" x 29"—12" Chuck Capacity.)

No. 3—A Universal Hollow Hexagon Turret Lathe
(Bar Capacity—3½" x 44" or 4½" x 44"——16" Chuck Capacity.)

No. 4—Universal Turret Lathe
(Capacity 1½" x 10"—16" Swing.)

Nos. 1 (⅝" x 4") — 2 (1" x 6") — 4 (1½" x 8") Plain Turret Lathes

Nos. 2 (1" x 6") — 4 (1½" x 8") — 6 (2¼" x 12") Geared Friction Turret Lathes

Brass Turret Lathes **Brass Working Machine Tools**

The Warner & Swasey Company
CLEVELAND, OHIO, U.S.A.

New York Office, Singer Bldg. **Boston Office, Oliver Bldg.** **Buffalo Office, Iroquois Bldg.**
Detroit Office, Ford Bldg. **Chicago Office and Show Room, 618-622 Washington Bouvd.**

CANADIAN AGENTS:
A. R. Williams Machinery Company, Ltd., Toronto, Winnipeg, Vancouver, St. John's.
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Charles Churchill & Company, Ltd., London, Birmingham, Manchester, Bristol, Newcastle-on-Tyne, Glasgow.
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McLeod & Company, Calcutta.
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Brossard-Mopin & Company, Saigon, Singapore, Haiphong.

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Robertson Process Metal

It Stops Depreciation

Most of the tumble down factory buildings you see are made of unprotected metal—metal that has quickly depreciated. *You can stop this depreciation on your factory buildings.*

You can replace this *worn out metal* with Robertson Process Metal—a three-time protected metal (a) asphalt (b) asbestos (c) waterproofing. New buildings can be built entirely of this good building material. It is made in corrugated sheets for roofs and siding in flat sheets and shapes for trim, downspouts and gutters.

Look at the sample below. We want you to see and feel a piece of this material. We have samples like that shown all ready for mailing—Let us send you a sample with descriptive literature showing many well known plants built of Robertson Process Metal.

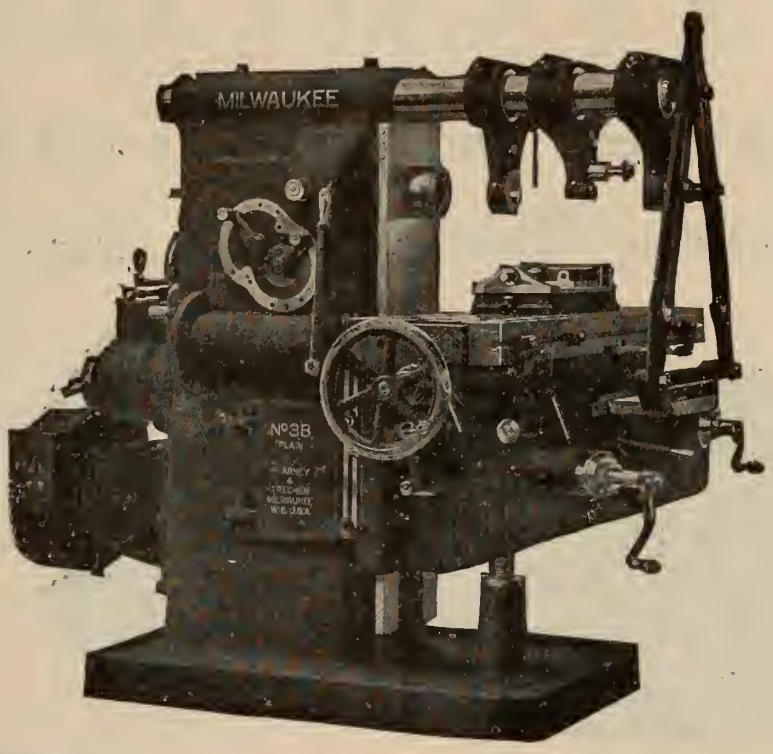
H. H. ROBERTSON COMPANY, Limited
Sarnia, Ontario
Branch Offices: Toronto, Montreal, Vancouver

ROBERTSON PROCESS

TRADE MARK REG U S PAT OFF

METAL FOR ROOFING AND SIDING

Milwaukee Milling Machines



For

Maximum Production

The rigidity and reserve power of Milwaukee Milling Machines permit high speeds and deep cuts without impairing the accuracy of the work.

These sturdy machines are quickly set up and easily operated. They are economical on light or heavy milling.

Maximum Accuracy

Constant speed drive, hardened steel gears and shafts, automatic flooded lubrication, double overarm, solid top knee with extended slide, flanged spindle, reverse self-contained, cutter lubricating pump that operates only when spindle revolves—these are the features that make Milwaukee Milling Machines profitable producers.

Catalog No. 21 sent on request.

KEARNEY & TRECKER CO. MILWAUKEE, WIS. U.S.A.

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BUTTERFIELD

High Speed and Carbon Twist Drills
Reamers, Milling Cutters, Dies Taps

Butterfield Tools Are Shipped Around the World

Specify "Butterfield"

thus you

Specify Quality

Butterfield tools have stood the supreme test of world competition where only tools of extra quality survive.

Highly skilled Canadian workers give of their best to the fashioning of Butterfield tools. Efficient, strong, durable, they give long and satisfactory service.

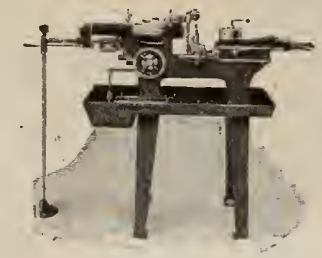
"Specify *Butterfield* — thus you specify *Quality*."

Butterfield & Co., Division

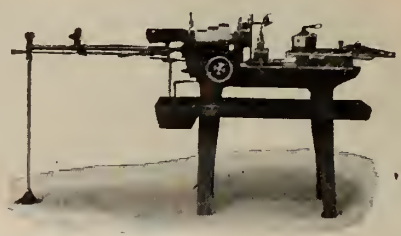
Union Twist Drill Co.

Rock Island Que.

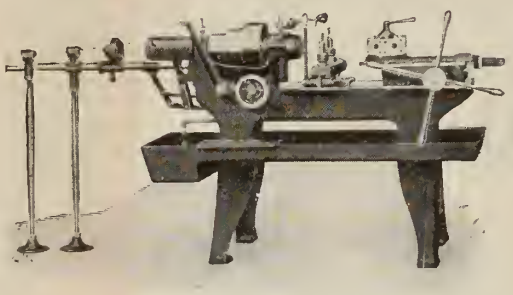
Toronto Office—220 King St., W.



No. 0. P.H. Screw Machine.

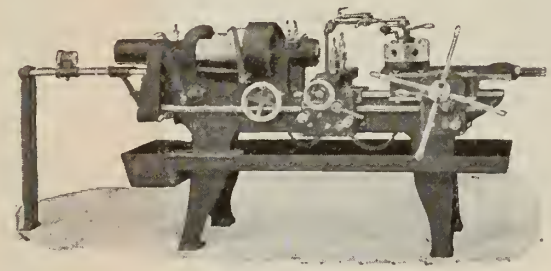


No. 1. P.H. Screw Machine.

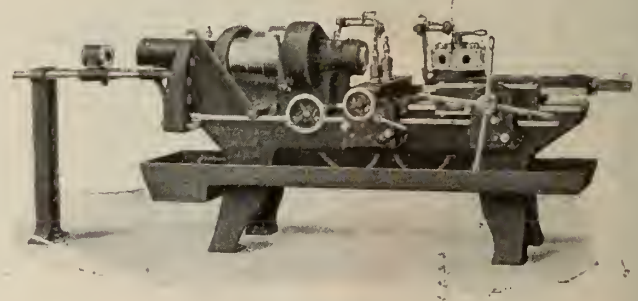


No. 3. P.H. Screw Machine.

No. 3. F.H. Screw Machine.



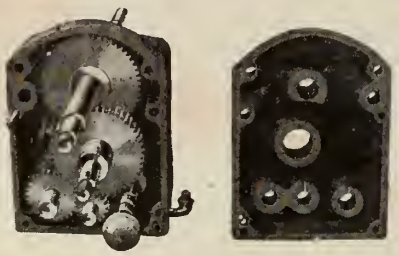
No. 7. F.H. Screw Machine.



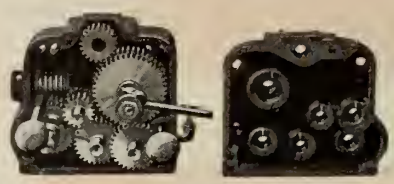
No. 5. F.H. Screw Machine.

DESIGN OF POWER FEEDS

The Fifth of a Series of Advertisements Describing the Foster New Line of Hand Screw Machines



Saddle Apron.



Cross Slide Apron.

More than any one other single feature of a Screw Machine the number of feed changes and the range of feeds obtainable must be considered from the aspect of cost of production. A great amount of loss of potential production has been and is to-day caused screw machine users because designers in the past have not realized the full importance of a wide and well balanced range of feeds.

No lengthy discussion of the subject is necessary to realize this. Just suppose that the correct feed on a certain job is 50, but that the nearest your machine will give is 70. The cutting time in this case is 40% longer than it should be. What is then the loss in dollars and cents per year?

Six feed changes are obtainable as well for the power feed cut-off as the turret slide in the Foster new line of Hand Screw Machines.

Carbonized and heat treated sliding gears are employed as a mechanism for obtaining the various feed changes. These are located in the aprons close to the operator's natural position. No time lost by having to reach for an out of the way place in order to change the feed. This also affects production favorably.

The power feed is instantly engaged by means of a powerful friction. No time lost here by having to wait for the engagement of a drop-out worm and worm gear.

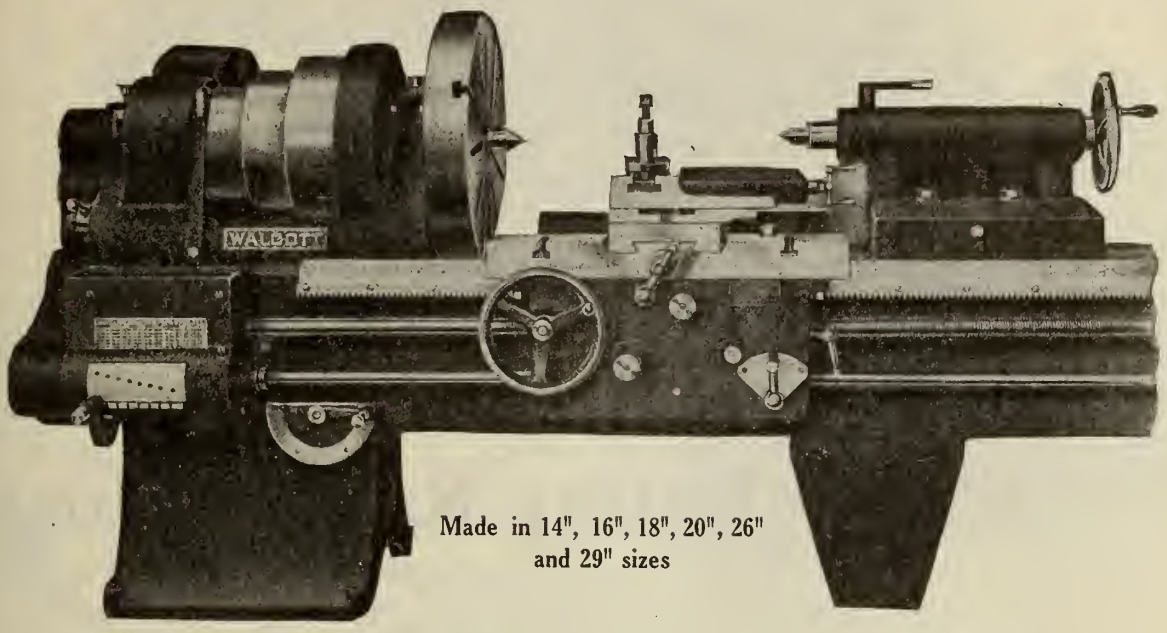
The six independent stops mounted in the turret slide stand in working connection with the drop-out lever, and by means of a simple mechanism disengages the power feed automatically at any predetermined point.

The power gears in the aprons are submerged in a bath of oil. The lubrication throughout has been given a thorough study.

HAVE YOU WRITTEN FOR OUR NEW SCREW MACHINE CIRCULARS YET? IF NOT DO SO TO-DAY.

FOSTER MACHINE CO., ELKHART, IND.

WALCOTT



Made in 14", 16", 18", 20", 26" and 29" sizes

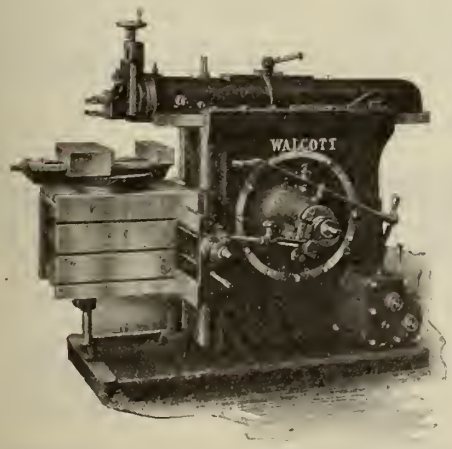
A machine that answers the most rigid requirements

Thirty-nine years of progressive lathe building experience is represented in Walcott Engine Lathes. They are standard equipment throughout and are designed in sizes to meet the requirements of the best practice so that the highest production can be secured.

The fact that Walcott Lathes are in use in practically every country throughout the world proves that they are capable of doing all that we claim for them.

It will pay you to investigate the possibilities of Walcott Lathes in your shop. We will fit them up with taper attachment, relieving attachment draw-in chuck and collets, turrets, pan and pump as you may desire. Write to-day for full details.

Walcott Crank Shapers



The simplicity of design, strength of construction, quality of material and finish of these Shapers appeal to every practical machinist.

Walcott Shapers are known for the **quality** and **quantity** of the work they turn out—continuous service and high standard of accuracy proves "Walcott" leadership. Investigate this machine before you buy your next shaper.

Catalogue on Request

WALCOTT LATHE CO.

115 Calhoun St., Jackson, Mich.

Canadian Agents: The Canadian Fairbanks-Morse Co., Ltd., Montreal, Toronto, Ottawa, St. John, N.B., Winnipeg, Calgary, Saskatoon, Vancouver, Victoria, Quebec, Que.

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FORESIGHT
in selecting Rubber Hose

"Performance" is the buying guide men of foresight depend on. Most buyers of rubber hose know from experience the dependability of Dominion Rubber System Hose in living up to every claim made for it.

We meet the demands of modern industrials by specializing in making over fifty types of hose to meet every condition, simple or exacting as it may be.

DOMINION RUBBER SYSTEM HOSE For Every Industrial Use

are made in various types, for liquids, oils, gas, acids, steam, suction and other uses, at all practical pressures and temperatures.

With our comprehensive catalogue before you, it is an easy matter to specify the particular hose for any requirement. It pictures and describes the complete Dominion Rubber System line, and gives service conditions for which each type is designed. It also features couplings, nozzles and reels.

For catalogue or information, write our nearest service branch.

"Everything in Rubber"

CANADIAN CONSOLIDATED RUBBER CO. LIMITED
DOMINION RUBBER SYSTEM
AND ASSOCIATED COMPANIES

DOMINION RUBBER SYSTEM

Service Branches

Halifax	Toronto	Fort William	Edmonton
St. John	Hamilton	Winnipeg	Calgary
Quebec	London	Brandon	Lethbridge
Montreal	Kitchener	Regina	Vancouver
Ottawa	North Bay	Saskatoon	Victoria

95

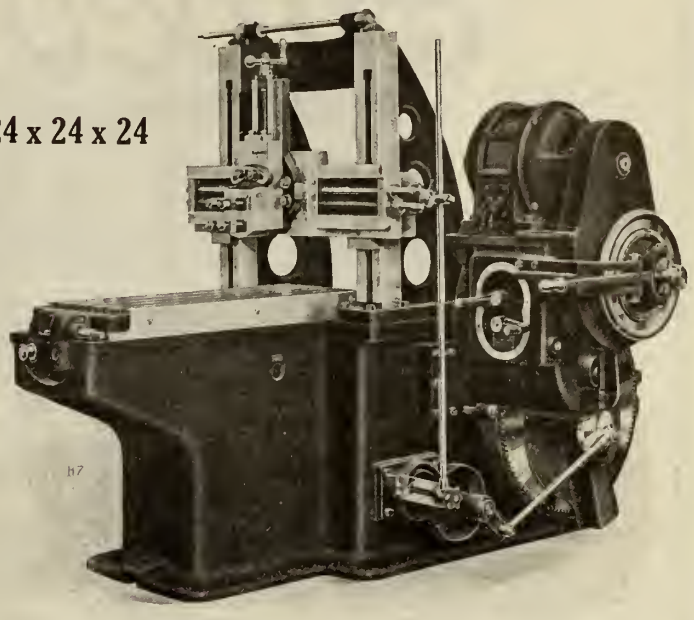
If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

H. W. PETRIE LIMITED
TORONTO

Canada's Dependable Machinery and Supply House

The CINCINNATI CRANK PLANER

24 x 24 x 24



THERE are several advantages in making us your headquarters for all your machinery and supplies. **First**, we always carry an immense stock and can always fill your requirements and make prompt shipments. **Second**, by consistently ordering from us we get to know each other thoroughly and thus better "team work" naturally results.

Our service is unequalled—it represents a half-century of success in catering to the requirements of Canadian manufacturers. Get the **Petrie** habit when ordering!

Sold in Canada by H. W. Petrie, Limited

We have the exclusive selling rights in Canada for many of the foremost machine tools. The Cincinnati Crank Planer is one of them.

This Crank Planer is a form of Planer having a positive stroke actuated by a crank and connecting rod, thus combining all the strength and rigidity of a Planer with Shaper speed. It will plane accurately to a line and feed the maximum amount on a one inch stroke, making it particularly adaptable for work where obstacles prevent through planing. The Crank Planer is also used to advantage for short planing in railroad shops and for such work as drop forging dies where planing to a line is necessary.

There are other features you should know about—write to Petrie for full information.

Firms We Represent Exclusively :

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cincinnati Bickford Tool Company, Cincinnati, Ohio.
The Lodge & Shipley Machine Tool Co., Cincinnati, Ohio.
The Cincinnati Shaper Co., Cincinnati, Ohio.
The Cincinnati Gear Cutter & Machine Co., Cincinnati, Ohio.
The Cincinnati Grinder Co., Cincinnati, Ohio.
The G. A. Gray Company, Cincinnati, Ohio.
The Colburn Machine Tool Co., Franklin, Pa.
The National Machinery Co., Tiffin, Ohio.
The Rivett Lathe & Grinder Co., Bridgeton, Boston. Mass.
The Universal Boring Machine Co., Hudson, Mass.
Rockford Machine Tool Co., Rockford, Ill.
The Bellevue Industrial Furnace Co., Detroit, Michigan.

Toronto Warehouse

75,000 Square Feet of Floor Space Filled With Up-to-Date Machinery.

H. W. PETRIE
LIMITED
TORONTO HAMILTON

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Speaking of STOCO SAFETY GOGGLE

CELOGLAS-LENSES

A Prominent Safety Engineer Says;

"It is not as heavy as the majority of samples submitted. This is in its favor because it is possible to get lenses so heavy that the goggles become burdensome, second I am inclined to think that your lenses come near to the condition of plain glass in that it apparently does not cut down the vision as much as the average non-shatterable lenses."

Every once in a while our offer of a sample STOCO Safety Goggle "on receipt of request on letterhead" results in a letter like the one from which the above is quoted. (The original letter is on file at our office). In fact, if we were not sure that an inspection and trial of the STOCO Safety Goggle would result in unqualified approval, could we afford to make such an offer?

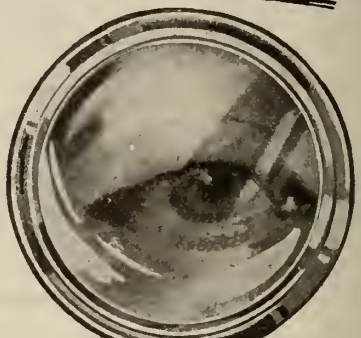
STOCO Safety Goggles
Price per Hundred
(f.o.b. Geneva, N.Y.)

With Celoglass Shatter-Proof lenses $115.00
With extra heavy optical glass lenses.... 90.00

Discounts for quantity orders.

Black elastic headbands or easy cable temples at same price.

A sample of the STOCO Safety Goggle will be sent to interested, responsible people on receipt of request on letterhead.



Eye Safe

Eye Still Safe

STANDARD OPTICAL CO.
GENEVA, N.Y. U.S.A.

The City of ST. JOHNS, QUEBEC

Why not take advantage of this generous offer?

Realizing the difficulties and expense to be encountered in the organization and establishment of a new industry, St. Johns offers her assistance by granting:

1. **Exemption from taxes for a period of fifteen years; same being subject to extension.**
2. **All public improvements required, such as street extensions, sidewalks, waterworks and sewage.**
3. **A cash bonus of 5% on your payroll for five years. If desired, this bonus will be advanced to you to be applied to the erection or purchase of any building suitable to your purpose.**

In addition to this, St. Johns possesses unusual economic advantages, such as its commanding geographical location, unequalled transportation facilities, adequate fuel and power and a solution for the vexed labour problem.

St. Johns is only 27 miles from Montreal and is directly connected by rail with the docks at Montreal, providing excellent ocean shipping advantages. It is particularly suitable as a Canadian location for the Amercian manufacturer wishing to trade within the British Empire.

Located in the centre of the most densely populated districts of Canada an abundant supply of skilled and unskilled labour is assured. The city is, in fact, recognized as the cheapest labour market in Canada. The workmen are happy and contented and labour troubles are practically unknown.

St. Johns is a beautiful residential city and is liberally provided with places of amusement for the entertainment of you or your employees.

The secretary of the city council will be pleased to answer any enquiry on St. Johns and will supply complete and accurate information on any phase of the industrial situation as it affects the city.

Consider these advantages:

Consider these Advantages

—Seven railroads, including Canada's great transcontinental lines.
—Finest ocean shipping facilities.
—Canal connections with New York, the Eastern States, and the Great Lakes.
—Cheapest labor market in Canada.
—Plentiful supply of skilled and unskilled labor.
—Cheap and abundant electric power.
—Cheap coal and lower freight rates.
—Desirable factory sites with all public conveniences immediately available.
—Extraordinary inducements to new industries.

For more specific information write

The Secretary, City Council
ST. JOHNS, QUEBEC, CAN.

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OAKITE CLEANS

40,000 More Parts Daily

A WORLD-KNOWN Connecticut plant has increased the output of the cleaning room ***40,000 pieces a day*** by using Oakite.

Formerly removed burnt oil from small steel parts by hand scrubbing with gasoline—put through 60,000 parts every 14 hours.

Oakite materials and methods have eliminated the labor of eight to ten men in the cleaning room (now work in another department) and the output is increased to ***100,000 parts every 10 hours.***

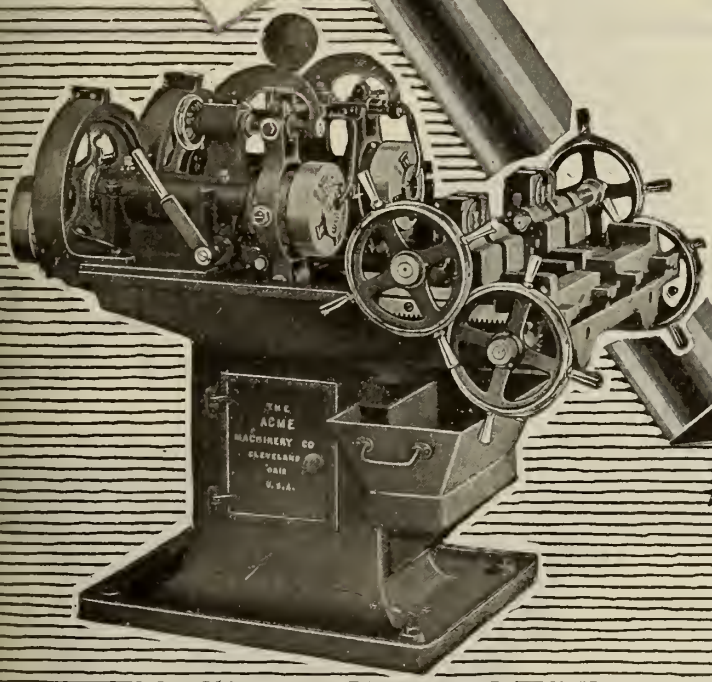
Don't wait until you have serious trouble. Find out now the best way to clean your work. Let our years of experience help you. Our organization of trained practical men are at work on cleaning problems every working day of the year. The practical application of our knowledge to meet your individual requirements constitutes Oakite service. This service is rendered to interested organizations without charge.

May we serve YOU too?

OAKITE MANUFACTURED BY **OAKLEY CHEMICAL CO.** 44 THAMES STREET · NEW YORK

BOLTS

SQUARE HEXAGON TEE-HEAD



DON'T depend upon outside deliveries for your square, hexagon and tee-head bolts. Cut them in your own plant with an Acme Bolt Cutter and save money.

Acme Bolt Cutters are made in various sizes for cutting bolts from ¼ to 1-in diameter. Their heads allow micrometer adjustments while they are in motion. The dies can be changed from one size to another in less than one minute and produce clean, accurate highly finished threads.

Our interesting catalog contains complete specifications.

Sent promptly upon request.

The Acme Machinery Co.
4530 St. Clair Ave. Cleveland, Ohio

Representatives for Canada:
The John Bertram & Sons Company, Limited, Dundas, Ont.

ACME BOLT CUTTERS

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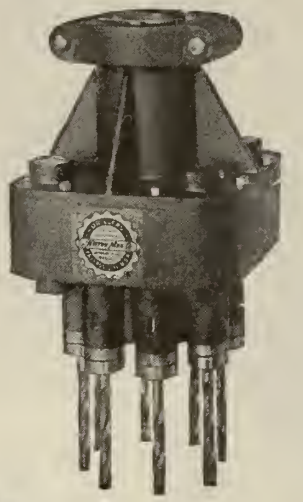
2 Minutes or 20?

This Is The Vital Question

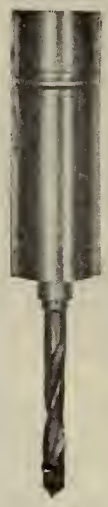


Do you drill ten holes in the time it takes for one? The Hoefer Auxiliary Head equips any driller so as to accomplish this big saving in time. It speeds up production in drilling tremendously. Not only do you save the drilling time, but also the time now lost in shifting the jigs and raising and lowering the spindle for the extra holes.

Hoefer Auxiliary Heads are made in any multiple, arranged in any manner, from 2 up. They are made by expert tool makers and unqualifiedly guaranteed to handle accurately the work for which they are designed.

Investigate now—every day you use a single drill where the multiple may be used you are paying for an auxiliary head through increased costs, but not securing its benefits.

Write for catalog. Send a blueprint of some of your work for estimate of time and cost.



THE HŒFER . . . Co., Freeport, Ill.

621 Washington Blvd., Phone Haymarket 2408, Chicago, Illinois; 1113 Citizens' Bldg., Phone Main 795, Cleveland, Ohio; 217 Stanwix St., Phon Court 1911 or 1912, Pittsburgh, Pa.; 602 Kerr Building, Phone Cherry 2884 Detroit, Mich.; 30 Church Street, Phone Cortland 1615, New York City Badger-Packard Mchy. Co., Milwaukee, Wisconsin; National Supply Co Toledo, Ohio; John M. Howett, 18 W. Second St., Dayton, Ohio; 881 Ellicot Sq., Phone Seneca 2033, Buffalo, N.Y.

The Canadian Fairbanks-Morse Co., Limited

"Canada's Departmental House For Mechanical Goods"

Halifax St. John Quebec Montreal Ottawa Toronto Hamilton Windsc Winnipeg Saskatoon Calgary Vancouver Victoria

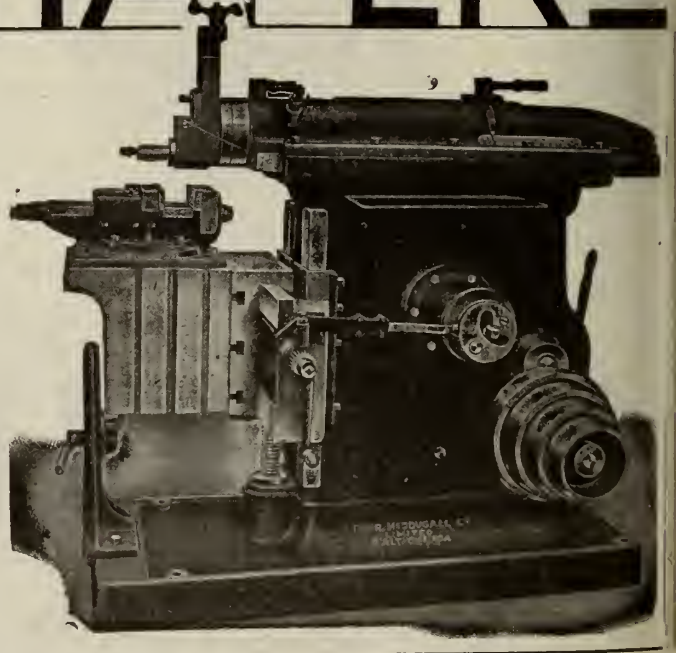
McDougall SHAPERS

Rigidity Plus

Simple Design and Convenience of Adjustments

give Operator every facility for Ease of Operation and Accuracy in Production

Our circulars, containing complete specification and descriptions, are ready. Write us for one.



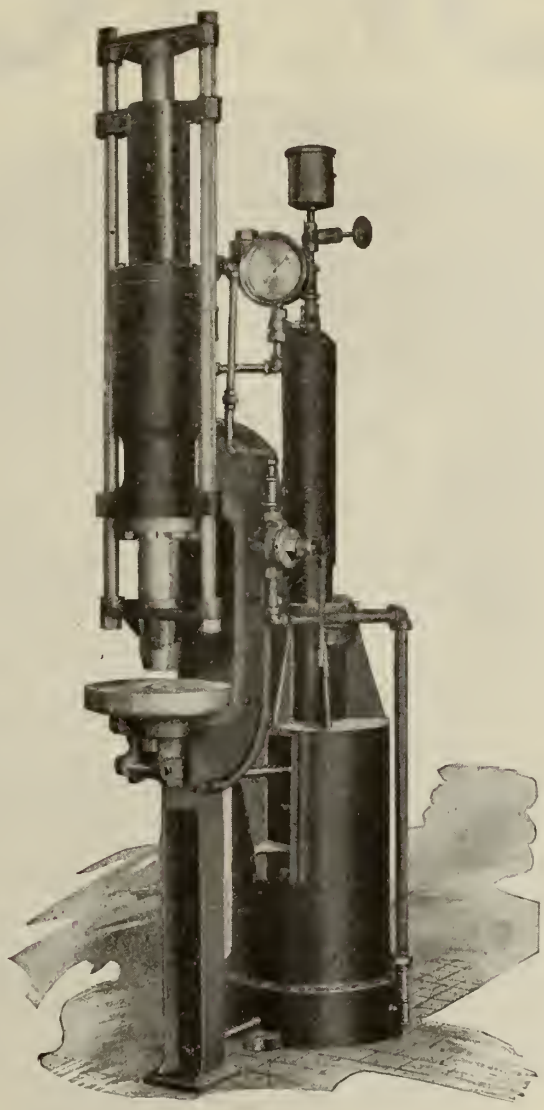
The R. McDougall Co, Limited

GALT, ONTARIO

THE CANADIAN FAIRBANKS-MORSE CO., LIMITED
Sales Agents

ORIGINALITY

is Characteristic Always of
"METALWOOD"
DESIGNS and DEVELOPMENTS



The "Metalwood" line of these Quick Operating Hydro-Pneumatic Presses comprises a variety of styles, types and sizes.

By performance through a period of years, these presses have established themselves in a wide range of industries as standard tools for light straightening, broaching, forcing and assembly operations.

The "R-149" style press of 20-ton capacity shown here is described in our bulletin B-47.

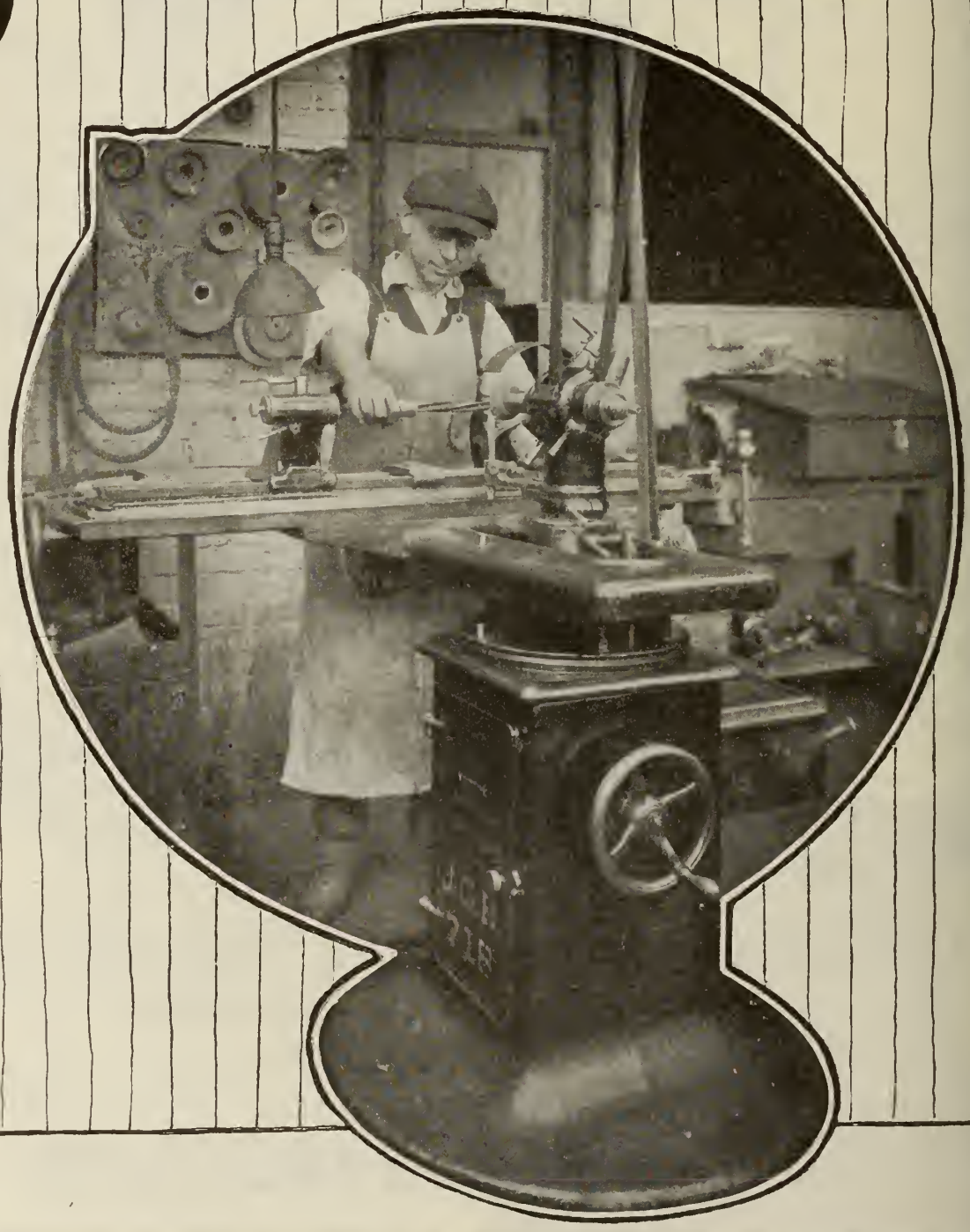
METALWOOD MANUFACTURING CO.

High Speed Hydraulic and Hydro-Pneumatic Machinery
DETROIT, MICHIGAN

EXCLUSIVE SALES REPRESENTATIVES:

Canadian Fairbanks-Morse Co., Ltd., Montreal and Toronto; R. E. Ellis Engineering Co., 621 Washington Blvd., Chicago; Fairbanks-Morse & Co., Inc., 30 Church St., New York City; Sherritt & Stoer Co., Inc., Finance Bldg., Philadelphia, Pa.

Norton



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"Keep 'Em Sharp"

Good finish on machined surfaces largely depends on the cutting edge of your cutters and reamers. A tool with sharp, clean edges will naturally cut more smoothly, generate less heat, consume less power and produce more work in a given time. So keep 'em sharp. Establish the practice of "touching up" tools as soon as they show dull. Don't let the edges burn before you send tools to the crib for re-grinding. A few minutes on a Norton Universal Tool and Cutter Grinding Machine will put a cutter reamer or end mill in top-notch cutting condition. Common-sense and a "Norton" will increase your production and lengthen the life of your tools. We have a bulletin fully describing these machines. When shall we send your copy?

NORTON COMPANY
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CANADIAN AGENTS:
THE CANADIAN FAIRBANKS-MORSE CO., LIMITED
Montreal, Toronto, Ottawa, St. John, N.B., Winnipeg, Calgary, Saskatoon, Vaucouver, Victoria.

F. H. ANDREWS & SON
Quebec, Que.

M-3

Universal Tool and Cutter Grinding Machines

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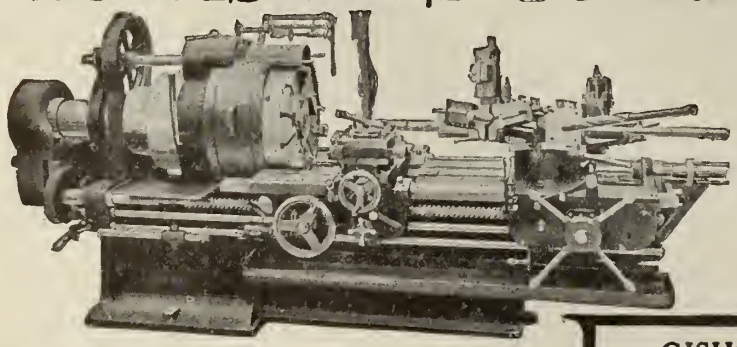
GIS

TIE UP
TO GISHOLT TURRET LATHES



Tie up to the years of experience behind these machines.
Tie up to a future of steady, dependable output, economy in the production of parts and the continued interest of Gisholt Engineers in your manufacturing problems.

A new Lathe Book has just come from the printer. When writing for a copy, please use your firm's letter head.

GISHOLT MACHINE COMPANY, 1207 EAST
Builders of Standard and Automat
Boring Mills, Tool Grinder
Eastern Sales Office: 30 Church St., New Yorl

Canadian Agents: The Canadian Fairbanks-Morse Co., Ltd., St. John, Quebec, Montreal, Ottawa, Toronto, Hamilton, Windsor, Winnipeg, Saskatoon, Calgary, Vancouver, Victoria.

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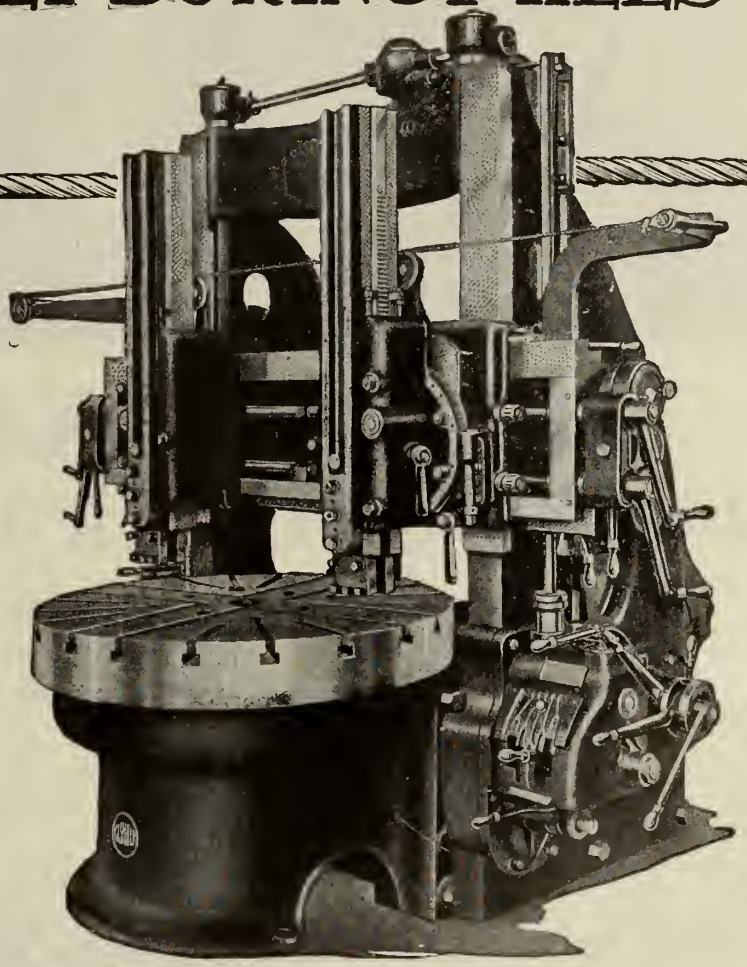
TIE UP
TO GISHOLT BORING MILLS



Tie up to their ability to yield the greatest returns per dollar of investment.

Tie up to the satisfaction, measured in lower manufacturing costs, which is prized by Gisholt users everywhere.

Write for our interesting Boring Mill Catalog

/ASHINGTON AVE., MADISON, WIS., U. S. A.
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all Tools, Special Machinery, etc.
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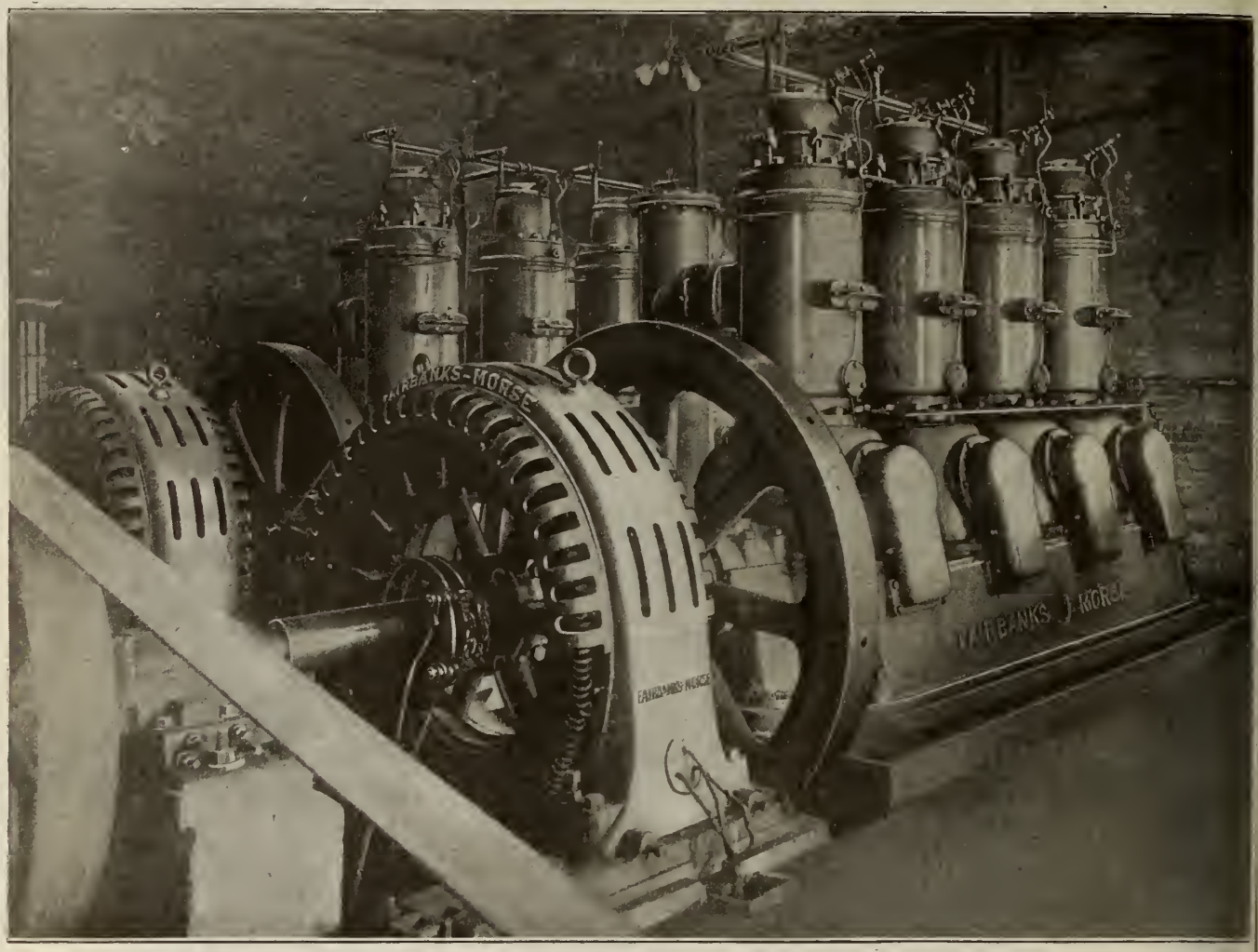
Canadian Agents: The Canadian Fairbanks-Morse Co., Ltd., St. John, Quebec, Montreal, Ottawa, Toronto, Hamilton, Windsor, Winnipeg, Saskatoon, Calgary, Vancouver, Victoria



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Each of the units shown above consists of a 200 H.P. Semi-Diesel Oil Engine and a 170 K.V.A. Generator.

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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

Vol. XIII, No. 19. May 6, 1920

Keeping Tab on Parts in an Agricultural Factory

How Would You Like to Keep Track of Over 10,000 Different Parts? Here is the Method Adopted in the Plant of the International Harvester Company, of Hamilton, Canada

By J. H. MOORE, Associate Editor Canadian Machinery

HAVE you ever spent a day on a farm? Of course you have, for there are very few people who have not sojourned at least one day of their life in the country. The next question, however, is not so easy to answer. You, no doubt, have seen a binder, drill, mower, or thresher at work, but have you ever stopped to consider the intricacy of these agricultural machines, or have you been content to merely exclaim as they accomplished their work, "My—that's wonderful!"

As a general rule, people never consider this phase of the situation, but in the article to follow, we will prove the exception to the rule, taking you into the plant of the International Harvester Co., of Hamilton, Canada, explaining their method of keeping tab on the innumerable number of parts which go to make up their various products.

Any attempt at mentioning the actual number of parts used on their machines, would only be confusing, but futile, so taking it for granted that readers appreciate the fact that these agricultural implements or machines are of a very complex nature, we will proceed to describe the various step of recording new parts, changes to old parts, instructions regarding setting up, etc., etc.

One can readily understand that a progressive concern, such as the firm we speak of, is at all times endeavoring to still further improve their product, thereby necessitating changes to former parts. These changes would cause confusion in the records were not some card system, symbol numbers, etc., adopted. Photographic records are also taken in order to have an actual reproduction of the part.

To avoid confusion, each type of machine is given a certain symbol number, the various parts of such machine carrying the symbol number throughout. For example, the Deering mower is known by the symbol letter D, while Deering drills and cultivators are classified by the letter F. These two examples will suffice to explain the system.

It is the policy of the company to issue part books, instruction setting up books, etc., containing line drawings, showing the various parts, either separate, or in assembly. In this way the photographs are used, not only for record purposes, but illustrative work as well. These books are of a standard type, 6 in. x 9 in., which allows the taking of a standard size of photograph. The advantage of thus standardizing the photography process is so self-apparent that no comment is necessary.

For illustrative purposes we will suppose a batch of new parts (or samples as they are called) have reached the stage when they are completed, and passed on as o.k. by the experimental department.

It might be well to mention that this experimental department is everything that the word implies, for a trained staff of experts are at all times engaged on the task of improving the various products. When a change is contemplated, the expert to whom the task is allotted makes a sample piece, using this part on a special machine kept for experimental purposes.

A thorough test is made before the idea is finally adopted (or rejected as the case may be) and the heads of the different departments are called in to give their opinion on the advisability of the change.

It is only after all the pros and cons of the situation have been carefully considered that a decision is given to adopt the new part. Immediately this point is settled, a photograph of the part (together with others which have received a similar o.k.) is taken in the following manner:

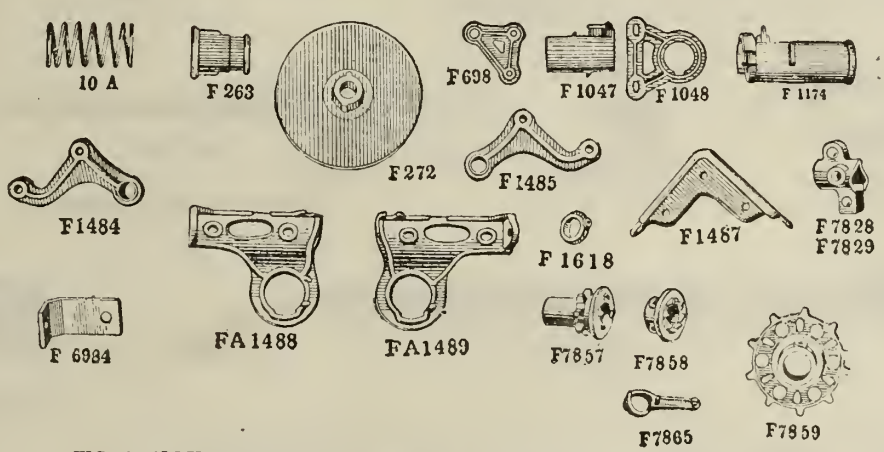


FIG. 3—ILLUSTRATING THE IDEA OF LINE DRAWING REPRODUCTION.

The Photographic Process

All photographs are taken on an 8 in. x 10 in. plate. Every arrangement of samples is made on a special board, 5 ft. long by 4 ft. wide. This board is painted white. The picture is always taken the long way of the board. The photographic system is standardized in this way to attain a definite purpose, for as explained before, all instruction books, etc., are of a standard size. By photographing the samples in this way, it is found, when reproducing for illustrative purposes, that by a certain scale of reduction, two of these boards can be shown on one page of the part or instruction book.

Another point which is watched very carefully is that every part shown on the board has sufficient space around it

to ensure the cutting out of that part if necessary, without interfering with the other parts shown.

To illustrate how one of these boards appears after being photographed, let us look at Fig. 1. It will be necessary to refer to this photo quite often, so we would suggest that readers give it their careful consideration. First, we call attention to the fact that in the upper left hand corner of the plate is marked, H 1306, Scale 1/6, 1-29-1916V.

This style of data is given on every plate in order that a definite record may be kept on every negative in the plant. H 1306 is, of course, the plate number, and an envelope is numbered in similar manner to hold this plate. Each negative has its own envelope, and these are filed in special cabinets, being numbered consecutively. The next notation on the plate, namely, 1/6, signifies that the parts are shown 1/6 their actual size. A two-foot rule is placed on the board to show the proportion of the various parts.

The previous method was that of painting in the letters. This was not only a slow process, but was never standard, or neat. Here is a tip well worth adopting for many other lines of work.

The matter of arranging the various parts on the board depends entirely upon the shape and size of the part. In as

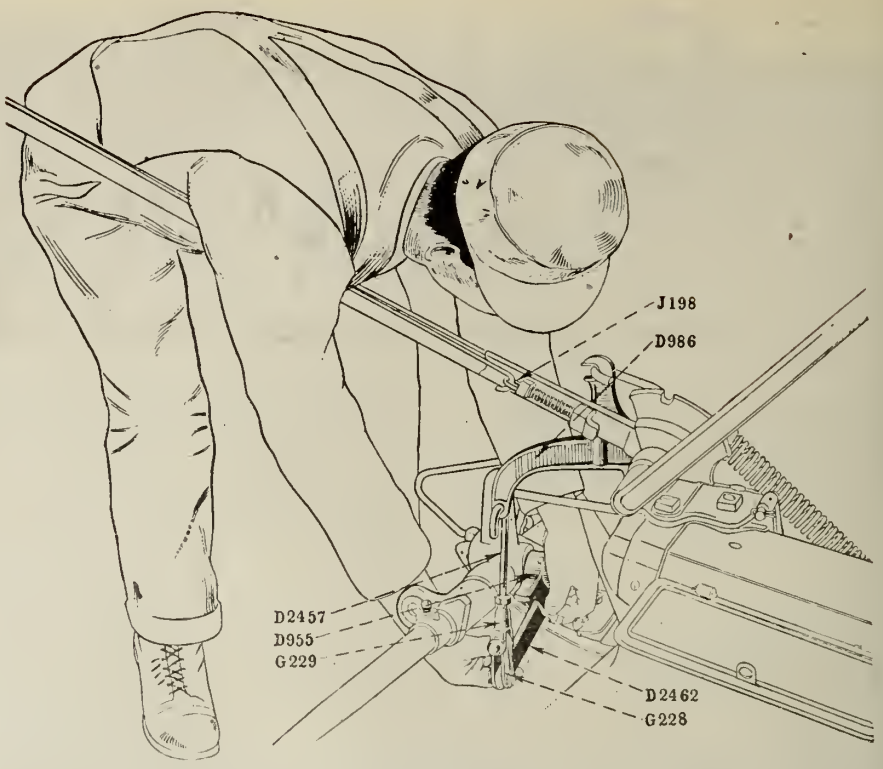


FIG. 4—A GOOD EXAMPLE OF THE INSTRUCTION POSSIBLE BY MEANS OF A LINE DRAWING.

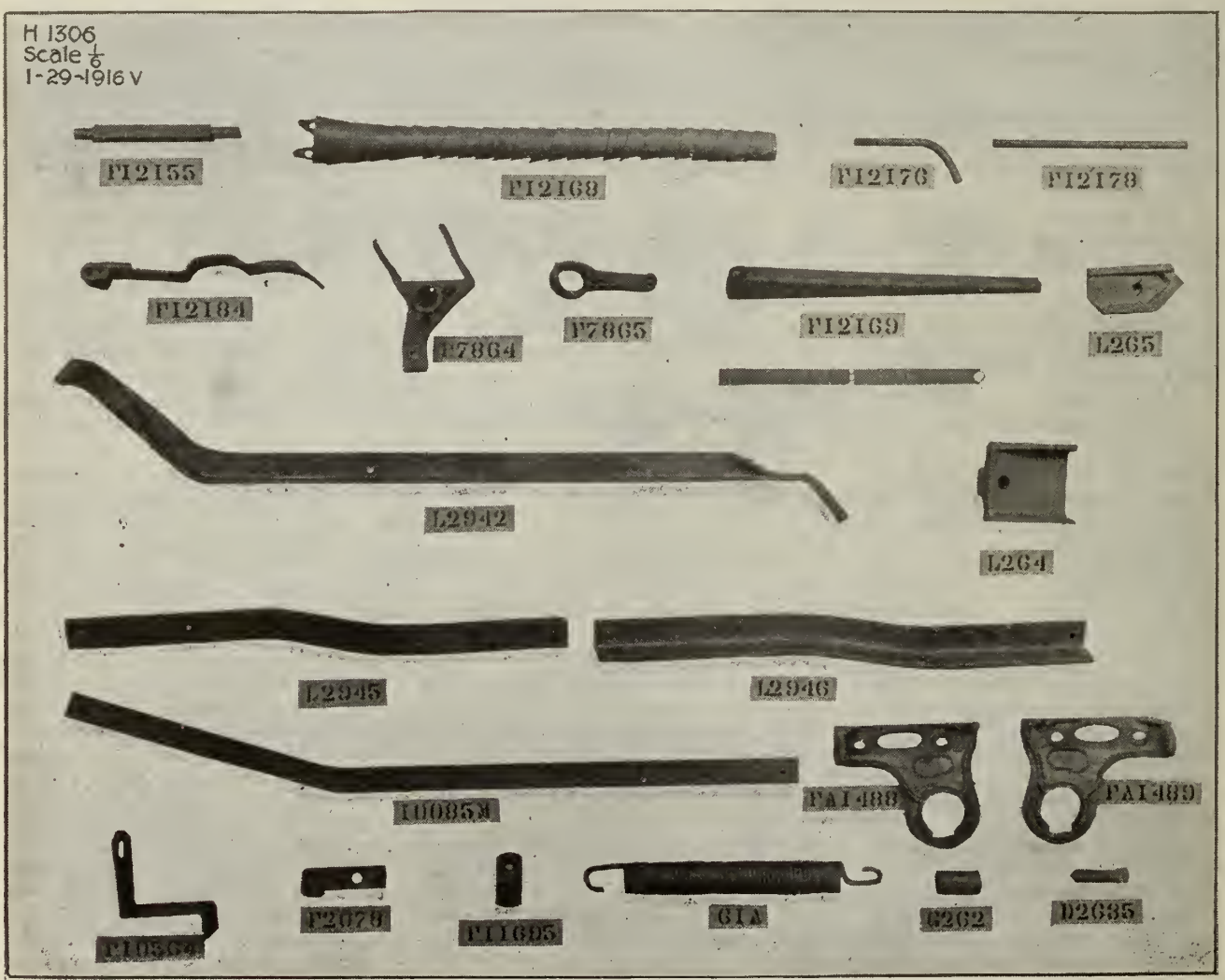


FIG. 1—ILLUSTRATING THE STYLE OF PHOTOGRAPHS MADE FOR REFERENCE AND FILE PURPOSES.

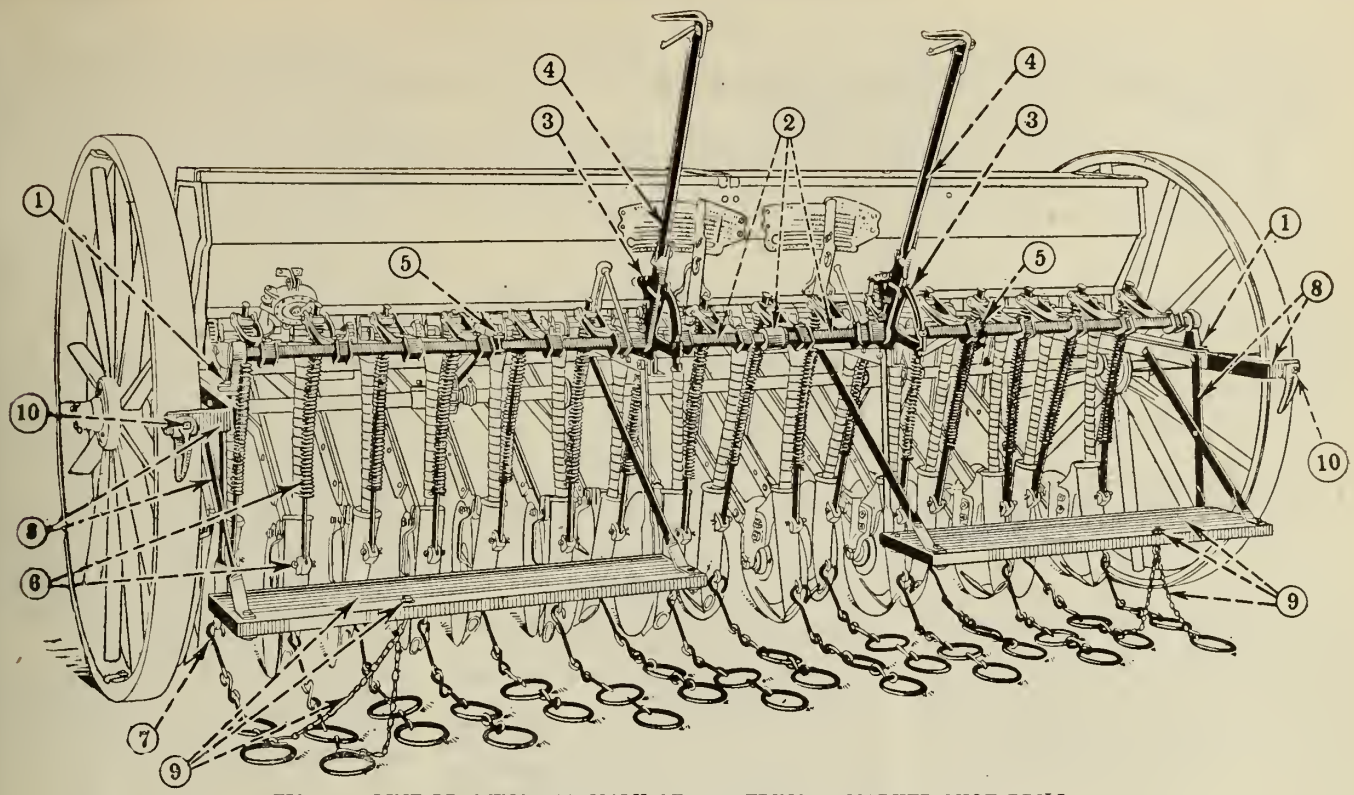


FIG. 3—A LINE DRAWING ASSEMBLY OF A DEERING 16 MARKER SHOE DRILL.

far as possible, they are placed consecutively, but this is not always convenient, as the illustration depicted clearly shows.

One point watched carefully is this, that every part must be so arranged that it can be cut out without disturbing any of the others. It is absolutely essential that this be done, as it often occurs that a certain piece is used on as many as twenty-five different machines. By placing the parts on the board in a separated manner, one photograph is all that is necessary of any part, as the line drawing which is later made from the photo is distinct in itself and can be used in the making up of the various part books, etc.

Once a photograph is taken, and a cut, or zinc made from that photo, it is interchangeable for any other book.

The Line Drawing Method

The next step following the development of negative and printing of photograph is the making of two blueprints from the same plate. It is, of course, impossible to show the blueprint in this article, but readers can well imagine its appearance. One of these prints is put on a board file for office reference purposes, while the other, together with the photographic print already made, is forwarded to the engravers. It might be mentioned that all prints are made on black and white contact paper, ferrotyped.

The engraver now outlines, in line drawing fashion, the various pieces shown on the blueprint of the negative, using the photograph for reference purposes whenever necessary. In this way he is sure of correctly portraying the contour of each piece, as between the photo, and the blueprint, he cannot—without being absolutely careless—make a mistake.

To illustrate how one of these boards looks after the engraver is through, we refer you to Fig. 2. You will note that the pieces FA 1488 and FA 1489 are line drawings made from the same pieces shown in the photograph at Fig. 1. The

Memo No. 1030 EXPERIMENTAL DEPARTMENT D4377. 2½m.-12-19.
SAMPLE AND PATTERN MEMORANDUM

Hamilton Works, Jan. 17th. 1920. 1920

MACHINE 1920 - DEERING HAY RAKES

Mr. Mr. P. Rigby,

Planning Dept.

Please note New Sample delivered to your Department to-day for

CAT. NO.	NAME	MATERIAL	PATTERN EQUIPMENT
RA317	- Hand Lever Socket	- Mall.-	

A portion of the Boss around the rear adjustment hole on the lever side has been cut away slightly. Also 1/16" of metal has been added outside each of the two square holes for Carriage Bolts which secure this part to Lake Head.

Is in accordance with Decision "2463-D-

Use up Castings on hand.

New sample was made here and replaces sample previously in factory which has been destroyed.

EXPERIMENTAL DEPARTMENT
BY

Copy to Messrs:

Armour	Hill
Dodds	Knapp
Forster	Linklater
Gleason	Muldoon
Goodram	Matbieson
Gayfer	Slater
Hubbard	Wiggin(2)
Honeyford	Raiser
Henry	

Received Patterns..... Foundry Foreman

Delivered Trial Castings to Inspecting Dept..... Foundry Foreman

Received Trial Castings from Foundry to-day.....

Checked Castings wtih following results.....

Inspection Foreman.

FIG. 5—TYPE OF MEMO. FORM USED IN PLACING NEW SAMPLE IN THE FACTORY.

D1022 Sm Heavy 2-18

CARD #1

EXPERIMENTAL DEPARTMENT—I. H. CO. of Can. (Ltd.)

CAT. NO F498 NAME Left Arm Trunnion

F498

MATERIAL	DECISION NO	DRAWING NO.
Malt White Iron	451 D, 1058 D, 1912 D,	117 A3
REPLACES F235, 38 M	REPLACED BY F A 498	WILL WORK FOR

	STEEL OR MISCELL.	LUMBER
CASTINGS WEIGHT PER 1000 PIECES 300#	CUTTING OIMENS	FINISHED OIMENS
REPAIR PRICE $0.15		ROUGH OIMENS
REPAIR PRICE MEMO.	MULTIPLE LENGTH	ESTIMATED OIMENS.
PHOTO NUMBER H993	BAR LENGTH	PREFERRED LENGTH = PCS WASTE
	WEIGHT PER 1000 PIECES	NO OF FT PER 1000 PIECES

Pattern ~~SAMPLE~~ DELIVERED	PATTERN DELIVERED
Sept 22-1916 (Changed & renumbered F A 498)	
Jan 15-1918 (Repeated)	

FIG. 6—STYLE OF CARD USED IN EXPERIMENTAL DEPARTMENT.

other pieces illustrated do not show in Fig. 1, but this feature is not a detriment, but rather a help, for it brings out the advantage of arranging each piece as a separate zinc by itself. Had this been the case, it would have been impossible to arrange the board as shown.

To further illustrate how this line drawing principle can be used to good advantage, we show Figs. 3 and 4:

Fig. 3 depicts an assembly of a Deering shoe drill, 16 marker, and gives the agent, or customer, a splendid idea of its arrangement of parts.

At Fig. 4, we see a drawing of a very different nature. In this case, the illustration takes the form of a lesson in the proper method of connecting lifting lever bell crank to swivel hinge bell crank on a Deering mower. These are only two examples, but the advantage of this method of illustrating parts is so self-apparent, that we pass on to the record system as adopted by the experimental office.

The Office Records

Having already explained how blueprints of the various negatives are kept on proper board files, there is no need to touch on this again, so we will start at the point where a new sample is issued from the experimental department.

At Fig. 5, we illustrate the type of memo form used for this purpose. It will be noticed that the memo number is placed in the upper left hand corner, in this case the number is 4080. These memos are, of course, filed consecutively. Next comes the date, also the type and year of the machine on which the part is used. This memo is sent to what is known as the planning department.

Now comes the catalogue number, the name of the piece, the material, and a detailed description of the piece. In the case shown the new sample is superseding an old one, and all the changes are explained, also the decision number is given, so that the result of the decision can be looked up if desired.

Copies of this memo are forwarded to the names listed below (see memo), these names being the various departmental heads throughout the plant. By this system every department in the entire plant is acquainted with the fact of the new sample being issued, and all particulars pertaining thereto.

The experimental department also keeps a card system on every part, these cards which are showing every particular. Take for example the card illustrated at Figs. 6 and 7. Here we show both sides of the card. It will be noticed that the catalogue number, name of part, line drawing of part, material, decision numbers, and drawing number are all given. The parts which the new piece replaces is also stated, and should it be later replaced itself, it is stated on the card, as is shown by FA 498, on the present card under discussion. The weight of 1,000 pieces, etc., are all given, and we cannot do better than suggest that readers study this card carefully, for there are many headings which we have not filled in, and that are worthy of note.

On the reverse side of the card is shown some of the machines on which the same piece is used. It will be noticed that this card is marked No. 1 in the upper right hand corner, the reason for this being that quite often a piece is used on so many other machines that more than one card is necessary to complete the record.

To illustrate how these cards can be used in conjunction with the finding of any certain part on a blueprint, let us concoct a theoretical case. We will suppose that we are in charge of the filing system and that someone comes in, asking for part No. F 498.

We immediately go to our filing cabinet, which is arranged in drawer form, and in the drawer with the proper tab on its front, we soon find the card as illustrated at Fig. 6.

"That piece is now replaced by FA 498." we tell our friend who is after particulars. We next go over to the board files, and in consecutive order we find the proper blueprint showing the piece desired. We can, if we desire, go right to the proper negative, as the photo number is also shown on the card. We can also go direct from this card to the drawer containing the mechanical drawing of the part, as this is also given on the card. In other words, the card serves more than one purpose.

When a card, as shown, is filled out completely, it not only records what piece replaces the original part, but it also depicts how long a period each piece was used, giving the year, model, etc.

The Cross Index Plan

To ensure against any possible error, a cross index system is arranged in the following manner: A complete list of parts, with full description, is placed in loose leaf book form. Should a piece become obsolete, it is marked out, by writing the word "Obsolete" across the entry, the reason why it is discarded and so on. Every detail is stated in this record, in order to be sure that a close tab is kept on the various parts going through the plant.

When we estimate that roughly some 10,000 parts are passing through this plant at the present time, readers can form a fair idea of the magnitude of the task. While we have explained this system in a matter of fact way, the method in its present state has only been reached after years of careful revision and improvement, so that readers in general will be wise to study carefully this method of record keeping in its entirety.

CAT NO

MACHINES USED UPON Card #1

NAME OF MACHINE	No. Used and Date	NAME OF MACHINE	No. Used and Date
Domestic Single Disc Drills (12M)	8-1904		
" " " " (9M)	7-1905-6		
" " " " (11M)	9-1905-6		
" " " " (13M)	11-1905-6		
" " " " (15M)	11-1904 13-1905-6		
" " " " (17M)	13-1904 12-1905-6		
" " " " (7M)			
" Hoe Drills (10M)			

REMARKS

REVERSE SIDE OF THE CARD SHOWN AT FIG. 6.

Are You Acquainted With Art of Roll Turning?

The Second and Last Portion on This Interesting Subject—Further Details Are Given as to the Duties of the Roll Turner

By W. S. Standiford

IT is a well-known fact that all tools must be harded than the metal that they are cutting. When they are nearly matched for hardness, the tool has to be ground often, thus delaying the work and adding to the expense. High-speed metal in spite of its high cost saves money in the long run for roughing work as a very little grinding is required. A few rubs of the tool on an oil-stone puts the cutting edge in good shape. Some employers seem to think that any grade of ordinary tool steel is good enough for roll-turning and buy cheap steel; which does for working iron or steel rolls but necessitates frequent regrinding. The hardest metal the roll turner has to turn is chilled cast iron and also chilled rolls made out of an alloy of chilled iron and manganese steel, and nowhere does poor steel show to such a disadvantage as in turning these classes of rolls. When used for finishing a groove, the edge breaks out and makes fine hair-lines upon the work. It does not produce true circular work on account of its being unable to keep a sharp cutting edge, it being necessary to use very sharp tools in finishing the grooves. There are two stages in roll turning, one called "turning" and the other "dressing" Turning is the making of new rolls out of the rough castings as they are received from the foundry; new ones do not have to be made every day in the ordinary sized mill, although in large ones, they always keep some journeymen on new work.

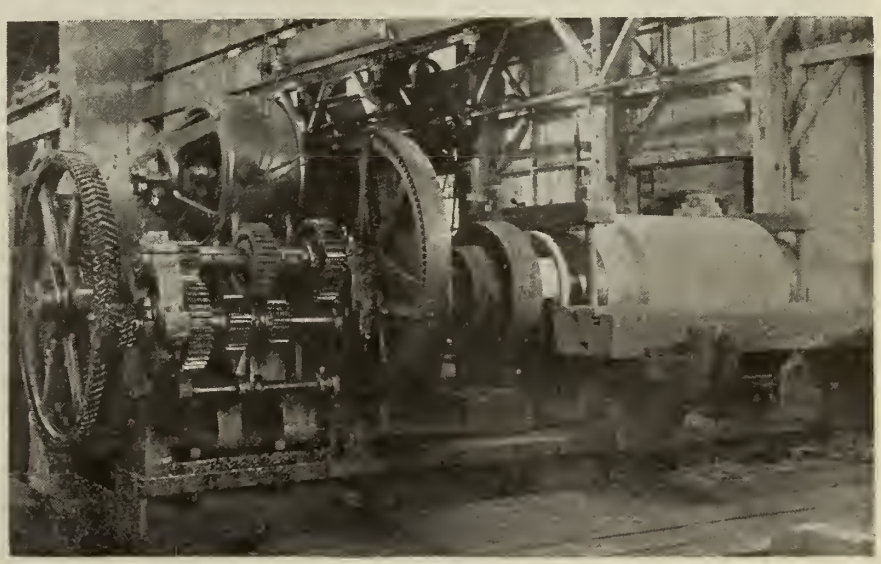
Other Interesting Facts

Roll foundries turn out rolls finished all ready to be put into the mill, as well as castings in the rough, they giving employment to quite a number of men. After the rolls have been awhile in the mill, the grooves become rough and worn by the constant friction of the metal rolled and need to be sent to the lathe to be put in shape; this is called "dressing." The amount of metal removed in dressing varies greatly, depending chiefly upon the kind of metal in the roll, length of time it has been used in the mill and the character of the metal rolled. On chilled rolls the amount is generally about 1-32 of an inch by the calipers, or 1-64 inch on each side of the roll. This removes the rough pin-holes caused by rolling friction and provides a bright surface. By frequent dressing, the rolls get smaller until they are too small for the mill; they then go to the "scrap-pile" and are replaced by new ones. As a general rule, they earn thousands of dollars for the company before being consigned to the scrap heap, although, it does occasionally happen that a new roll breaks in two, or has a neck twisted off after a few hours of use. The rolls that are mostly in use by mills are sand, chilled, chilled-alloy, semi-steel and steel rolls. Each of these kinds has its good qualities and its particular use for certain purposes. Sand rolls are made by pouring the hot metal into a mold made out of sand, the best ones being made of gray-mottled iron; this is a material that gives most excellent results when used for making bar iron rolls. Chilled iron rolls are made by ing in a metal mold. When the molten iron comes into contact with the cold sides. it cools quickly on its surfaces to a depth of 1½ to 4 inches and over as desired, it all depending upon the size of the rolls and what they are to make. The usual practice of foundries is to leave the centre soft and tough so as to prevent the necks being twisted off or roll breakage in cold weather. The characteristics of this class of rolls is their extreme hardness, a file making no impression upon them. But the best ones are made just so hard that a file or a first-class centre punch will barely make a mark. This gives a degree of toughness to the dense brittle material, and helps to some extent to prevent the collars of such rolls from breaking out so readily, if a sliver on a bar should get between the collars during rolling. These rolls are used, to a great extent, for finishing work, the grooves keeping their shape quite a long while before they require dressing. In putting them in the mill, care must be taken that they are not too roughly handled or dropped, as pieces of the grooves are liable to be broken out, thus ruining it for future use.

The chilled-alloy rolls are generally tougher than the chilled ones, but some of them are liable to have hidden cracks in their interior, which come to light when turning deep grooves. Semi-steel rolls have a closer grain when turned than the ordinary cast iron soft rolls, they being a good wearing material which works well in turning in the lathe. Steel rolls are used where great toughness with a moderate amount of hardness is desired; they are for roughing, and also for shapes having delicate points, such as "finger-bars," etc. They should be made of steel containing very small quantities of sulphur and phosphorus. The following is the analysis of a pair of open-hearth steel rolls that comes very near the ideal of what such rolls should be. In actual work, they stood the battering action of heavy manganese steel ingots of all degrees of hardness for nearly sixteen months, and were then relegated to the scrap heap because they became too small in diameter for the mill.

Carbon combined	.49
Silicon	.211
Phosphorus	.041
Sulphur	.036
Manganese	.68

The mill should be so constructed and equipped with labor-saving machinery (and also with powerful engines or electric drive) that there need be very little re-handling of coal, etc. Modern American mills and also Canadian ones are splendid examples of this, they being operated with very few men and producing a large tonnage at a minimum of expense. The up-to-date mill has a separate shop for its roll turners; well-lighted and so arranged that it can be warm-



A HEAVY GEARED TYPE OF ROLL TURNING LATHE

ed to a comfortable temperature in the winter.

The Life of the Turner

Anyone passing through a roll shop and observing a roll turner at work, naturally concludes that he has "a snap"; nothing could be further from the truth, as he has a lot to contend with. Iron, steel and copper work differently in various mills. This is due to the difference in engine power to drive the rolls and other factors such as the manner in which the metal is heated for making the finished bars. Rolls that work well in one mill, will not do so in another, the differences in the motive power making it necessary to ease the drafts of the roll passes in order to make them pull the metal through. Uneven heating, with cold spots on the metal, alters the working of it in the rolls, the roller in most cases, putting the blame on the roll turner for defective work, when as a matter of fact, it is the heater's fault. The roll turner has to be continually on his guard when he works in various mills throughout the country. However, the advantages that accrue from working in different mills are not to be gainsaid, as each one turns out a different line of product, and also has the roll pass layout put in rolls at different angles for making the same lines of goods, the result being that the roll turner who works in various mills gets skilled in every variety in work, and thus renders himself fit to take a foreman's position, as the latter must be filled by a man skilled in designing and turning all kinds of work, new inventions of iron and steel sections being made continually. The roll turner should stay a year at each place in order to get the benefits of experience, and not move to another mill every two weeks like some roll turners do.

Many journeymen stay at one mill all their lives, thus becoming specialists in their line of work, but rising no higher. This accounts for the fact that some men are able to do only sheet work and others wire rod work, etc.; travel also broadens a man, as he is bound to come into contact with people of different dispositions, and overcome many difficulties in roll turning, thus learning self-control.

It is equally certain that he will get into some mills of an antediluvian pattern, if he gets his situations by advertising, which is the usual method, it being advisable to not let go one position until another is secured. Considering the bad roll lathes that some of these mills contain, it is surprising that the roll turner can turn out anything like decent work at all. Some lathes are so worn in gearing and bearings that they can be heard a square away. The housings are so broken and patched that they do not stay long in line with the bed, but twist and spring one way or another, when a decent cut is being taken. Add to the above, a roof that lets the water in onto the roll and lathe when it rains, and a condition is met with that taxes the patience and moral fibre of the roll turner. Some firms put the lathes in the mill, near the roughing rolls; the result being that the workman stands a first-class chance of having an eye destroyed by flashes of hot metal from the rolls. Other parties have the happy (?) faculty of placing the roll lathe in the darkest part of the mill, and then generously allowing their roll turner to use a couple of small miners' lamps, each holding about two ounces of oil. These supply barely enough light to allow the workman to see where the point of the tool is going. There being a draft of air in most mills, also allows the roll turner to inhale a lot of the smoke from the lamps. In addition to all this, the journeyman generally freezes in winter and roasts in summer. Another Eastern roll foundry, which is now defunct, had a yellow clay floor for the worker to stand on while turning rolls, the clay being finely pulverized by the constant putting of finished rolls on it caused a fine yellow dust to settle over the lathe and workman, the result being that when it was time to go home, every man had his clothes colored yellow. It is needless to say that the writer did not stay long at that shop, as it was too uncomfortable.

In some old-fashioned mills, equally strange methods are used to put large rolls into the lathes, one of the most curious of these being the use of a large ship's capstan. This was situated at about 50 feet from the machine. Above the latter, fastened to an I-beam, placed at a right angle to the lathe and extending 6 feet in front of it, was a traveler fitted with two ordinary ship's blocks. Located on the floor, and secured firmly to a post, was another block. A two-inch rope extended from the capstan along the ground to a sheave of the block on the floor, and thence to the blocks fastened to the traveler over the lathe. The lower block on the traveler contained a large hook on the end. The method of procedure was as follows: The roll was placed by means of crowbars in front of the lathe; a chain with a ring in the middle and two hooks, one on each end, was attached, the ends of the chains being passed around the wobblers and the hooks run through the chains, thus holding the roll securely. The hook on the overhead block was run through the ring, and capstan manned by eight negroes, the roll being hoisted higher than needed. The traveler block holding the roll was pushed in until it was over the lathe, and the roll then lowered in place.

This method of doing business was exceedingly dangerous, as the rope was old and had many of its strands unravelled. Had the rope broken, it is most

THE NUMBER OF MEN IN THIS PICTURE GIVES READERS SOME IDEA OF THE LARGE SIZE OF THE LATHE.

likely that some of the men working the capstan, and also those around the lathe, would have been killed or hurt. Another mill had its rolls put into the lathe by means of an inclined plane; they being rolled up it by workmen with crowbars, while one man kept placing wooden wedges back of the rolls, to hold it while the others got another hold with the crowbars. When it arrived upon the lathe rest it was rolled into position in the machine. One firm had a method of putting large rolls weighing 6,000 pounds into the lathe by means of jacks and a cribbage of railroad ties. This was accomplished by raising the roll by the jacks, then placing the ties under; letting the jacks down and taking a fresh hold and putting more ties under the roll. This performance was repeated until the roll was at the requisite height; it then being rolled into the machine. Nearly three hours were wasted by this process. It is most likely that such crude ways of doing business and wasting time will be done away with in the future, even in small mills. A good, first-class electric or a hand-driven crane would use up only a few minutes in doing work of this kind. A rolling mill should be erected where ample shipping facilities can be had, both by rail and water. It is also advisable in locating new mills to build them where a free supply of water can be obtained to cool the rolls and also for condensing purposes. The writer knows of one small mill that has to pay a city for all the water that it uses, the result being that their bill for water supplied is over $3,000 per month. This adds considerably to the operating expenses and should be avoided.

Another thing that ought not be overlooked is the fact that steel works, etc., should not be built in a town of less than 10,000 inhabitants on account of the difficulty of keeping the skilled men, as the latter generally do not care to stay in small country towns where there are very few places of recreation. This is the reason why many employers have such difficulty in getting skilled men to remain long in towns containing a few people. A married man, non-resident, must send his wife money for her living expenses, until he can save up enough money to bring his family to their new location. If the married man owns a home, he generally stays in one place. If employers wish to retain their men, they should encourage their workmen to buy homes. The company's idea in locating mills or factories in small towns, is due to the fact that the taxes are low; but the means of retaining their working force should also be given consideration.

The influence that new invention and improvements exert upon the roll turning trade is most important, some of the shapes that the inventor creates calling for the utmost skill on the roll turners' part in designing rolls, in order that the section may be rolled. From the foregoing, it may readily be seen that the roll turner holds a most important position in regard to helping to add to the comforts that the civilized nations enjoy, his being a trade that will probably last until the end of the world.

CANADIAN ENGINEERING STANDARDS MAKING HEADWAY IN SOME LINES

A MEETING of the main committee of this Association was held at Ottawa on April 12th, Sir John Kennedy in the chair, when a number of items of interest were dealt with.

The general specification for steel railway bridges submitted to the Main Committee by the Sectional Committee on steel bridges and construction, was approved for publication. This specification, the essential provisions of which are fortunately in general agreement with the practice of the American Railway Engineering Association, is not drawn up with an intention of limiting the choice of the engineer as to type of bridge, but is so framed as to indicate definite methods of work for the designer, retailer and manufacturer, with a view of thus obtaining uniform results as regards strength and utility.

The specification, as now approved, is based on that published in draft form in 1918 by the Engineering Institute of Canada, and drawn up by a committee of that Institute under the chairmanship of Mr. P. B. Motley, engineer of bridges, Canadian Pacific Railway Company. The work of the C. E. S. A. upon it was undertaken at the request of the Engineering Institute of Canada.

It is announced that sub-committees have been appointed for the purpose of drafting general specifications for guidance in the purchase of wire rope, both for mining purposes and for dredging and steam shovel work. The former subcommittee is under the chairmanship of Mr. F. H. Sutherland, Inspector of Mines of Ontario, and the Chairman of the latter is Mr. K. M. Cameron, Department of Public Works, Ottawa.

A report from the Chairman of the sub-committee on Telegraph and Telephone Wire, Mr. W. J. Duckworth, of the Great North Western Telegraph Co., Toronto, stated that a specification for two standard grades of this material had been drafted and was now being considered and amended by the sub-committee.

Mr. J. G. Morrow, Steel Company of Canada, Hamilton, chairman of the Sectional Committee on Steel, reported that a Special Committee had commenced work with a view of co-ordinating the numerous specifications for material for carbon steel forgings now being worked to in Canada, and if possible, establishing the characteristics of a comparatively small number of grades of steel which could be used to fill those specifications.

It was decided to instruct a Special Committee, under the chairmanship of Mr. E. G. Burr, consulting engineer, Montreal, to proceed with an inquiry into the desirability and possibility of framing a Canadian National Electric Code. It was pointed out that such a document, so far as hazard to life is concerned, has been drawn up in the United States under the auspices of the Bureau of Standards, while fire hazard has been dealt with by the rules of the National Board of Fire Underwriters. The subcommittee is to consider the measures to be taken should it be thought advisable to draft a Canadian Code for covering these subjects for wide acceptance in the Dominion.

A communication was read from the Council of the Engineering Institute of Canada, requesting the Association to deal with a number of the specifications of the Institute, considering and revising them if thought necessary, as has already been done in the case of the specification for steel railway bridges. It was decided to take up first the Engineering Institute of Canada specifications for steel highway bridges and for cement, and to organize suitable committees to report upon them.

It was announced that the Air Board had approved of the Canadian Engineering Standards Association, through its Sectional Committee on Aircraft Parts, as the body through which Canada is to be represented on the International Aircraft Standards Commission. This action was welcomed by the committee, and it was pointed out that the approval of the Air Board gave official recognition to the work which has already been accomplished by Canadian representatives at meetings of the Commission.

The International Aircraft Standards Commission was organized in 1917, primarily as a war measure, with the object of obtaining, as far as may be, international agreement regarding materials for aircraft as well as details of aircraft construction and equipment. It is, for example, obviously desirable that aero engine magnetos made in different countries should be built within certain limits of overall dimensions, and should conform to general specifications which would enable a French magneto to be used in an emergency on a British machine finding itself in difficulties in France. The commission has already made gratifying progress, although it is unfortunate that the United States has so far been unable to appoint a committee to take part in its work. The countries now active on the Commission are Great Britain, France, Italy and Canada.

A grant of £200 towards the funds of the Association was announced from the British Engineering Standards Association, and the secretary reported that he now had in stock a supply of almost all of the publications of the B. E. S. A., which are available for distribution at a nominal charge.

A communication was read from the American Engineering Standards Committee, advising that in the opinion of the A. E. S C. co-operation between that body and the C. E. S. A. should be provided for by the interchange of minutes of the meetings of the respective Main Committees, so that joint action could be arranged for, wherever necessary. The committee heartily concurred in this suggestion, which will be adopted in future, and the hope was expressed that many opportunities for co-operation would present themselves.

Three Kinks of Interest to the Machinist

UNIQUE FORM OF SCRIBER

By W. S. Standiford

The scriber as a tool for making lines upon steel and other metal surfaces, is used so extensively by machinists, workers in automotive shops and other trades, that a special interest attaches to any improvement that will render it handier to use. The regular form of scriber made out of a round steel rod, hardened at the points, has the drawback, when long or curved lines are being drawn, of shifting its position slightly in the artisan's hand—which is always more or less greasy—thus rendering it harder to hold, the line being drawn wider at some places than at others, due to the scribers wearing unequally on different sides.

In laying out templets which have to be filed to a line, this interferes, to some extent, with the accuracy of the filers' work and slows the latter down.

The scriber devised by the writer is easier to hold straight in any position, and it makes lines of equal width; it only being necessary to hold the handle in one position—either a vertical or a horizontal one—to ensure that the line will have the same width. So much for its advantages, now for the constructional details.

Get a piece of 5-32 or 3-16 inch round rod of high-carbon tool steel of the desired length. Heat it to a cherry red and bend the hot end around an iron rod in a vise. Cool in water, and place the end where the point is to be, in the fire, until it is red-hot. Quickly remove with a tongs and rapidly draw the end to a point with a hammer. When cool, grind it on an emery wheel until it is as round as possible; finishing any inequalities with a file or oil-stone, making a needle taper toward the point. Heat the business end to a cherry red and dip into water. Try the point for hardness by making a scratch on a flat steel plate. If the metal contains too much carbon, the point will crumble; if just right, the sharp point will hold. Should the former conditions prevail, sharpen the point again and heat it to a cherry red and plunge the business end in cold water, leaving some heat in the upper portion of the rod. Quickly rub one side, near the point, with a piece of emery cloth tacked on a block of wood, and watch the colors extend to the point; when a straw color is reached, dip into water.

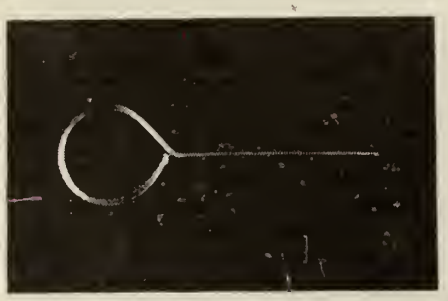


FIG. 1—SHOWS THE HANDLE OF SCRIBER BENT TO SHAPE AND THE POINT ROUGHED OUT.

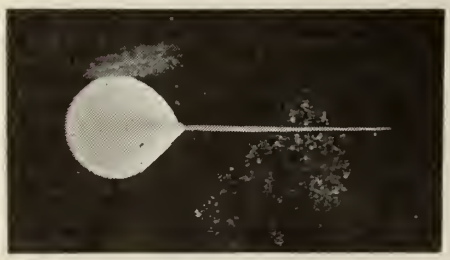
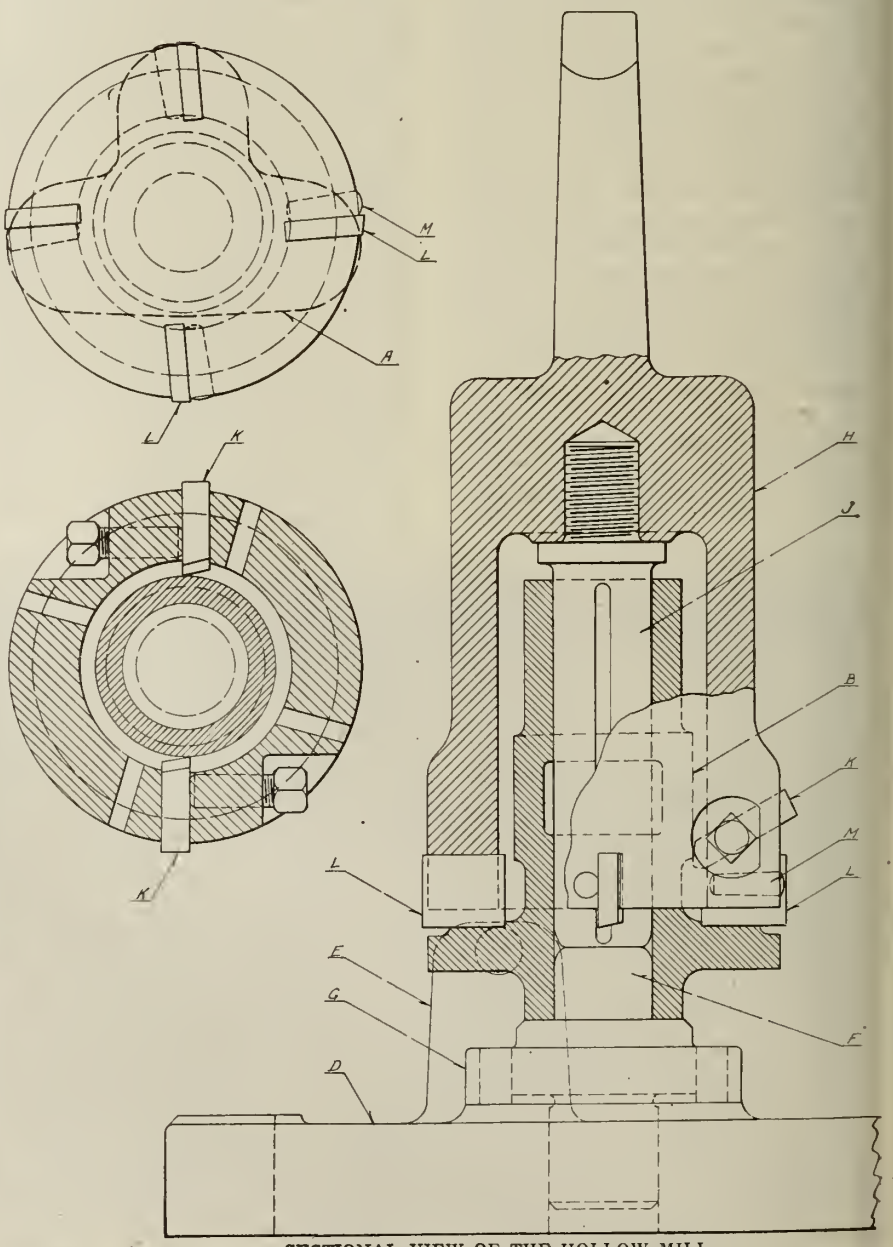


FIG. 2—REPRESENTS THE FINISHED APPLIANCE, READY FOR USE. A VERY EFFICIENT DEVICE.

The next thing to do is, to fill the handle with solder. Plunge loop in a chloride of zinc soldering fluid, which is made by putting pieces of sheet zinc into hydrochloric acid, until the latter will not dissolve any more. The above solution is a good flux of iron, steel, copper and brass, but should not be used for electrical work. After dipping, lay the loop upon a board and holding a hot soldering copper against a bar of solder, run sufficient of the latter in, until the handle is filled. Also lay the hot copper over the sides of the wire loop, as both the solder and meal requires to be hot, to do a good job. While soldering, cover the point with a wet cloth to prevent its temper being drawn. Remove all traces of acid by washing thoroughly in water; then grind the sur-



SECTIONAL VIEW OF THE HOLLOW MILL.

plus solder off the handle, brighten every part with emery cloth and oil to prevent rust and it is ready for use.

Fig. 1 shows the wire handle bent to shape and the point roughed out.

Fig. 2 depicts the finished appliance ready for use. For use with a scriber in making templets, the writer has found out by experience, that a line drawn on a copper coated plate, shows more clearly than does one drawn upon a blue chalk-covered surface. Free one side of the plate from grease and dissolve a few crystals of copper sulphate in a small quantity of water in a bottle. Use a round brush to put it on the plate, which will instantly turn copper colored. Rinse and dry thoroughly, and it is then ready for use. Sulphate of copper is a poison, so be careful in handling it.

HOLLOW MILL FOR TURNING AND FACING

By A DRAFTSMAN

The piece to be treated is a hub casting with a three-lobed flange, A, the bore having previously been machined. The drawing shows a hollow mill, to be used on a large drilling machine, for turning a diameter, B, and a force, C, at one setting.

The baseplate, D, has a lug, E, and stop pin to prevent rotation of the piece, which is centred by the limits pin, F, having adjustment and a circular locknut, G. The body of the mill, H, is of steel and has a tapered driving shank. It carries an internal centering and limit pin, J, which fits the bore and is grooved to accommodate grit. Two square tools, K, for turning the diameter, are set in at an angle to the horizontal and are pinched by set screws with a slight forward rake. There are four tools for the forcing cut, this number being necessary to ensure that two will always be in operation on the irregularly spaced lugs. These tools, L, are located so that they do not come into action until the turning tools have neared the end of their cut.

The method of securing the facing tools is simple and effective. Before cutting the radial-faced slots, four holes are drilled at 5 degrees to the slots. Then the slots are cut, breaking into the drill holes. When each tool is inserted, a pin, M, with a flattened and tapered side, is knocked in alongside. Acting as a taper pin, it effectively prevents chatter.

TOOLHOLDER FOR TURNING TWO DIAMETERS

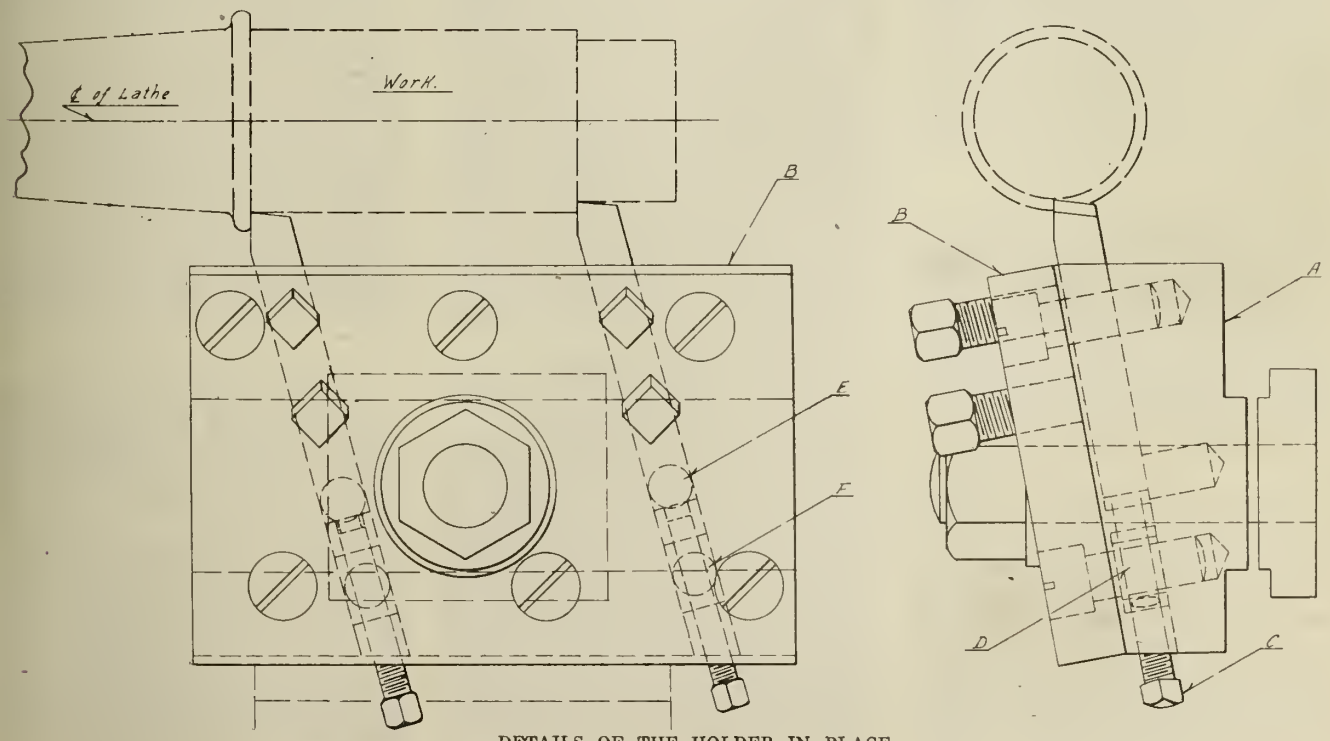
The drawing illustrates a device for simultaneously turning two diameters and shoulders on a shaft. It consists of a block A clamped by a central stud to the tool-rest of the lathe. The tools used are of ½ in. square steel and lie in slots at angles of 15 deg., both to the horizontal, and to the plane of the shoulders. A cover plate B, held to the block by six screws, carries set-screws by which the tools are gripped. Each tool is kept to its work by a long screw C passing through a T-block D, whose round stem engages with a hole in the bottom of the slot. Two holes E and F are provided in each slot so that the T-block may be moved forward and the overhang of its screw shortened when the tool has sufficiently worn down.

The advantage of this arrangement is that the double bevel on the tool faces enables the cutting edges to be easily ground and the two tools can be adjusted for height and distance apart of cutting edges as well as for relative diameters.

ACTION OF WATER ON LEAD

In a paper on "The Action of Water on Lead," read before the Birmingham and Midland section of the Society of Chemical Industry, the authors, Messrs. J. F. Liverseege and A. W. Knapp, said that the erosion of lead pipes is due to the action of oxygen in the presence of water; such variations as occur naturally in the percentage of oxygen preally in the water produce no appreciable effect on the erosion. Exposure to glass lowers the water's erosive ability. The greater the depth at which the lead is immersed in the water, the slower the erosive action. The velocity of the erosion falls as time proceeds; variation in the volume of water does not appreciably affect erosion. For the untreated water the amount of lead eroded varies directly with the area of the lead exposed. Small changes in the area of the water surface produce no appreciable effect on the erosion. Erosion readily occurs in waters which contain no carbon dioxide. Such variations as occur naturally in the percentage of carbon dioxide present in the water produce no appreciable effect on the erosion. The presence of from 1 to 2 per cent. of carbon dioxide causes a sudden change from "erosion" to "plumber solvency." Carbon dioxide dissolves lead more rapidly in the presence of oxygen.

The annual report of the Chief Inspector of Mines shows that the output of coal from the United Kingdom fell from 287,400,000 tons in 1913 to 227,700,000 tons in 1918, which represented the lowest output since 1902. The number of persons employed in the mining industry in 1918 amounted to 1,029,688, and there were 1,487 deaths caused by accidents.



DETAILS OF THE HOLDER IN PLACE.

Oil Burners, Their Function in Furnace Operation

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THE natural advantages of oil fuel have led to the development of many appliances designed to further its use, the most common of which are the so-called "oil burners." In the early days of burning oil it was generally assumed that the most essential requirement was an efficient oil burner, and such opinion is still quite common even though years of development have conclusively proved it to be in error. This assumption is responsible for a general misunderstanding of the real principles involved, and has in no small measure retarded progress in the efficient use of oil fuel. It also has retarded progress in the development of heat-treatment work, largely because there is not proper appreciation of the difference between burning oil, making heat, and properly applying heat to produce a uniformly heated product. The latter is the result actually sought for, everything else being a means to that end.

Generally speaking, there is no such thing in industrial heating as an oil burner in the sense that is considered with a gas burner or the burner of an oil stove or lamp. The very term is a misnomer, because the type of oil burner generally used for furnace work is not an appliance to burn the oil but merely a regulating, mixing, or atomizing valve to inject the fuel and air into the furnace in which it is actually ignited and consumed. The oil itself does not burn; it is a mixture of gas and air which burns. The gas from the oil generally used for fuel is generated under the action of heat at high temperature in the zone of combustion. The air may be supplied through or induced by the burner or in some other manner, and the supply must be regulated in proportion to the fuel to obtain proper results.

Efficiency of Oil Burner

The real efficiency of an oil burner is mainly mechanical as with any other type of spraying, injecting or mixing valve. Some types of burners may produce better results than others in atomizing or mixing, or from an operating standpoint offer greater convenience in cleaning, adjustment, interchangeability of parts, etc., but in general the efficiency is more mechanical than thermal.

The fuel consumption is determined primarily by the requirements of the furnace, and is largely influenced by the method of operation and not by the mechanical details of the burner itself. A great deal of oil is burned successfully on certain types of furnaces without the use of oil burners at all; in others the operation is conducted with air pressures so low that there is practically no atomizing effect from the burner, which serves merely to inject the air and fuel. Excellent heating results, with material reduction in fuel consumption, have been produced with new furnaces of improved design operated with old burners which have been in constant use for over twenty years.

There are some special forms of oil burners, such as torches for brazing, drying, lighting cupolas, spot heating, etc., with provision for maintaining combustion after a gas has been generated by heat and ignited, but these differ from the type generally used in connection with furnaces and designated by the term oil burners. On account of the high temperature necessary for the combustion process and the resultant expansion, contraction, and oxidation, these devices burn away in time. While very well adapted to these specific heating operations, which cannot well be conducted with a furnace, their use is unnecessary and unwarranted for general furnace operation.

A properly designed oil furnace is in reality a combination of a gas producer and a furnace and should be considered as such. The oil generally used for furnaces must be converted into a gas before it can be consumed, and this gasification process is conducted at a temperature too high for ordinary metal to withstand. When the nature of the heating operation and the design of the furnace will permit the gasification of the fuel within the furnace it is desirable that the process of gasification be conducted in a chamber lined with refractory material. This refractory combustion chamber is necessary on account of the temperature that must be employed to actually gasify the oil without deposits of carbon or tarry matter, which naturally follow any attempt to gasify oil at low temperatures. With the oils employed as fuel for furnace operation the high heats are absolutely necessary because it is impossible to form the gas by mixing the oil and air, or by mixing air with vapors of the oil—as in automobile practice—on account of the fact that these oils can be only partially gasified without heat.

Years ago it was thought necessary to convert the oil into a gas and deliver the fuel as gas to the furnace.

This unnecessary complication gradually brought about an appreciation of the fact that, with proper design and operation of furnaces, this work of gasification could be accomplished in the comparatively small space occupied by a suitable combustion chamber. This without any loss of heat outside of the furnace in gasifying the oil, difficulty in starting, and risk or discomfort to the operator by radiation or contact with the gasifying equipment or by the explosion hazard incident to the movement of combustible mixtures through pipes. For these reasons, if the nature of the heating operation and the size of the furnace will permit the use of oil it is better to gasify the oil at high temperature in a refractory combustion chamber within the furnace. But when the nature of the heating operation and the size of furnace make it desirable to employ a gaseous fuel, then that gas should be generated in a central station at a point distant from the furnace, and the gas, whether it be made from coal or oil, should be scrubbed of its tarry matters so that it may be delivered as a clean, cold fuel through a pipe, after the manner of the gas service in cities. In some cases, when the heating operation and manufacturing conditions make a gas fuel desirable, and the gas made from the coal is, by reason of its chemical composition or cost, unsuited to the operation, it is in order to consider the use of gas made from oil. To produce this gas it is necessary that the oil or a mixture of oil and air be injected into a retort heated to the temperature necessary to break up the oil and convert it into a fixed gas, and, in addition, to scrub and cool the gas so that it may be delivered through pipes without forming deposits. This is a true gasification process. Oil and air may be mixed at low temperatures, and if the oil is thoroughly atomized an oil vapor may be formed. However, this is not a gas and cannot be considered as such until it has been subjected to the temperature that is absolutely necessary for true gasification.

There is no one type of burner suitable for all heating requirements. The essential features are that it be properly proportioned to the oil and air or steam pressures available, and so designed that all parts are accessible and permit of close adjustment, cleaning and convenient removal from the furnace without affecting the operation of any other burner served by the same piping system. The position of the burner and arrangement of piping are determined by the design and location of the furnace.

General Rules

The same general rules apply whether the oil burner is of the high pressure type using steam or compressed air, the straight low pressure type using moderate air pressures, or of the combination type.

There are no fixed rules that can be laid down to determine whether air or steam should be used or the pressure at which it should be delivered, because the specific operating conditions of each case, coupled with the design of furnace determine these points The real test is the effect upon the finished material and the total cost of installation and heating operation. There are certain cases t

which steam, even at a higher cost, is well adapted, but the conditions determining the use of steam are based upon the ultimate result in heated product and not upon any combustion condition. When steam is employed it must be as dry as possible, and all lines well covered and trapped to avoid trouble from condensation. Higher pressures are more necessary with steam than air, not because the pressure is necessary for atomizing but because steam at a fairly high pressure will be comparatively dry when expanded at the burner tip. The existence of water seriously affects combustion, the character of the heat in the working chamber, the brickwork of the furnace, and increases the operating cost. The use of steam with a properly designed and operated furnace produces excellent results for certain classes of work, giving soft, even heats. Steam requires more attention than air, but when the operating conditions make it desirable the difference in results is well worth the extra attention. The use of steam is limited to certain types of furnaces by reason of the space required, temperature or other manufacturing conditions and the necessity for inducing all the air required to support combustion.

There is no one air pressure or type of blower suitable for all conditions. The use of air at pressures above 4 or 5 pounds per square inch involves the use of piston-driven compressors or other expensive water-cooled equipment, which are objectionable on account of the high cost of installation and operation. When the furnace equipment is small and compressed air is available, high pressures may be employed to avoid the installation of new blowing equipment; but as a general rule, in a new installation involving machinery to deliver air, the higher pressures are unnecessary.

In many cases when the design of the furnace permits, air at 4 or 5 oz. less per square inch may be employed to maintain clear fires without smoke or carbon deposit; in others, the design of the furnace makes it necessary to employ higher pressures in order to secure sufficient atomization of the fuel. When the very low air pressures are employed there is practically no atomizing effect—the air acting merely to support combustion and assist in the delivery of oil to the combustion chamber—the gasification being almost entirely brought about by heat and the action of the gases within the furnace.

Proper Air or Steam Pressure

The proper air or steam pressure to employ is invariably determined by local plant conditions and furnace design. Each case must be dealt with on its own merits. The purpose should be to adapt the existing air or steam equipment to the furnaces whenever possible so that the question in each case becomes one of delivering heated product at the lowest cost of installation and operation, all things considered.

High oil pressures are frequently employed for mechanical atomization of the oil without the use of air to assist in the atomizing process. This practice is common on marine and other large boilers for steam generation, and has many advantages in cases where the consumption per burner is relatively high, when the oil is of low gravity, and when the requirements for raising steam do not demand the refinement and control that is necessary for modern heat-treatment processes. The advantages of mechanical atomization in such cases do not hold good in the average heat-treatment plant, where, with properly designed furnaces, it is possible to secure the desired results without the mechanical equipment and high pressures necessary in boiler work. In average heating practice the actual pressure is not so important as the uniformity of flow because there is a material reduction in pressure at the needle valve of the burner, so that the pressure of the oil as it enters the furnace is invariably less than the pressure on the line. A slight variation in oil pressure will react more readily on furnaces where the consumption is relatively small than on steam boilers where the pressure on the steam line is generally controlled by a regulating valve.

The combustion of oil is based upon the same principles as those governing the operation of an ordinary coal or gas stove, gas or oil lamp. It is essential that provision be made to regulate the supply of air in proportion to the amount of fuel required to make the proper heat. If this is not done, improper combustion is likely to result, due either to insufficient air for the amount of fuel injected into the furnace or an excess of air beyond that necessary to complete combustion. It may react in a waste of fuel due to the necessity of injecting more fuel than is necessary for the heating operation in order to balance the excess air drawn into the furnace. This is what generally happens without proper control of all air entering the furnace. As the supply of fuel varies from the time of starting until the furnace is up to heat, it naturally follows that means should be employed to effect a corresponding variation in air supply. The burning of oil or any other fuel without provision to regulate every cubic foot of air supplied to the furnace, whether it is under pressure of not, results either in a waste of fuel or in a waste of material through inability to maintain proper heating conditions in the chamber.

Design and Operation

The design and operation of the furnace, and not the burner, whether the burner be for oil or gas, determine the nature of the combustion, the manner in which heat is applied to the heating chamber, the amount of fuel required to heat the material, and the uniformity of temperature throughout the mass to be heated. No type of burner or method of preparing or delivering fuel to a furnace will remedy improper furnace design.

The ordinary oil burner bears about the same relationship to the operation of a furnace that the spraying valve of a carburetter does to the operation of an automobile. It is just as useless to expect good service from a poorly designed or worn-out automobile through the attachment of a good carburetter as it is to expect perfect heating after attaching a good oil burner to a furnace which is not in condition to properly heat material after the heat is generated.

With the automobile, fuel is but one factor in transportation, and for the same reason it is with the furnace but one factor in the production and cost of uniformly heated product. In either case it is the proper combination of all the factors involved that produces the result. Generally speaking, a difference in fuel consumption reflects a difference in the construction or operation of the furnace. Often, however, it is attributed illogically to the burner which performs no other function than that of injecting the supply of fuel and air, the proportions of which are under control of the operator and the effective use of which is determined almost entirely by the furnace design.

Good combustion is not necessarily an indication of fuel economy in the operation of a furnace. It may be possible to show good combustion through analysis of flue gases and at the same time waste fuel in a poorly designed furnace through improper location and size of vents, discharge of gases at unnecessarily high temperatures, excessive radiation through light walls or bottom, lack of control of the gases leaving the furnace, or difficulty of properly applying the heat to the material in the chamber, regardless of how good the combustion may be. It is possible to show good combustion in a furnace lacking provision to control the supply of air by delivering sufficient fuel to balance the air actually supplied. A good fuel gas analysis from such operation is surely not an indication of fuel economy. It is possible to maintain relatively good combustion, with fuel economy, in a furnace that would be well designed from the standpoint of utilizing the heat and yet very poorly designed from the standpoint of properly applying that heat to useful work. This is equivalent to maintaining good combustion in a good engine, the power of which is not applied properly to the driving wheels of an automobile. Unless there is proper heating of material or good results in the form of transportation, fuel economy in furnaces or automobiles is of little value, and unless there is proper design and operation of the furnace or automobile, oil burners or carburetters cannot in themselves produce the results sought for.

There is no one system of burning oil. Practically all the methods employed are substantially alike and the governed by the same principles, which are not changed by variation in mechanical detail. The fundamental factors are the delivery of oil at a uniform pressure, with proper provision to insure oil free from water and foreign matter, absolute control of all the fuel and air entering the furnace,

(Continued on page 441)

The Use of Chain Drives on Grooved Drums

This Article From "Practical Engineer" Emphasizes the Importance of Studying Lead of Chain Before Going Ahead With Layout of Drive, in Order to Minimize the Wear on the Chain and Drum

By G. H. Roberts

THE lead of a chain or rope from a grooved winding drum is a matter which, in the opinion of the author, is seldom given the full attention and consideration that it should have, with the inevitable result that when haulage takes place much more wear and tear occurs on the chain, drum, and fair-lead than would actually be the case if greater thought had been given to the original lay-out of the arrangement. While admitting that site conditions or requirements do not always lend themselves to the ideal scheme, as referred to later, nevertheless a better compromise between theory and practice could have been applied to innumerable saving in wear and tear and considerable saving in wear and tear effected, with its consequent increase in life of the various parts directly affected.

Before dealing with the different chain leads, it may be advisable to briefly refer to certain features in regard to the drum itself, and also the chain. The diameter of the drum has much to do with the useful life of the chain, and, although there appears to be no predetermined or recognized ratio between the two—as there is in deciding the minimum diameter over which a steel rope should work—still it should be kept as large as circumstances will permit. If too small a diameter drum is introduced with heavy loads, the links will be subjected to considerable distortion in their attempt to adjust themselves to the surface of the drum barrel.

Fig. 1 shows in a slightly exaggerated sense the tendency of the horizontal links to bend when stressed in working. Theoretically this condition will always occur, no matter how large the diameter of the drum or sheave, but the possibility of fracture in the link through this cause will practically disappear if reasonable sized drums and short-link chain are used in conjunction with heavy loads.

Again, the length of the drum may have something to do in settling its diameter, as the whole should be so designed that any possibility of the chain coiling up on itself is obviated. A long barrel is objectionable, as will be observed later; this, however, should not be cut so fine that no latitude is provided for an additional coil or two—this should always be allowed for, even though the need appears unlikely to arise when the machine is in use. Two or three "dead" turns are frequently provided for at the fixed end of the chain; these, as the name implies, never pay off, their duty being to relieve the stress on the anchorage and prevent any irregularity at the beginning of the haul. The "live" coils are those whose total length are equivalent to the possible travel of the load. The length of the drum is therefore made up of three distinct parts, as indicated on Fig. 8. With regard to the grooving, care must be taken that the running clearances are no more than actually required; if the channel is made too wide, an insufficient seating is obtained for the links, and they are likely to bind in the groove, as shown in Fig. 2. There is always a tendency for a chain to do this, due to the twisting effect which occurs when winding begins. Cast grooved wheels are the greatest defaulters in this respect. In Fig. 3 are indicated four of the most common chain lead arrangements, where a fair-lead wheel is introduced to deflect the chain in the desired direction. These are enumerated as follows :—

(A) Horizontal lead with pull downwards.

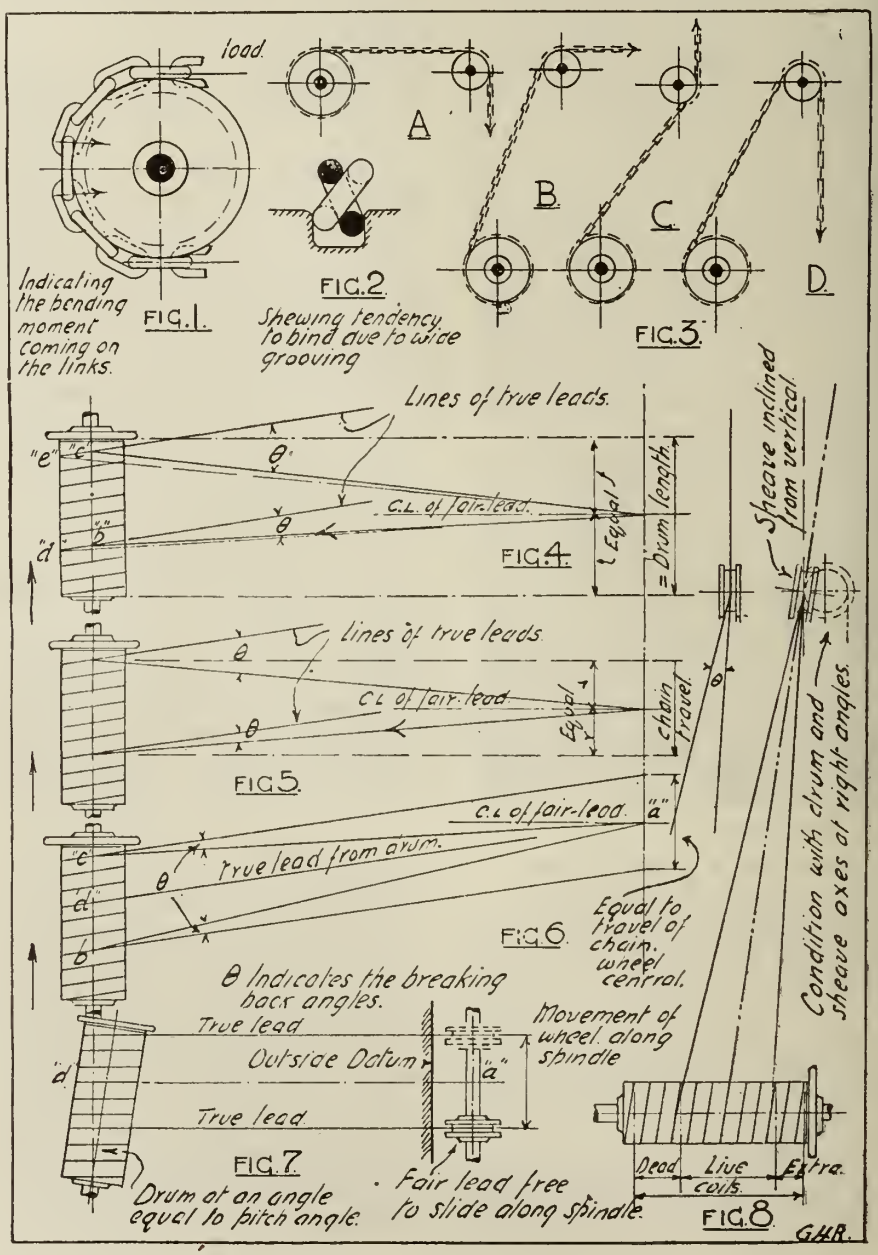
(B) Inclined lead with horizontal pull.

(C) Inclined lead, chain deflected upwards.

(D) Inclined lead with downward pull.

There are, of course, other arrangements, but the foregoing will be sufficient for the purpose of this article.

With diagram A it will be found that in numerous cases the relative positions



in plan of drum and lead wheel will either be as Figs. 4 and 5. What is the effect on the chain and grooving ? In Fig. 4 the fair-lead has been placed practically central with the total length of barrel, winding being in the direction indicated by the arrow head. Assuming that, say, three "dead" turns have been allowed, then at the beginning of the haul the chain follows the line a b, and at the end of the full travel will be as a c. These, as will be readily seen, do not represent the true lines of force, these latter geing respectively a d and a e, and to which the chain is continually trying to align itself, but prevented from doing so by the grooving in the drum. The detrimental effect of this is at once apparent, the resultant pressure increasing as the chain works its way along the drum, as will be observed on reference to the diagram in question. As a result, excessive friction and wear to the groove sides and the links is constantly taking place, and the heavier the load the greater will be the adverse conditions under which the machine will have to work. In Fig. 5 an improvement is made. Here the lead wheel occupies a position central with the total travel of the chain along the drum. This reduces the breaking-back angle o, and consequently lessens the wear and tear on chain and grooving. Scheme 6 represents the best practical solution with a fixed lead sheave, i.e., a sheave limits of chain travel along the barrel having been settled, the distance between is halved and a line produced parallel to the helix line of the pitch angle, as a d, point a being the first point of contact with the guide sheave. If points a, b, and c are now triangulated, it will be observed that the breaking-back angle at start and finish is considerably reduced, while at mid-travel a perfectly true lead is obtained. The working conditions on drum and sheave are therefore very much improved by this arrangement. Where the fair-lead can have freedom to slide along its spindle, and the lead is also free to adapt itself to varying horizontal positions, then a very satisfactory arrangement is arrived at, and one which can be further improved if the spindle of the sheave is moved round until it is at right angles to the chain lead, as indicated. This considerably reduces the running friction between sheave and spindle, the only wear now occurring being due to the sliding action along the shaft. If such an arrangement of guide sheave is applied to the former examples, it will undoubtedly help matters, but never entirely eliminate the breaking-back of the chain as it winds on or off the drum. The three diagrams just described are drawn to the same scale, so that they indicate proportionately the different conditions, the pitch angles being increased for the sake of comparative clearness.

Fig. 7 illustrates the practical application of Scheme 6, wherein the winding drum is shown moved round until the lead wheel spindle is parallel with the outside datum.

For various reasons it is not always practically convenient to apply the last scheme on the skew, as indicated, because, as a general rule, the lengthwise centre line of the machine must be at right angles to the loading face, taking an ordinary runway cat-head hoist as a case in point. In order to meet such requirements and still maintain arrangement No. 6, it is adjusted until the centre line a d is in the desired position, the angle through which it is moved being, of course, equal to the pitch angle, as shown in Fig. 7. The drum now occupies the angular position, but this, in the majority of cases, will not be found a practical objection ; generally the other parts of the gear and supports can readily be arranged to meet this particular feature.

Considering now the three remaining leads B, C, and D, it will be noted that the scheme shown, Fig. 6, still retains superiority over the other two, although with an inclined or vertical lead to sheave; skewing the drum on its base a small amount does not help matters much, but if it is turned round until the axes of drum and sheave are at right angles to each other, then the conditions illustrated in Fig. 6 with fixed sheave are obtained, with the added advantage that no breaking back on the sheave groove occurs. This relative arrangement of drum and wheel, as will be conceived, is equally applicable whether the chain is led upwards or horizontal or has a downward pull. With parallel axes there will always be a certain amount of breaking back on the fair-lead sheave; this is unavoidable. But with a fairly long lead between drum and sheave this does not amount to much, and is to all intents and purposes practically the same in all the cases referred to. The fixed sheave could, of course, be inclined to suit the central lead, if so desired, but no real practical purpose is served in doing so unless the chain has to follow such paths as indicated by the chain-dot line in Fig. 8, and then circumstances must decide if such a modification is necessary.

Too often conventional methods are blindly followed, with the result that Schemes 3 and 4 are continually perpetrated ; the introduction of arrangement 5 may disturb previous routine, but it is a good thing to create a precedent sometimes that has distinct advantages.

The Randfontein Central Mine, Transvaal, is going to install what, it is claimed, will be the largest electric winders in the world. They are to be capable of raising net loads of five tons each from a depth of 5,000 feet at 4,000 feet per minute. The Crown Mines winders, which have hitherto held the record, can raise eight tons net some 3,500 feet at the same speed. An American firm is likely, according to the "South African Mining and Engineering Journal," to be successful in tendering for the electrical part and a British firm for the mechanical part.

OIL BURNERS, THEIR FUNCTIONS

Continued from Page 439

regulation of the air in proportion to the fuel required, control of the gases within the furnace, the application of the heat generated to a design of furnace that will permit of a uniform distribution of heat not merely in the furnace when empty, but to the material in the furnace when it is loaded to normal working capacity. There is nothing in the nature of the fuel or of any appliance employed to burn it that will make up for the lack of these essentials, which form the basis of all heating operations regardless of the fuel or method of burning it.

A vast supply of sodium sulphate—Glauber's salt—is represented by the deposits of some of the lakes in Siberia. Lake Marmyshansk alone contains about 2,600,000 tons, and altogether there must be over 7,000,000 in the various lakes.

There is a proposal on foot to institute an aerial service for the transportation of passengers and merchandise between the United States of America and the Island of Jamaica, via Havana and Santiago in Cuba. An aviation station will be constructed at Miami or at Key West, in Florida. The service will, it is anticipated, most probably be started before the summer.

The Australian grass tree, locally known as the "blackboy," say the "Engineer," grows to a normal size of from 7 feet to 10 feet. The tree contains gum in large quantities, and amongst other by-products extracted under treatment are tars, free from harmful acids, tarpaulin dressings, rope and sanitary tars, lacquers—such as Japan black—steam refrigerating pipe lagging, paint for ironwork that requires stoving at high temperatures, stains and paints, phenol, benzol and alcohols coke, potash, and pyrogeneous acid. Although until recently no attempt has been made to utilize this tree commercially, a company has now been formed to extract and market its by-products.

The iron mines of Bell Island, Newfoundland, are among the most remarkable in the world, says "The United Empire. There are two areas, both rich in iron ore, one of which has an annual output of 700,000 tons, and is credited with a supply which would be sufficient to last at this rate for nearly 250 years; while the other, with an annual output of 600,000 tons, is believed to contain enough ore to last for about 3,300 years. Newfoundland may, therefore, be regarded as having an almost inexhaustible supply of iron. The mines are conveniently situated near the coast, where ships of 7,000 tons can be loaded in six or seven hours. The iron is then sent to Nova Scotia for smelting and refining processes.

WELDING AND CUTTING

Lessons on the A.B.C. of Good Welding

This is the Third Lesson by an Authority on the Subject — The Remainder of the Series Will Follow

By W. B. Perdue*

IN the training of welders, my policy has always been, "Let them master some of the difficult problems first." This tends to discourage those who lack the initiative necessary to carry the work to success, while those who have the broader vision are encouraged by the fact that such welds as they are able to make excel in appearance and efficiency those made by the average journeyman.

Consequently the student is never permitted to waste time in fusing together the edges of thin steel plates without the addition of filler rod. The operator who learns to weld properly can do this without instruction. He must, sooner or later, learn to weld with rod—the sooner the better.

Having acquired sufficient proficiency in the manipulation of the rod and torch to enable him to execute a neat "ripple" 24 inches long on the surface of a steel plate, the student should begin practise in welding together thin plates six or eight inches in length. The muscular practice necessary to acquire proper and symmetrical movement of the torch must be continued. How long? For several weeks—at least until any movement of the left hand or any diversion of thought does not affect the regular swing of the torch.

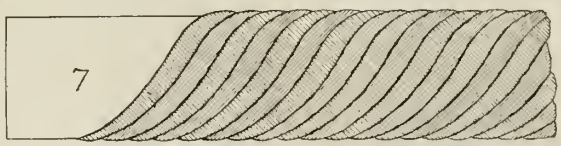


FIG. 7.

The accompanying illustrations are intended to assist the beginner in mastering two very important points, viz.: Penetration and contraction.

Method for Practice

Having prepared and set up the pieces in accordance with the suggestions given in the illustrations, the operator is ready to begin practice. The edges of the bevel are fused together at the right; then material added by plunging the filler rod into the melted pool thus formed and vigorously stirring it about; the completed weld being a series of extremely thin layers of metal thoroughly fused together.

Note particularly the capillary curve at the bottom of Fig. 7, caused by the flowing together of the melted metal from the sides of the bevel. A common fault is to allow the flame to get behind the melted metal, instead of keeping it ahead of the sloping fill in the position indicated by Figs. 2 and 3.

Failure to keep the flame on the sloping side of the fill prevents proper fusion of the edges and results in the melted metal from the rod being blown over them and adhering thereto without forming a proper bond. When this happens the weld will be defective.

There is a very simple reason why this happens with the beginner. In starting a new fill he does not bring the flame far enough to the right. When he notices that there is a gap that is too low he promptly carries his torch further to the right. Instead of producing the desired result, this melts down the fill previously formed, and, instead of moving the flame rapidly to the left and getting ahead of the melted metal to blow it back, he keeps trying to add rod in the flat hole which keeps continually growing larger. As soon as he learns to keep his flame to the left of the melted pool the metal will automatically pile up in proper form.

When welding has commenced it should be carried on continuously. Even in the thickest sections of metal it is necessary to execute the successive fills with sufficient rapidity to hold the whole mass at a bright white heat. In practice the experienced operator performs these motions in such rapid succession that they can not be noticed by the observer. In most cases the operator himself is not aware that a successive series of fills are being made, and is therefore unable to properly describe the process to the uninitiated.

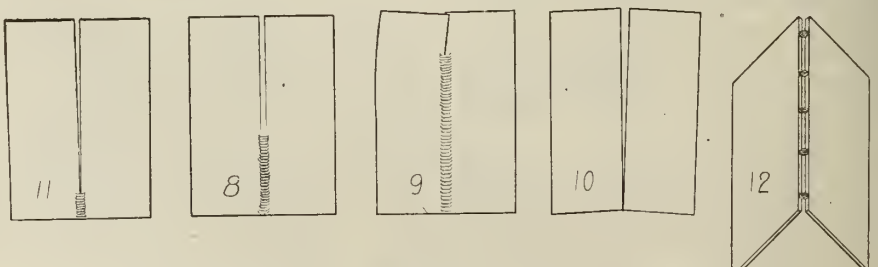
Checking Up Results

There is no good reason for lack of penetration. As soon as a weld is fairly started the reverse side should be examined. If proper penetration has not been secured the weld should be broken, the edges rebeveled, and a new trial made. The beginner should inspect his practice pieces at least every inch until he secures proper penetration without difficulty.

As soon as two parts are welded together with apparent good penetration they should be broken apart by gripping them in a vice at the line of welding and hammering against the upper plate on the same side as the reverse side of the weld.

If all those who have out their shingles as "Professional Expert Welders" would but condescend to make such tests occasionally, and to profit thereby, all complaints about the oxy-acetylene process would cease to be heard.

The selection of tips of the proper size deserves more attention than is generally given thereto. The average



VARIOUS EXAMPLES OF SHRINKAGE OF CONTRACTION IN WELDS.

*Director Welding Department, Healds Engineering School, San Francisco, Cal., also manufacturer of Perfectype acetylene generators, torches, and regulators.

welder either fails to get the metal in the vicinity of the weld hot enough to properly fuse together, or attempts to use a tip so large that he can not "stay on the job," and burns or oxidizes the metal in and near the weld.

The incandescent white cone should be brought very close to the metal in the weld. In welding steel the extremity of the cone is brought into direct contact with the metal and produces melting. This is because the melting point of this metal is very high. In welding cast iron the point of the flame is held extremely close but not in contact with the metal. The flame is also held quite close to aluminum, but at a greater distance for welds in copper, brass, and bronzes. Methods of handling these metals will be more fully explained later.

Burning the Metal

At this point it seems necessary to explain that "burning" the metal is not the effect of heat, but that the burning of any substance is caused by the chemical combination of itself and oxygen. Steel is often "honeycombed" by the burning out of a portion of its carbon content by the action of oxygen. Certain operators are able to execute a fairly good weld in those steels in which the percentage of carbon is quite low, but have little or no success with medium or high-carbon steels.

"Burning," as applied to steel, means the chemical combination with oxygen of the iron, or some of the elements with which the iron is alloyed. It may be caused by:

1. The use of a torch which supplies an excess of oxygen to the flame.

2. Improper manipulation of the torch, which does not protect the vicinity of the weld from attack by the oxygen of the air.

3. Improper distribution of heat in the parts to be welded, whereby violent reactions are set up in the zones between the heated and the cold areas.

The ability to exercise better control over the last mentioned items is but another instance of the superiority of the acetylene over other methods of welding.

From the foregoing it follows:

1. That the weld should be executed without any appreciable change in the composition of the parts welded.

2. That the filler rod should be of similar analysis to the parts welded, or sufficiently so to avoid the blending of metals, the physical properties of which may set up internal strains within the weld.

3. That the torch which does not stir the gases into perfect and uniform mixtures can not produce a sound weld.

The ordinary torch drives an excess of oxygen through the welding flame. This, in turn, drives before it a portion of partially-burned acetylene in the form of carbon. To partially absorb this carbon many welders use "Norway" or "Swedish" wrought iron wire, which contains very little carbon. In this manner it may be possible to produce a "sound" weld and at the same time "kill" the metal on either side.

In the selection of filler rod American products of known chemical analysis and the use of low carbon steel rods free from impurities of phosphorus and sulphur for welding steel products will be found most satisfactory. The welder who thoroughly familiarized himself with the methods of regulating and testing the flame, given in the previous chapter, will be able to note any minute change that may be effected by the refrigeration of the gases in passing through the regulators. This, with proper manipulation of rod and torch and the selection of proper equipment, will insure the production of welds of maximum quality. It is a matter of common occurrence for a student, soon after taking up the trade, to produce welds in alloy steels which, after proper heat treatment, will withstand a tensile pull of from 60,000 to 150,000 pounds.

It is needless to state that these results can not even be approached by the use of any form of iron wire, or by any other known process of welding.

Contraction or Shrinkage

All metals are affected by heat. Its action produces an increase in volume; that is, a piece of metal when heated has greater length, breadth and thickness. Experiments have proved that most metals continue to expand until they reach the plastic state, just before they reach the melting point. In cooling they contract, or decrease in volume, until at normal temperature they assume a normal size.

Any attempt to prevent this action on a welding job would be futile. If clamps strong enough could be secured the distortion of the part welded would result, and some trouble would arise from its use. Many welding jobs are of complicated and irregular pattern, the various parts of same varying in thickness, therefore some study must be made of the effects of contraction and expansion, which will be more fully dealt with later. Setting up a weld in such manner as to secure proper alignment of parts should become a matter of pride. The welder is not a mere machine—he is an individual whose success depends upon the development of his own ingenuity.

If, while making the weld, he ignores the fact that contraction must result from its cooling, one of three things will occur:

1. The work will break in the weld or at some point affected by the shrinkage of the metal in the weld.

2. The work, if it does not break, will be distorted and the alignment of its parts destroyed.

3. The weld may not break and the strength of other parts may prevent visible distortion, but there will be an internal strain, which will weaken it and may cause it to break after it has been placed in service. This is most disappointing, and in many cases expensive, since all labor of dismantling and replacing is, in such cases, unnecessarily performed.

Various results of contraction, due to the cooling of the metal in the weld, should be carefully studied, the process reasoned out and proper means thought out for the prevention of such unpleasant results.

Practice on thin pieces, not over a foot long should be continued until the proficiency of the operator enables him to reduce the angle of separation to one-fourth inch or less per foot. The ability to execute a weld in such a manner that the angle of separation is reduced to a minimum is an accomplishment well worth cultivating.

AUTOGENOUS WELDING RULES

The following rules have been adopted by the Committee on Standards for the purpose of preventing the use of autogenous welding for purposes for which it is not well adapted. These have been sent to the regional directors with instructions to direct all roads to observe the rules in the construction or repair of locomotive boilers, so that any failures which may have been caused or contributed to by unrestricted or improper use of autogenous welding may be prevented.

The Committee of Standards, after carefully investigating the use of autogenous welding in connection with the construction and repair of locomotive boilers and fire boxes, has in the interest of safety and efficiency adopted the following rules:

1. Autogenous welding will not be permitted on any part of a locomotive boiler that is wholly in tension under working conditions; this is to include arch or water bar tubes.

2. Staybolts or crown stay heads must not be built up or welded to the sheet.

3. Holes larger than 1½ inches in diameter when entirely closed by autogenous welding must have the welding properly stayed.

4. In new construction, welded seams in crown sheets will not be used where full-size sheets are obtainable. This is not intended to prevent welding the crown sheet to other fire box sheets. Side sheet seams shall not be less than 12 inches below the highest point of the crown.

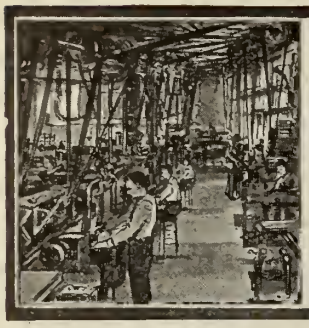
5. Only operators known to be competent will be assigned to fire box welding.

6. Where autogenous welding is done the parts to be welded must be thoroughly cleaned and kept clean during the progress of the work.

7. When repairing fire boxes, a number of small adjacent patches will not be applied, but the defective part of the sheet will be cut out and repaired with one patch.

8. The autogenous welding of defective main air reservoirs is not permitted.

9. Welding rods must conform to the specifications issued by the Inspection and Test Section of the United States Railroad Administration for the various kinds of work for which they are prescribed, which specifications will be issued later.



DEVELOPMENTS IN SHOP EQUIPMENT

HIGH POWER RADIAL DRILL

Joseph T. Ryerson & Sons have placed on the market what is known as their Ryerson-Conradson High Power Plain Radial Drilling Machine. This machine is equipped with twin motor drive and differs materially from the usual design. Drilling, tapping, boring and reaming can be performed with equal efficiency.

The machine has only four shafts and sixteen gears, without sacrificing the range of work possible to be performed. The spindle and driving shafts are all contained in a single cast box of rigid construction. Only spur gears are employed, eliminating bevel gears and the consequent trouble of keeping them aligned.

The head mounted upon S. K. F. ball bearings, travels on the top surface of the arm and is held in place by a plate which is guided by parallel V's on the under side of the arm. This plate serves various purposes, chief of which is to keep the head in perfect alignment with the arm. These features eliminate all torsional strains on the arm as well as overcoming the difficulty of keeping the spindle properly aligned when the usual side mounting is employed. Cross traverse of the head is carried on ball bearing rollers provided with eccentric shafts which permit adjustment for wear.

Spindle Drive.—A reversible motor is mounted on the head and directly connected to the drive shaft by means of a self-aligning, internally splined coupling. This drive shaft carries a pinion and gear, the pinion being cut integral with the shaft and both run in mesh at all times with clutch gears of the conical friction type. The friction cones are mounted on a spacing rod and a movement, up or down, from the neutral position engages the high or low speed clutch gear. Four other gears are keyed to this clutch shaft and drive the spindle sleeve over change gears on an auxiliary shaft. The auxiliary shaft is splined and the change gears are shifted by two shifter yokes which, in turn, are actuated by interlocking levers, making it impossible to engage two sets of gears at a time. Each end of the auxiliary shaft carries a pinion, permanently in mesh with bronze bushed gears on the spindle sleeve. A jaw clutch engages one or the other and affects the drive. The spindle has two keyways cut its entire length and is driven by two inserted keys in the sleeve. By shifting the levers, all of which are on the head, the operator engages the entire speeds.

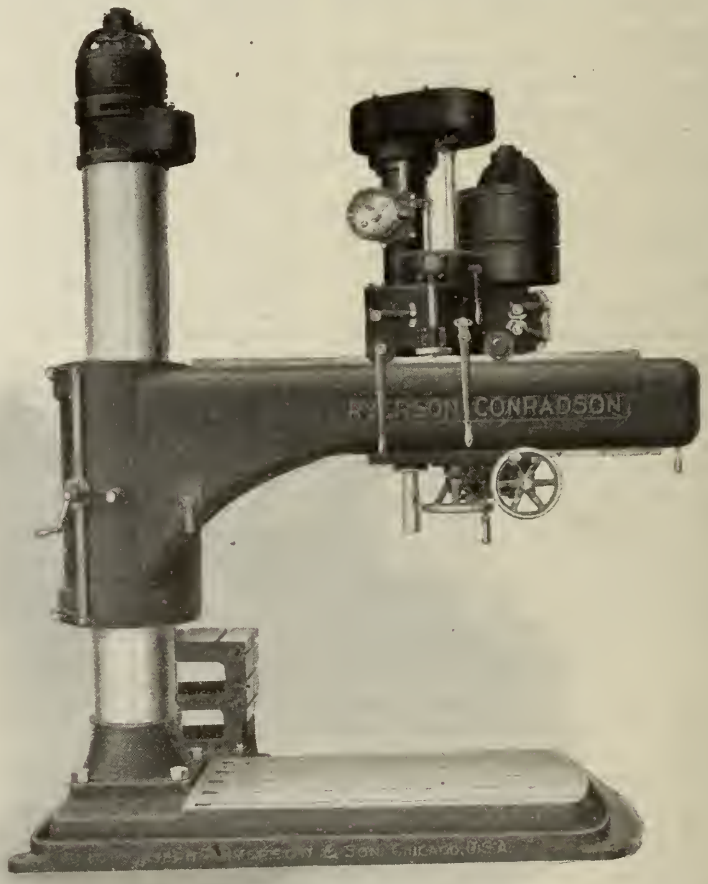
Sixteen spindle speeds, ranging from 9 to 310 R.P.M. in practical geometrical progression, are obtained in this manner.

For tapping, the motor is reversed, which is instantaneous and entirely eliminates all shock in the transmission. All gears are cut from solid alloy steel forgings and heat treated. The head is completely enclosed and all gears run in oil, a gauge indicating the level to the operator. All shafts run in S.K.F. ball bearings, which results in a low power consumption.

Feed.—Two series of 8 feeds each, ranging from .005 in. to .078 in. and from .023 in. to .370 in. per revolution in practical geometrical progression are provided. Feed changes are secured by a cone of gears in connection with a dive key controlled by a feed indicating dial and also by engaging in upper or lower position a clutch controlled by a lever on the hand wheel.

All feeds are disengaged instantly by a friction clutch on the hand wheel shaft, which is actuated by a lever conveniently located on the head. By the use of an automatic or adjustable stop, feeds are disengaged when the desired depth is reached.

For raising and lowering of the arm an independent motor of the elevator type is mounted on top of the column. A pinion is keyed directly to the armature shaft and drives a reducing gear on the elevating screw, the thrust of which is taken up by a ball bearing. This composes the entire elevating mechanism, doing away with the shock of engaging gears, which, in course of time, produces a noisy machine. Limit switches are provided and consist of standard



GENERAL APPEARANCE OF THE DRILL.

units. These are equipped with a bracket carrying a roller which opens the circuit when struck by the sleeve of the arm.

The design of arm is of box section type, heavily reinforced and capable of reducing to a minimum all sagging or springing when high speeds and feeds are employed. The arm revolves on ball bearings and is carried by a sleeve of exceptional length, to which the elevating nut is attached. Means are provided to clamp the arm securely to the column, with equal pressure at the top and bottom simultaneously. Pneumatic clamping device can be furnished if desired. The centre of the spindle is arranged to travel on a radial line, passing through the centre of the column.

The column is a hollow cast iron cylinder of more than usual dimensions, firmly bolted to the base. An internal web is cast in the column in the line of strain, greatly increasing the rigidity. The base is practically of box section, stiffened by traverse and longitudinal ribs which are of the inverted "T" type bearing on the foundation and supporting the base throughout its entire length and width. Surrounding the base is a deep flange which materially stiffens it and serves as an oil retainer. The main base has an extension which carries a box table of generous proportions with an accurately planed top and side surface which are provided with large "T" slots.

Machines are furnished with the necessary main driving and elevating motor, both of the reversing type. These are operated by control apparatus consisting of reversing contactors, auxiliary units, two knife switches properly mounted in a steel cabinet, and two master control switches for any desired standard current and voltage. In addition, an overload relay and under voltage release for main driving motor only is supplied. The former of these two items is not part of the regular equipment and is considered an extra.

AUTOMATIC DRILL GRINDER ..

The Bellevue Industrial Furnace Co., Detroit, Michigan, have placed on the market their line of Automatic Drill Grinders. This style grinder was designed and constructed with the idea in mind to both economize on time and material. They state their claims in the following manner:

To our belief it is impossible for anyone to repeatedly sharpen a drill to perfection by hand, no matter how good a mechanic they may be. Very few people have eyesight good enough to see the proper point on a drill without the continuous use of the gauge, which also takes a great deal of time.

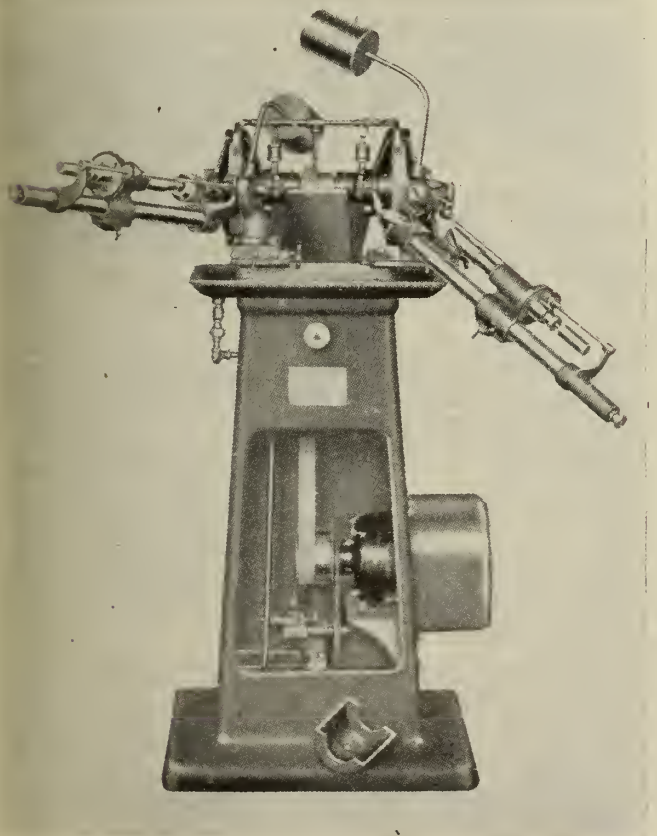
The automatic drill grinder can be easily operated by a boy or girl.

The grinder can be equipped with carriages for left hand drills as well as for right hand drills. A two, three, four or more lip drill can be sharpened on the machine. An index is provided that sets the lips so that each lip is ground perfectly, and a gauge for setting drill in carriage insures that no more stock is taken from drill than is necessary. Lathe centres can also be ground quickly and accurately.

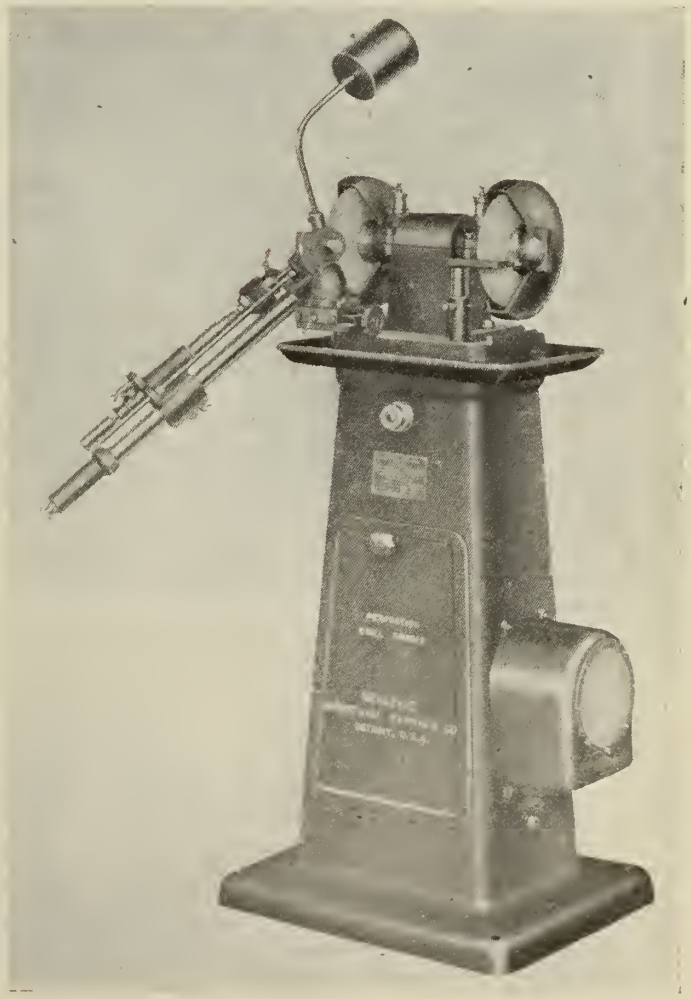
Another interesting feature of the machine is that it grinds on the circumference of the wheel instead of on the side. This results in greater wear and longer life to the wheel. When the wheel needs trueing a diamond or other sharpening tool is placed in the chuck and brought forward to the gauge, as is a drill for grinding. The carriage is then operated across the circumference of the wheel by a cross feed and the wheel is trued exactly and without waste.

The machine is driven by an electric motor contained in the pedestal and is equipped with two-step pulleys so that two speeds are available. It can also be driven from the line shaft.

Manufacturers are said to be turning their attention seriously to air cooling for the engines of small cars. Autocar sees in the possibilities of air cooling a chance for the British manufacturer to get ahead of foreign rivals, for in no country has more careful research work been done and more progress made in the design of air-cooled cylinders during the war.



VIEW SHOWING MOTOR MOUNTED IN PEDESTAL.



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Do Mergers Increase Prices?

THE matter of the big steel-shipping merger, now completed, came up in the House at Ottawa this week, and the question was put whether the Government intended to stop it.

"This new merger," said one member, "is capitalized at nearly a billion, and is almost consummated. The question is whether the Government should not take steps to stop this huge merger, which will most likely result in an increase in rates."

It would be interesting for this member of the Dominion House, seeing that the Canadian merger is primarily a steel concern, to look over the trend of prices of steel on this continent.

He might be surprised to learn that Canadians—and we depend largely on United States for steel—have bought at a much lower rate from the United States Steel Corporation than from any of the independents and smaller mills.

The United States Steel Corporation adhered to the regulated schedule of March 21, 1919, and is still very close to it.

The independents, on the other hand, are selling steel at a stiff advance over the March 21 schedule.

The U.S. Steel Corporation has been, and is yet, the one agency that has stood in the path of a runaway steel market.

There seems to be an opinion that the word "merger" implies a gouging of the people. In the steel trade the evidence does not bear this out.

There is right now a concrete example in the steel trade of this continent. In fact it is so marked as to lead to the belief that the Steel Corporation is too low or the independents and premium mills too high—and in this connection it is well to remember that the Corporation is neither passing up dividends nor going into liquidation.

New York Gets After The Gouger

SEVERAL meetings have been held at different points to protest against the prices of potatoes, sugar, etc.

These meetings afford a good chance for people to state their case. Misery likes company, hence the sessions are well attended.

Farmers sold lots of potatoes in the fall for $2 and $2.50 per bag. That price represented the finished article. All the necessary labor had been expended. The difference between that price and the present $7 and $8 per bag represents the amount of gouging that has been going on since.

It is also a monument to the inability of the Government officials to put a crimp in the profiteers.

This week three dealers in New York City were arrested for profiteering. That is exactly what they call it.

They don't throw up a smoke screen and call it the high price made necessary by excessive production costs.

The first two arrested in New York were charged with selling 5,000 pounds of sugar at 25½ cents a pound, which they were alleged to have secured for 14 cents. The third sold at 22 cents and made 8 cents a pound. Bail is set at $1,000 each.

The jail is a mighty good place for the gouger and the financial glutton. Too bad that lenient officials admit that bail applies in all such cases.

Chance To Start Right

THE Secretary of the Navy at Washington is offering a lot of vessels for sale at bargain prices. That's what he means, although the official document puts it that they are "appraised low for immediate sale."

There seems to be a very good opportunity for some of the malcontents to start a brand new war. They could start out with buying a cruiser. There's a nice one offered for $225,000. No guns go with it, but these can easily be secured.

Then there are patrol boats, yachts, tugs, etc., in fact, everything except first-class battleships.

If you are not satisfied with present conditions, step right up and buy a fleet.

Where Good Times Hinge

THE stock market has been having several convulsions and near-convulsions during the past few days.

Shivers have gone up and down the financial spine of speculators, and they have predicted blue ruin and bread lines.

Fortunately the bread and butter of the country does not depend on the scares and shivers of the stock market.

The coming and going of May 1st without an industrial upheaval has more to do with our good or bad times than all the shoutings and scares the stock market can boast.

An idea of the amount of money the people of New York City are spending for amusement can be gleaned from figures made public by William H. Edwards, Collector of Internal Revenue, which show that the theatres of Manhattan collected $783,891.42 in war taxes during January and $695,626.70 in February. The tax on all theatre tickets is 10 per cent., so Mr. Edwards' figures indicate that the income of Manhattan theatres during January was $7,838,914.20 and the following month it totalled $6,956,267. The collector declared his office checks up all box office receipts and that the auditors have not discovered any attempt to cheat Uncle Sam.

In 1919 Ontario had fire losses of $9,500,000. These were manufacturing places, 447 fires at a loss of $2,275,000; stores, 1,008 at $1,900,000; dwellings, 5,695 at $1,650,000, and farm barns, 748 at $1,100,000. Officials say that fully half of these were from pure carelessness. We are certainly paying a fancy price for letting our ears grow long.

NORTON COMPANY OF CANADA BEGIN OPERATING AT HAMILTON

BUILDING operations on the Norton Company of Canada, situated at Hamilton, have been completed, nd the management of the concern is eady to ship orders to the Canadian rade by May 15.

The plant has a complete equipment or the manufacturer of grinding wheels nd the entire handling of the wheels rom the mixing to shipping will be done t this new centre.

The main building is three stories high ith a single floor space 50 x 100 feet nd will be connected with a kiln build- ng of two stories in back, the floor di- ensions of which are 16 x 128 feet. he entire plant has a modern construc- ion built of Hamilton pressed bricks ith steel sashes throughout. It was tarted on November 4, 1919.

A number of expert workmen and effic- ncy heads from the Worcester plant are n charge of the several departments nder the direction of the manager, R. . Douglas. The personnel includes rank Ryan, head of Methods; A. J. louncey, time-keeper; Albert Jornson, eneral foreman of Mixing, Abrasive nd Bond Supply; Oscar Wahlberg, head f Shaving and Cutting; M. Anderson nd Carl Forsman, in charge of Kiln; J. loglund, in charge of Balancing, Bush- ng and Truing; William Landquist, in harge of Grading, Inspection and Stock; S. H. Healey, in charge of Packing, Shipping and Traffic, and J. Jelicka, in charge of Silicate and Plastic Departments. W. H. McNeilly from the electric furnace plant, situated at Chippawa, Ontario, will take full charge of the office detail.

The Norton Company of Canada is a separate corporation, and has been capitalized at $500,000.

MR. R. C. DOUGLAS
Manager Norton Co. of Canada, Hamilton, Ont.

NEW THINGS IN MACHINE TOOLS

The Rieker Instrument Company, of hiladelphia, are placing on the market line of precision levels for general ma- hine shop use. Accuracy is enhanced y the special heat-treatment of the ases, a feature that prevents warping.

* * *

A machine for the twisting of flat ron bars, hot or cold, has recently been onstructed by the Wallace Supplies lanufacturing Company, of Chicago, ll. A special arrangement has been pro- ided for offsetting the stock in such a anner as to leave the vertical edge par- llel with the flat side after the twist as been made.

* * *

The Golburn Machine Tool Company, f Franklin, Pa., are now equipping heir motor-driven heavy-duty drilling nachines with alternating current elec- ric control. The use of this electric ontrol of the spindle has been in oper- tion on these drills equipped with direct urrent motors, but the development of he control for use with alternating mo- ors will increase the scope of these ma- hines.

* * *

The O. B. Herlth Manufacturing Com- any, of Hartford, Conn., are making ad- ustable parallel sets that are claimed to e accurate to within 0.0001 of an inch. set of these parallels comprises five adjustable blocks, ranging from 1-8 inch to 1 1-8 inch maximum thickness. They are primarily intended for the use of tool-makers, and can be used in combination with precision blocks for jig and fixture gage construction.

* * *

An improvement that provides means for controlling the length of the arc on electric arc welding apparatus, has been developed by the Electric Arc Cutting and Welding Company, of Newark, N.J. In the change that has been effected the control of the arc is in the hands of the foreman. When once the length is set it is not possible for the operator to alter the same. Provision is also made for the regulation of the voltage automatically, so that the factor of safety is a feature of its construction.

* * *

Goddard & Goddard Company, of Detroit, Mich., are now making a special inserted tooth milling cutter with the blades of high speed steel and the bodies of heat-treated alloy steel which has an elastic limit of about 105,000 pounds. The blades have multiple notches in the rear, so that when worn, they can be taken out and re-set, moving them latterly from one notch to another, thus providing long life. They are especially adapted for work of ten inches diameter and upwards.

A machine designed by Spencer Brown and manufactured by Franklin Products, Inc., of Syracuse, N.Y., provided for the mechanical rubbing down of flat and curved surfaces in paint shops and automobile plants. The machine has two feet of kickers, operating in opposite directions at each stroke, the power being supplied by compressed air. The same materials as in hand rubbing are used and the total weight of the device is about 20 pounds.

* * *

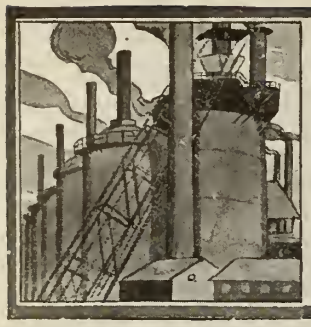
The Black & Decker Manufacturing Company, of Baltimore, are now making two sizes of portable air compressors for factory and garage use. The smaller of the two, No. 46, has a capacity of 6 cu. ft. per min., and an operating pressure of 200 pounds per sq. inch. This machine is adapted primarily for the inflation of tires direct, and will inflate a 44x 10-in. from flat to 140 pounds in 6 minutes. The other size, No. 412, is intended for the blowing out of motors and machinery, paint spraying, sand blasting, etc., and has a capacity of 12 cu. ft. of free air per min., operating at a guaranteed pressure of 75 pounds.

* * *

An interesting design of punching and bending machine has been placed on the market by the Armstrong-Blum Manufacturing Company, of Chicago, Ill. It is of structural steel construction. The legs are so mounted on the angle iron base pieces that adjustment can be made for any desired depth of throat or width of sheet within the range of the machine. The tool carrying bars, which hold the punches and dies are 40 inches long, and these tools may be placed anywhere along the bars to suit the work being done. Hand-operated eccentrics are used for operating the punches and forming dies. The machine has a capacity of 3-8 inch holes in a 3-8 inch plate.

* * *

Additions to the machine tool lines that the Alfred Herbert, Ltd. are placing on the market are the Atkins slotting machine, the Herbert hexagon turret lathe, and the Gardner crank-pin turning machine. The slotting machine has a capacity stroke of six inches and a work diameter of 30 inches. The ram is of the swivel type and the tool holder of universal clapper design. The machine has a net weight of 2,050 pounds. The turret lathes are built in three sizes, the largest taking work up to 3½ inches in diameter and 42 inches in length. Driving pulley runs on ball bearings and requires no counter-shaft. All gears run in oil and the bearings are lubricated automatically or by the continuous feed system. The Gardner crank-pin machine is designed for rapid and accurate machining of crank pins. Special chucking facilities provides for the drive through the rib next to the crank being turned, the previous turned portion being supported within the hollow spindle, thus preventing whip in the shaft. These machines are made in three sizes, with spindle bores of 16 inches, 22 inches, and 21 inches, respectively. Operating requirements call for 8, 14 and 20 horsepower.



MARKET DEVELOPMENTS

Now Feeling the Pinch of a Starved Market

Canadian Plants Find It Harder to Keep Up the Output Because Material is Uncertain—Prices for Sheets Are What Can be Secured

THE passing of May 1st without a serious disturbance in the metal working trades has been received with some satisfaction by the trade in general. A year ago developments were badly interfered with when the strikes of molders, machinists, etc., took place.

Manufacturers in several lines are facing the serious situation of not being able to get material enough to keep their plants in operation. The absence of a few parts holds back the finished article, and throws the whole system of assembling or building out of joint.

Steel mills are not doing any better in the way of delivery. There are many influences working against them, the last of which is the switchmen's strike, which has a number of shipments tied up and practically lost.

One manufacturer from Nova Scotia arrived in Toronto a day or so ago. He had been all through the warehouse district on the way up here, and was going on to Chicago to see what he could gather up in the way of black sheets. He had to have them to keep his plant going. He got only a few tons here, nothing in proportion to what he wanted. One warehouse got an offer of several hundred tons of black sheets in New York this week, the price there being 10.20. Brought here under present conditions it would mean a resale price of over 13c. The size of this price, which of course is a broker's, can be judged from the fact that at the outbreak of the war black sheets were selling at Pittsburgh mills around 2 cents per pound.

Machine tool dealers report a good inquiry in this district, but are experiencing the old trouble of very poor delivery. Some of the dealers who have just returned from the States found that makers there are sold out for weeks and months to come, and they received little encouragement of getting the Canadian allotment advanced.

The scrap metal market is dull and stagnant. Reds and yellows are not allowed to cross the border, and the market is better here for iron and steel. The wanted varieties, such as stove plate, heavy melting and cast iron, are scarce and the volume coming in is very meagre.

MAY DAY BROUGHT HARDLY ANY TROUBLE IN MONTREAL

Special to CANADIAN MACHINERY.

MONTREAL, Que., May 3rd.—While May-day brought forth its usual demonstration from certain elements in the industrial world, the celebration in this district was not of a disturbing character, and the day passed much quieter than was expected, there being considerably less interest displayed this year than last. During the past month there appeared to be a hidden influence on the activity of business which, in some quarters, was due to the possible developments in labor circles at this particular period of the year. The general quiet nature of the laboring classes here has removed the pressure to some extent and affairs have taken a turn that promises well for the season's developments. The after results of the American railroad troubles are now coming to the fore, and while the strike is virtually over, the effects are still apparent on all sides. Delivery of material is showing improvement but the inconvenience in this respect is still a retarding factor. The abnormal conditions of the past winter and the continual demand for all classes of steel, despite the high costs, has prevented the mills from keeping pace with the requirements of the trade. A feature of present activities is the comparatively heavy buying in America for export to Europe. This situation increases the difficulty of Canadian buyers in getting supplies in from the States. Dealers here are still handicapped in the matter of warehouse stocks, as surplus material can usually find a ready market, with buyers waiting to take the overflow. While conditions are expected to improve steadily from now on, it is not likely that the present month will be marked with any great advantage to the consumer on this side of the line. The recent announcement of the organization of the British Empire Steel Corporation is encouraging news to Canadians, but this venture will provide no immediate cure for existing ailments.

Normal Business in Machine Tools

There is little of exceptional interest in the present movement of machine tools. The business is quite normal with wide distribution on varied lines with no pronounced activity in any particular direction. American purchases are still affected by the exchange rate, but this factor is of less influence now than during the early part of the year. Delivery is still uncertain and used machinery maintains a prominent position in local trading. Supplies continue to move freely but difficulty is frequently experienced in locating the materials and equipment needed by the customer. Prices in all cases are well maintained.

Scrap Remains Quiet

The movement of scrap just now is not very bhisk, for the reason that many lines in constant demand are very hard to obtain, the consequences being a very strong market with few heavy sales recorded. The requirements for machinery scrap is still pressing and supplies of this character will bring record prices at the present time. It would seem that every available atom of machinery scrap has been gathered in and distributed to the foundries, as only current accumulation is now in evidence. The weekly transactions show a fluctuating market but prices on the average are much the same as last week, with non-ferrous, if anything, a little easier.

NOTHING BETTER IN DELIVERIES YET

And Some Canadian Firms Are Finding It Serious Enough to Keep Operating

ORONTO.—The fact that the first of May has come and gone, and that there has been very little trouble in this district, has made a better feeling in all circles touched by iron and steel and the other metals. Of course it can do nothing to make the supply of material any better. That is still bad—away off.

Several of the principals who are represented in Canada are looking for a change in representation in this country. One dealer, according to his own statement to CANADIAN MACHINERY, was approached and asked to take over the handling of a certain line. He replied that he did not think he could give any better service than the firm that already had the agency, as he happened to know that one of their salesmen has been pushing it steadily for some time. but could get no encouragement from the head office in the way of delivery. The firm replied again urging that the change be made. To bring things to a head the dealer wired asking if they could give prompt delivery of a number of machines. The reply came back that they would be placed in their allotment schedule, and one of the machines would be sent as far ahead as as February 8th. 1921.

The firm that wants to get into the market just now must be ready to give something like service in the way of delivery. Otherwise it does not make much difference who acts as their agents in the Canadian territory. That, at least, is the opinion of the agent who was approached to take over a line already handled here.

The Steel Market

Some of the offices here are not booking at all in steel lines. They are out of the market in everything that it means. Steel makers are finding it harder, in this country, to keep operating, especially if they are depending on United States for coal. The strike on the railways has things badly tied up for them. It is a serious matter where the operation of a battery of by-product coke ovens is concerned, as the closing of them down would mean a very serious loss. Steel making plants have been operating under heavy pressure for some time, and the finishing departments have been able in nearly all cases to keep ahead of the blast furnaces.

It is a fact that there are no prices for many of the lines that are stable in the jobbing trade. The price is simply what the material can be secured for. The market has become so drilled out that the man who holds is in a position to name his price, knowing that he can get it. Here are some of the things that one hears in the warehousing trade this week:

"We have an offer here now from a jobber in New York, who wants to know if we are interested in black sheets at 10.20 f.o.b that city. It would mean a re-sale price of between 13 and 14 cents."

"We had a stove maker in here the other day from Sackville, N.S. He had been all through the East trying to get some sheets to keep his plant in operation. He had secured little or nothing, and was working through this way, and finally on to Chicago. He got a little in Toronto, but it was only a drop in the bucket in comparison with what he wanted to keep him going."

Some of the firms throughout the country are in a bad way for want of material. Some of them face cancellation of orders because they cannot get the material to turn out the business. One jobber in Toronto got in a shipment of boiler tubes the other day. There were some three cars in the lot, and it was supposed that there would be plenty for some days. In the lot were 200 tubes of one size. The first half hour they were on the siding here, one manufacturer came in and wanted to know if they would let him have 700 of this size. So that's how long a stock lasts now.

The deliveries for material that has been railed at the mills and allotted to this district are very poor. The strike has tangled many of the lines up to a point where they do not know where cars are. It may take some days before this can be straightened out. When things do get loosened up there may be a deluge in some lines, but there is hardly a danger of any of the users getting any more than they want.

A Dull Scrap Market

Prices stay where they have been for some time. Especially for the red and yellow metals the market is dull and slow. Shipments cannot be sent to United States now, and anything that is sold has to be marketed in Canada or shipped abroad.

There is no temptation to ship iron or steel scrap to United States, under the present conditions. The market in Canada is stronger than in the States, especially for the three leading classes, stove plate, heavy melting steel and cast scrap.

There is no disposition to buy anything more than is necessary for present needs.

POINTS IN WEEK'S MARKETING NOTES

The passing of May 1 without any serious labor disturbances in Canada is regarded as a very favorable sign.

—

The switchmen's strike is playing havoc with many deliveries that have been expected in Canada and which are now long overdue.

—

Stove makers from the far-Eastern part of Canada have been in Toronto during the week trying to secure sheets. They have been through all the warehouses from here to the East, but succeeded in securing very little.

—

The scrap metal market in Canada is dull. Reds and yellows are not allowed across the border, and the market at home is better than in U.S. for scrap iron and steel, but the supply is very limited.

—

Offices in Canada of American steel mills are not booking business as a general thing. They are sold out too far ahead. Neither are they making promises as to when they will open their books.

—

Toronto machine tool dealers who have returned from U.S. points report that many of the big makers are sold out for months to come, and that the chances of Canadians getting more of their allotments are not very bright.

BIG STEEL MERGER NOW COMPLETED

List of Companies Given Out, to Which Others May Be Added at Later Date

MONTREAL.—The new British Empire Steel Corporation, the largest consolidation in the British Empire, and second only to the United States Steel Corporation, has now emerged from the nebulous stage into that of definite existence, as an imperial organization. Capitalized at $500,000,000, this Canadian consolidation of steel, coal and transportation company associating the iron and coal deposits of the Atlantic seaboard of the Dominion with the steel making experience and financial resources of Great Britain, is now an accomplished fact, according to Colonel W. Grant Morden,

Authoritative details as to the terms on which the three principal component parts of the British Empire Steel Corporation, Ltd., are to enter the new consolidation, subject to shareholders' approval, are as follows—Dominion Steel Corporation $95, par value in 7 per cent. non-cumulative preferred stock of the new corporation, plus $40 in common stock, to each holder of $100 of the security known marketwise as "Iron, common." Canada Steamship Lines, Ltd., $100 par value in 7 per cent. non-cumulative preferred stock, plus $45 in common, and Nova Scotia Steel and Iron Co., Ltd., $90 par value in 7 per cent. non-cumulative stock, plus $40 in common.

Details as to the terms upon which the enterprises of lesser importance are included are as yet unavailable, but will be communicated to the shareholders of each company within the next few days.

Companies Included

Included in the consolidation are the following: Dominion Steel Corporation and its subsidiaries; Nova Scotia Steel

and Coal Co., Ltd., and its subsidiaries; Canada Steamship Lines, Ltd., and its subsidiaries; Canada Foundries and Forgings, Ltd., and its subsidiaries; Maritime Nail Co., and its subsidiaries; Collingwood Shipbuilding Company, Ltd.; Port Arthur Shipbuilding Company, Ltd.; Halifax Shipyards, Ltd.; Davie Shipbuilding and Repairing Company, Ltd.

To the above list may be added several other enterprises, negotiations with which are now in progress.

MORE THINGS TO INTERFERE WITH THE STEEL DELIVERIES

Special to CANADIAN MACHINERY.

PITTSBURGH, May 6.—Blast furnaces and mills are getting along decidedly better than a week or two weeks ago, as to both production and shipments. The improvement is due not so much to striking railway workmen going back to their jobs as it is due to the employment of various expedients, particularly the movement of solid trainloads of freight, and the help of an increasing number of volunteers who are helping to break the strike.

The Youngstown district was affected the most by the rail strike, practically everything being closed for a time, but now about one-half the blast furnaces in the district are operating, and steel production is nearly if not quite one-half of normal. In the immediate Pittsburgh district production is but slightly curtailed, hardly by as much as 20 per cent. Shipments are reduced by a much larger percentage, but the steel at any rate has been made and some time it will go forward, probably to the embarrassment of some customers who will get too much at one time. East of Pittsburgh the furnaces and mills are operating fairly well, while there is no trouble in the south. In the Chicago district, including Gary, operations are at 50 per cent. or more of normal.

The trainload movement that has helped so much has been chiefly of coal and coke. Even single merchant blast furnaces have received coke by the trainload. The blast furnaces operating are not all running at capacity. One merchant furnace interest, for instance, which has ten furnaces scattered at various points is operating all ten, but with slack blast, so that the pig iron output is only about 75 per cent. of capacity. This procedure is regarded as better than banking furnaces entirely at intervals.

The worst feature of the rail strike is that nothing very definite, certainly nothing very vigorous, is being done to settle it. The wage commission at Washington, only set up after the strike started, is at work but there are no definite reports of its making progress.

Taking the iron and steel industry as a whole, operations are curtailed by the rail strike by not more than about 20 per cent., while shipments of finished steel are curtailed by a larger amount. Just before the rail strike the production of finished rolled steel in the United States was at the rate of fully 110,000 gross tons per working day, so that while it is literally true that hundreds of thousands of tons of finished steel are piled in mill warehouses and yards and are loaded on cars which either remain on mill sidings or have gone only a few miles to a convenient public siding, this does not mean such a great deal after all.

Consumption Curtailed

There is a great deal of curtailment in operation of factories that consume steel, arising from the rail strike. Of all materials, coal seems to be the greatest of the restrictive influences, but some factories lack other materials and not a few of course have run out of steel itself. It appears, however, that there were more consumers having a 30 days' supply, or thereabouts, of steel than was generally assumed. The automobile factories have long made it a rule to carry 30 to 60 days' stock of all their materials, but for several months past it has been impossible to follow the rule in all cases. Some stocks of steel, however, had evidently been built up. There have been various reports in the past week of the rate at which the automobile factories in Detroit were running, the reports bein of a 15 per cent. operation up to a 50 per cent. operation. There is much motor trucking of the finer forms of steel such as wire and strips, classes of steel the lack of which may hold up the consumption of much larger quantities of other descriptions of steel that may be in stock. Only a few pounds of strip steel, for instance, are required per automobile, and it is not remarkable that this material is being trucked in five-ton loads.

The Foundries

It is being pointed out that while the

THE MACHINE TOOL TRADE IS LEARNING WHAT SELLING MEANS

Never make the mistake of thinking that haberdashers and shoe merchants are the only ones who study the likes and dislikes of the dear general public. Far from it.

The footwear merchant who finds that a good line on which he can make money will not sell at $7, immediately puts them up to $12 or $14 and clears the thing with a flourish.

The same thing happens in shirts. A bit of a garment that decorates a man's carcass from the neck down to a few decimal points above the shanks may go begging for an owner at $2, while at $5 men will scramble to get inside of the thing, and manly bosoms will swell and heave in a $5 front that would have been flat as a well-flattened pancake in the same article at $2.

And so it is that the machine tool trade has caught the spirit of the thing. Profiteers? No. sir. Students of human nature and all the foolishness to which it is heir. That's all.

Well, that's simply by way of a preamble. Now for the facts. One Toronto firm of machine tool dealers had a used machine that had been taken from a good Ontario shop on a deal or something. It was overhauled and a few new parts put in where wear had shown. The mechanics in the shop where it was gone over were quite sure it would do a lot of work yet, and so the thing was listed along with a good many other tools at a very fair price. The dealer simply took the amount he had allowed, and added a figure to cover the work put on it in his shop. The trade got the list with this machine on it. But did they come around to lead it away to their premises? They did not.

The old tool simply sat on its haunches in the stock room while spiders did fancy work on it, and the dealer wondered why under the sun he had ever opened the kitchen door and let the cripple in.

Then he started to operate on the line of the shirts and the boots. All of a sudden the old tool that had been with him long enough to answer to its first name, took on a new value. The dealer wouldn't tell just how many per cents. he tacked on the price, but the supposition is that there were quite a numerous quantity of 'em.

A new list goes to the dear trade, and the old tool is on at the new price. Folks didn't want him at ten, so see if he'll be wooed and won at twenty. Say, friend, it's a fact it went with a real bang. Three or four after it, and the man who got it pleased beyond measure, and congratulating himself that he is a keen man and a real purchasing agent.

average foundry usually carries a good stock of pig iron, the foundries lately have been running into their higher-priced contracts, at above $30 or perhaps even above $35, and have been less willing to stock the higher priced iron than they were in the case of the cheaper iron. Coke has been so scarce for months that the average foundry has not been able to accumulate much stock. Thus some foundries are running out of pig iron, while others are running out of coke.

In the past few days there is an improved movement of foundry coke from the Connellsville region, but only in certain directions, chiefly east and north. There is fairly free movement from the Connellsville region clear through to Buffalo via the Pennsylvania, while the Baltimore & Ohio, in conjunction with the Buffalo, Rochester & Pittsburgh, has been running solid trainloads of furnace coke through to Buffalo. As a result of this the Buffalo furnaces are doing fairly well in the matter of operation, much better than the valley furnaces.

A fair estimate is that by this time the consumption of foundry pig iron is being curtailed by the rail strike more than is the production, there having been a gradual change in this respect, as furnaces began to operate better after feeling the first effects of the strike, while consumers have been running out of stocks of pig iron or coke.

When Connellsville coke shipments can be arranged at all, prices done are substantially the same as in the open market prevailing just before the strike, $11 to $12 for furnace coke and $12 to $13 for foundry coke, per net ton at ovens.

Quiet Markets

The pig iron and steel markets are quiet, practically stagnant, and while the condition is usually ascribed to the rail strike there is no doubt that other influences are also at work. Buyers are indisposed to make commitments for very extended delivery, particularly deliveries running over the second half of the year, while early deliveries, at least in steel products, cannot be secured except at very heavy premiums.

One little item that may be the forerunner of more important news is that some merchant bars and structural shapes have been sold by independent mills at 2.35c and 2.45c respectively, these being the Steel Corporation or Industrial Board prices. Previously all the independents were demanding higher prices, generally 2.90c to 3c for bars for delivery in a few months, and 3c to 3.10c for shapes. The sales just made were exceptional, to large buyers and for extended delivery, but there may be more of this sort of thing because of the disinclination of buyers to pay premium prices for late deliveries.

DEMAND GREAT IN THE OLD COUNTRY

And Advancing Prices Have Not Had the Effect of Keeping Down the Orders

Sheffield.—The steel trade of the country has gained enormously in strength during the past month, and, contrary to expectation, the recent drastic price advances have failed to check the expansion of buying and demand in the slightest degree. In fact, the rate of progress has been greater since that revision than before. Demand has swollen to an extent which a few years ago would not have been deemed possible. Although it has been growing rapidly since the end of last year, there is no indication that the movement is nearing its end. Unfortunately, there is no expansion of production, so that the actual turnover of the trade remains much the same, while arrears of deliveries are accumulating. A large proportion of the business offering receives no attention, simply because it is impossible to handle it. Every steel maker is assured of the disposal of the whole of his output for the present year at least, and at good prices. Large consumers would be only too ready to cover their wants until the end of the year at the current high rates, but no maker is prepared to risk the possibility of further rises in costs. The consequence is that the day of firm quotations is a thing of the past. The trader can no longer pursue the safe old custom of covering his sales with contracts for materials.

PIG IRON TRADE

The railway situation is still interfering seriously with pig iron trading. In the Pittsburgh district all efforts are bent on getting shipments through, and for the time being buying and selling are secondary considerations. The same may be said of conditions in the Chicago district, although in this case some buying has been done for second and third quarter delivery. This has been done at the price of $42 for the base grade foundry iron, Birmingham. Spot iron is bringing about $1 higher than this, Birmingham. Buffalo has to report better sales during the past week than have been made for some time, the aggregate running into nearly 15,000 tons. This includes basic, which grade made nearly half of the total, and was sold generally at $45. The base grade of foundry iron sold at $45, while a lot of malleable brought $46.25. Production is improving. Reports from New York show a strong market with demand for both domestic and export iron good. The base grade of iron at Pennsylvania furnace is now at a minimum of $46. Furnaces are not offering iron for export, fearing that they will not have enough to supply their customers in the domestic field. The situation in New England, according to Boston advices, is still limited to spot transactions, and the total sales do not reach more than 2,000 tons. Spot iron has been sold at a price which means $63 delivered.

MONTREAL NOTES

The Lachine Canal was opened for the season on May 1, when the Lady Grey passed up on her way to accelerate the breaking up of the ice at the lower entrance to the Soulanges Canal. The repairs to the Lachine Canal that have been carried on during the past month, were speeded up so that the water was turned in on the last night in April. Regular traffic is now possible on the canal.

Roy M. Wolvin, president of the Dominion Steel Corporation, will probably be the first chief executive of the new $500,000,000 British Empire Steel Corporation, now in the course of consolidation. It is expected that D. H. McDougall, president of the Nova Scotia Steel and Coal Company, will likewise be given an important position on the administration force. Plans are being formulated so that employees will participate in the success of the company and closer co-operation is hoped for. Within the course of a few years the activities are expected to be equal, or even surpass, anything of a similar character now operating throughout the world.

One of the most interesting meetings held this season at the Montreal branch of the Engineering Institute of Canada was that of the last one in April, and practically the final one of the season. The paper read and discussed was on the attainment of greater efficiency in tramway service. The subject was dealt with in a very able manner by D. E. Blair, superintendent of rolling stock of the Montreal Tramways. The speaker brought forth some very strong arguments, supported by diagrams, showing that fewer stops on existing routes would react to the betterment of present conditions and would benefit both the public and the company. A notable feature of the evening's meeting was the presentation of the Gzowski medal to Phelps Johnson and G. H. Duggan. G. F. Potter was jointly honored with one of these medals, but owing to his absence the presentation will be made at a later date. These medals are presented for the most valuable contribution to engineering literature during the year, and the committee this year decided in favor of the triple paper on "The Design, Manufacture and Erection of the Superstructure of the Quebec Bridge." Still another feature of the meeting was the presenting of gold badges as honorary members of the institute to Sir John Kennedy and Lord Shaughnessy. In expressing his thanks, Lord Shaughnessy said that during a great part of his career he had been actively associated with engineers, and had lived in an engineering atmosphere, had consulted with and taken the advice with practically every class of engineer, and while he had never been in training as an engineer, he had nevertheless learned very much from the profession.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$42 40
Lake Superior, charcoal, Chicago	57 00
Standard low phos., Philadelphia	50 00
Bessemer, Pittsburgh	43 00
Basic, Valley furnace	42 90
Toronto price:—	
Silicon, 2.25% to 2.75%	52 00
No. 2 Foundry, 1.75 to 2.25%	50 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 50
Steel bars, base, Toronto	5 50
Iron bars, base, Montreal	5 50
Steel bars, base, Montreal	5 50
Reinforcing bars, base	5 00
Steel hoops	7 00
Norway iron	11 00
Tire steel	5 75
Spring steel	10 00
Band steel, No. 10 gauge and 3-16 in. base	6 00
Chequered floor plate, 3-16 in.	9 40
Chequered floor plate, ¼ in.	9 00
Staybolt iron	9 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	4 00
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 90
Small shapes under 3"	3 62

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points	O.L.	L.C.L.
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

	Gross. Montreal	Toronto
Lake copper	$25 00	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	72 00	75 00
Spelter	12 00	12 25
Lead	11 50	12 00
Antimony	14 50	14 00
Aluminum	34 00	35 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$ 7 25	$ 7 25
Plates, ¼ up	6 50	6 50

PIPE—WROUGHT

Price List No. 44—April, 1920.

STANDARD BUTTWELD S/C

	Steel Black	Steel Galv.	Gen. Wrot. Iron Black	Gen. Wrot. Iron Galv.
⅛ in.	$6 50	$ 8 50	....	....
¼ in.	5 13	7 26	$ 5 43	$ 7 56
⅜ in.	5 13	7 26	5 43	7 56
½ in.	6 84	8 42	7 27	8 84
¾ in.	8 45	10 58	9 03	11 16
1 in.	12 50	15 64	13 35	16 49
1¼ in.	16 91	21 16	18 06	22 31
1½ in.	20 21	25 30	21 59	26 68
2 in.	27 20	34 04	29 05	35 89
2½ in.	43 00	53 82	....	....
3 in.	56 23	70 38	....	....
3½ in.	71 30	88 32	....	....
4 in.	84 48	104 64	....	....

STANDARD LAPWELD S/C

	Steel Black	Steel G lv.	Gen. Wrot. Iron Black	Gen. Wrot. Iron Galv.
2 in.	$30 90	$37 74	$34 60	$41 44
2½ in.	45 34	56 16	51 19	62 01
3 in.	59 29	73 44	66 94	81 09
3½ in.	73 14	90 16	82 34	99 36
4 in.	86 66	106 82	97 56	117 72
4½ in.	0 98	1 23	1 24	1 49
5 in.	1 15	1 44	1 44	1 73
6½ in.	1 49	1 86	1 87	2 25
7 in.	1 94	2 43	2 42	2 90
8-L in.	2 04	2 55	2 54	3 05
8 in.	2 35	2 94	2 92	3 51
9 in.	2 81	3 52	3 50	4 21
10-L in.	2 61	3 26	3 25	3 90
10 in.	3 36	4 20	4 18	5 03

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.

4½" and larger 50%.

4" and under, running thread, 30%.

Standard couplings, 4-in. and under, 30%

Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds. Montreal	Toronto
Copper, light	$15 00	$14 00
Copper, crucible	18 00	18 00
Copper, heavy	18 00	18 00
Copper wire	18 00	18 00
No. 1 machine composition	16 00	17 00
New brass cuttings	11 00	11 75
Red brass cuttings	14 00	15 75
Yellow brass turnings	8 50	9 50
Light brass	6 50	7 00
Medium brass	8 00	7 75
Scrap zinc	6 50	6 00
Heavy lead	7 00	7 75
Tea lead	4 50	5 00
Aluminum	19 00	20 00
	Per Ton	Gross
Heavy melting steel	18 00	18 00
Boiler plate	15 50	15 00
Axles (wrought iron)	22 00	20 00
Rails (scrap)	18 00	18 00
Malleable scrap	25 00	25 00
No. 1 machine east iron	32 00	33 00
Pipe, wrought	12 00	12 00
Car wheel	26 00	26 00
Steel axles	22 00	20 00
Mach. shop turnings	11 00	11 00
Stove plate	26 50	25 00
Cast boring	12 00	12 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜-in. and less	10
Carriage bolts, 7-16 and up	Net
Coach and lag screws	25
Stove bolts	55
Wrought washers	45
Elevator bolts	Net
Machine bolts, 7/16 and over	Net
Machine bolts, ⅜-in. and less	15
Blank bolts	Net
Bolt ends	Net
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square, blank	add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 50
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	25 and 5
Sq. and hex. hd. cap screws	22½
Rd. and fil. hd. cap screws	plus 17½
Flat but. hd. cap screws	plus 30
Fin. and semi-fin. nuts up to 1-in.	20
Fin. and Semi-fin. nuts, over 1 in., up to 1½-in.	10
Fin. and Semi-fin. nuts over 1½ in., up to 2-in.	Net
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$60 00
Open-hearth billets	60 00
O.H. sheet bars	76 00
Forging billets	56 00-75 00
Wire rods	52 00-70 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 70
Cut nails	5 85
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 35½
British Manila rope	0 28
New Zealand hemp	0 28
Transmission rope, Manila	0 47
Cotton rope, ¼-in. and up	0 88

POLISHED DRILL ROD

Discount off list, Montreal and Toronto ..... net

MISCELLANEOUS

Solder, strictly	$ 0 40
Solder, guaranteed	0 43
Babbitt metals	18 to 70
Soldering coppers, lb.	0 62
Lead wool, per lb.	0 16
Putty, 100-lb. drums	8 30
White lead, pure, cwt.	20 00
Red dry lead, 100-lb. kegs, per cwt.	16 50
Glue, English	0 40
Tarred slater's paper, roll	1 30
Gasoline, per gal., bulk	0 35
Benzine, per gal., bulk	0 35
Pure turp., single bbls., gal.	3 60
Linseed oil, raw, single bbls.	3 00
Linseed oil, boiled, single bbls.	3 03
Sandpaper, B. & A.	List plus 43
Emery cloth	List plus 37½
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin, "D," per lb.	0 14
Borax crystal and granular	0 14
Wood alcohol, per gal.	2 70
Whiting, plain, per 100 lbs	2 75

CARBON DRILLS AND REAMERS

S.S. drills, wire sizes	32½
Can. carbon cutters, plus	20
Standard drills, all sizes	32½
3-fluted drills, plus	10
Jobbers' and letter sizes	32½
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	net
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus 20 to	40
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At warehouse]

Rounds and squares	$7 base
Hexagons and flats	$7.75 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	60	75
Class B	27	37
Class C	18	27

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 8 50	$ 9 50
Sheets, black, No. 10	8 50	9 00
Canada plates, dull, 52 sheets	8 50	10 00
Can. plates, all bright	8 60	9 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	11 00	....
Fleur-de-Lis, 28 B.W.G.	10 50	....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28.	....	....
Premier, No. 28, U.S.	11 50	10 50
Premier, 10¾-oz.	11 50	10 90
Zinc sheets	16 50	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	29 50
1¾ in.	31 50	30 00
2 in.	30 00	30 00
2¼ in.	35 00	29 00
2½ in.	42 00	37 00
3 in.	50 00	48 00
3¼ in.	.. ..	48 50
3½ in.	63 00	51 50
4 in.	85 00	65 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	24½
Palacine	27½
Machine oil, per gal.	43½
Black oil, per gal.	18½
Cylinder oil, Capital	82
Cylinder oil, Acme	70
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	$2 60
Union thread cutting oil, antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil, bbls., net	13½

BELTING—No 1 OAK TANNED

Extra heavy, single and double	10%
Standard	10%
Cut leather lacing, No. 1	2 75
Leather in side	2 40

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 60
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	09
Pumice, ground	06
Emery glue	30
Tripoli composition	09
Crocus composition	12
Emery composition	10
Rouge, silver	60
Rouge, powder, nickel	45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE

XXX Extra	.24	Atlas	.20
Peerless	.22½	X Empire	.19½
Grand	.22½	Ideal	.19
Superior	.22½	X Press	.17½
X L C R	.21		

Colored

Lion	.17	Popular	.13
Standard	.15	Keen	.11
No. 1	.15		

Wool Packing

Arrow	.35	Anvil	.22
Axle	.28	Anchor	.17

Washed Wipers

Select White	.20	Dark colored	.09
Mixed colored	.10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades ... 15%

ANODES

Nickel	.58 to .65
Copper	.38 to .45
Tin	.70 to .70
Zinc	.18 to .18

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6 x 4 base	45 00	44 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 75	$14 50
Sheets, 3½ lbs. sq. ft.	10 50	14 00
Sheets, 4 to 6 lbs. sq. ft.	10 25	13 50

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .23
Acid, hydrochloric	.03¼
Acid, nitric	.10
Acid, sulphuric	.03¼
Ammonia, aqua	.15
Ammonium, carbonate	.20
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.14
Copper, carbonate, annhy	.41
Copper, sulphate	.16
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.08
Nickel carbonate	.32
Nickel sulphate	.19
Potassium sulphide (substitute)	.42
Silver chloride (per oz.)	1.25
Silver nitrate (per oz.)	1.20
Sodium bisulphate	.11
Sodium carbonate crystals	.06
Sodium cyanide, 127-130%	.38
Sodium hyposulphite per 100 lbs	8.00
Sodium phosphate	.18
Tin chloride	1.00
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated

British Firms Should Study Canadian Field

Big Mistake to Take Too Much for Granted—The Customs Regulations and the Preferences of the Trade Here Should Also be Consulted by the British Makers

THE Canadian Association of British Manufacturers and their representatives, since their organization in Canada, and particularly since their affiliation with the Federation of British Industries, a world-wide organization, have become more and more a factor in assisting trade between Britain and Canada. British firms wanting representatives in this country are depending largely on the advice of this society, and British firms having inquiries for material from various parts of the world are sending many of them to Canada to see what can be done here in the way of looking after the business. So it will be seen that the organization works both ways, helping British trade to get on the Canadian market, and helping Canadian firms that have material or goods for sale to place them to advantage.

Mr. George A. Marshall, president of the Canadian Association of British Manufacturers, and also a member of the Supreme Council of the Association, discussed the problem of marketing British goods in Canada with a representative of CANADIAN MACHINERY. Mr. Marshall has been in the importing business here for some years, and is in a position to have seen mistakes that have been made, and also to offer to the British manufacturer who has not yet cultivated the Canadian market some worth-while advice.

About Representation

"What would you consider," inquired CANADIAN MACHINERY, "the most desirable method for a British firm to try and get established in the Canadian field?"

"In the first place, the British manufacturer should seek to understand the Canadian market. He should not take too much for granted, as it is very easy to go wrong at the start from this cause. It is this way — a Canadian understands the territory and the conditions of trade here, but may not understand the British lines, while a man from the Old Country house will have a good knowledge of the lines but no knowledge of the territory and what it wants. It seems to me that it is easier to get a man who knows the territory to become familiar with the lines. Large British firms should seek to establish their own branches here. Roughly speaking, I should say there are three points from which to work in Canada, and of these I would put Montreal first, Toronto second, and Winnipeg third. Remember, I am speaking of the lines in which I am interested, the steel, machinery and metals. Montreal is the point for steel and heavy lines, but I believe Toronto is the best commercial city in the country. Montreal has the advantage in the way of having the ocean liners coming up there a good part of the year, and this cannot be overlooked. Of course, a manufacturer would have to judge his locations by the lines he has to sell. He might want to cater to Western trade entirely, and to do that Winnipeg to my mind is the point."

Stocks or Samples

Speaking of stocks here, samples and catalogues, Mr. Marshall continued: "The placing of a new line before the Canadian trade is a big problem, as the territory is large and would take a long time to cover. Some people seem to have the idea that they can do it all by catalogues and circulars. They cannot. As far as possible I would advise that the representative seek to personally know his customers or prospects. The British manufacturer should seek to select in the first place a paper that specializes in his line, and I consider that one of the best ways of reaching the people he is desirous of influencing. Successful advertising is a combination of all the forces that can be brought to bear on the field. British manufacturers would be well advised to send goods out to their agents here on consignment. Of course the average British firm would say to-day that they cannot send out material on consignment, but I am speaking of the cultivation of the Canadian field by a British firm for years to come."

Financing the Business

"Anything in the matter of financing the business that the British firms should know?"

"There should be a change made in the system of cash against shipping documents," replied Mr. Marshall. "I don't suppose it will be necessary to reassure the British firms that Canada is good pay and that they will have little or no trouble in the matter of securing their money. They should adopt the same system that the Canadian uses when he is sending material to Britain. He does not demand cash against shipping documents, but on receipt of goods. The Canadian trade has come more to that system of dealing since the outbreak of the war. People here like to see what they are getting before they are asked to pay for it, and it is only proper that such should be the case.

Should Remedy This Matter

"Apparently there are many British firms sending material to Canada who have not yet learned to follow the customs regulations of this country, and there is an endless amount of trouble as a result. I wish you would make it very clear to the British exporter to Canada that he must send along properly certified triplicate invoices. Now, get that plain — triplicate invoices—properly certified. It is hardly likely that British firms understand the trouble, inconvenience and loss of time that disregard of this simple rule causes to the firms in this country that are trying to get their goods delivered on anything like proper schedule. This refers to samples or bulk, and there is no exception to it. Here is one instance of many I have heard that shows the trouble one gets into. At Christmas we had a quantity of cutlery coming in. The triplicate invoices were not forwarded, and we had to pay a sight entry to get the goods out so as not to disappoint our customers in the matter of seasonable delivery. The duty amounted to $300, and we had to pay $851 in order to get the shipment released. When the papers finally arrived we applied for and secured a rebate, but all the same it makes a lot of annoying worry and accomplishes nothing.

"The British manufacturer should also consider his Canadian distributor in the matter of giving him all the assistance possible in the way of publicity. On the literature he sends out from the home office, and in all advertising matter, he should always give particulars and address of the firm in Canada handling the line. Too often this is neglected. There is business to be secured from an adherence to this plan.

Should Study Canada

"The British manufacturer," remarked Mr. Marshall in conclusion, "has a real chance now to show that he is interested in the Canadian field. One way would be by giving some service in the matter of delivery. There should be more elasticity in the making of lines to meet the needs of the trade here. British firms should bear in mind that Canadians have bought largely of American machine tools, and are accustomed to them. All these things can best be learned by a study of the field here, and by observing the advertising pages of the specialized papers. By all means let the Britisher, wherever possible, know and study Canadian industrial conditions. He can hardly secure too much information. You know we are looking forward to seeing Canada a great country. The British manufacturer should not come in here for the business he can pick up this year or next year, but should look at it from a standpoint of permanency. In short, let him study the requirements, use the papers that specialize in his lines, observe the regulations necessary to get prompt delivery, take a sympathetic attitude to the Canadian view of payments, and give his best service in the matter of shipment. There is a lot of business in Canada, and there is no reason why the British manufacturer should not secure a good share of it."

LeBLOND
HEAVY DUTY
Universal Millers

Are not only Tool Room Machines, but as a manufacturing proposition appeal to the careful buyer.

Their long life insures ample returns for the investment made.

May we explain to you their many advantages and the convenience of their control.

Carried in stock by

The A. R. Williams Machinery Co.
LIMITED
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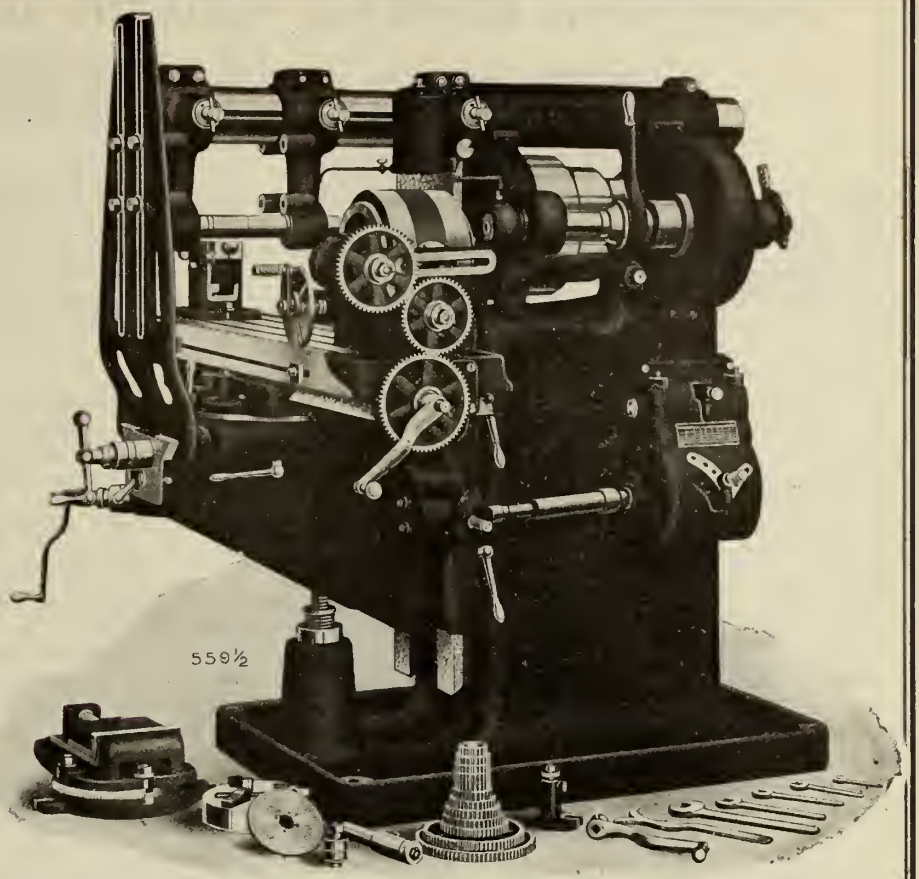
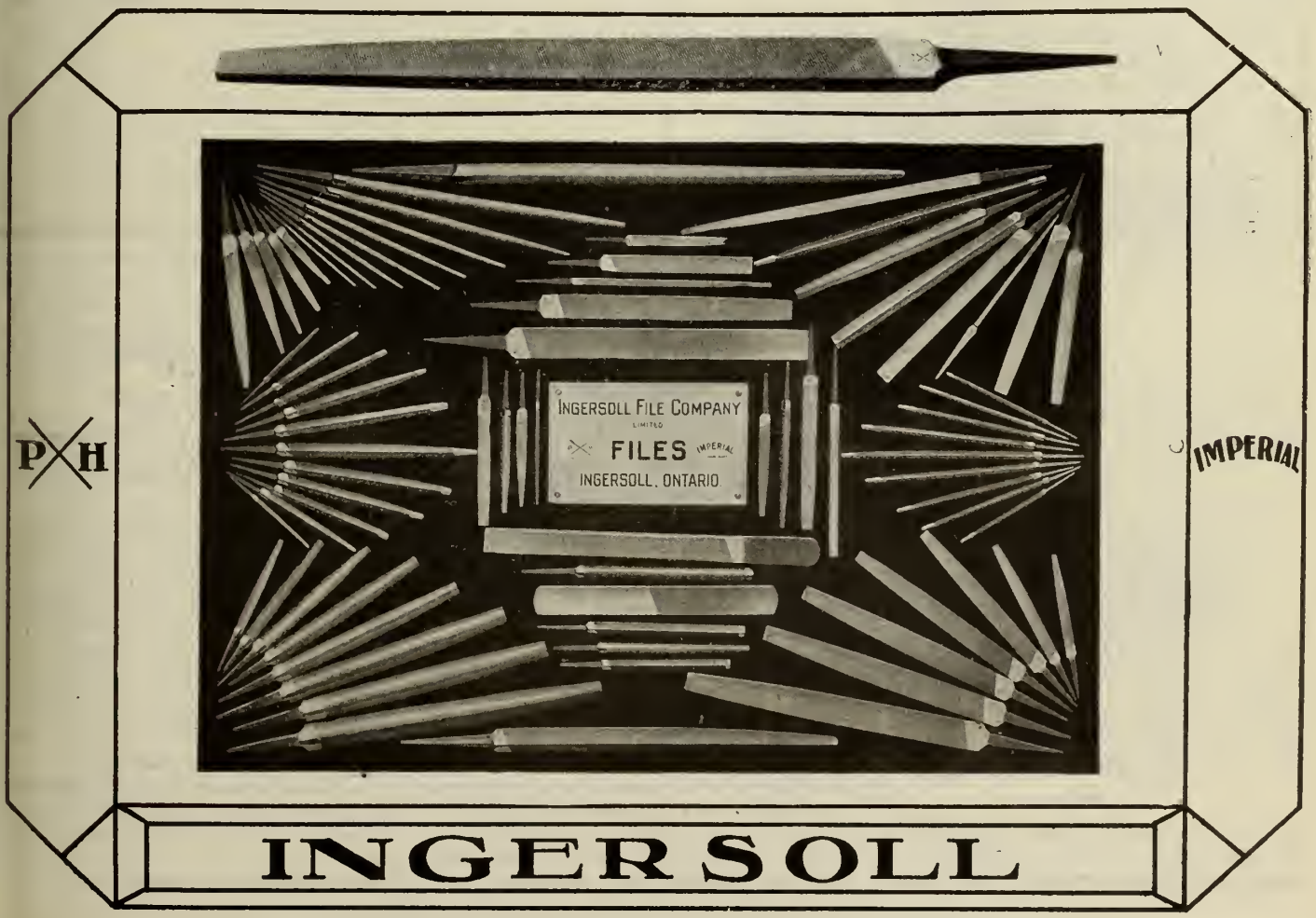




INGERSOLL

If interested tear out this page and place with letters to be answered.

Northern Electric Pension and Benefit Plan

The Matter Has Been Gone Into Very Carefully and Firm is Able to Announce Exactly What It Can Do in the Way of Pensions or Sick Benefits

THE Northern Electric Co., Montreal, have announced the inauguration of a comprehensive pension and benefit plan. They have set aside the sum of $150,000, and the manner in which the fund is sustained is set forth in a letter to the employees from Mr. P. F. Sise, president of the company.

To the Employees:

At the regular meeting of the Board of Directors of the company, held on December 17th, 1919, authority was granted for the establishment of a plan for an Employees' Pension and Benefit Fund for the granting of pensions and benefits to the employees of the company, to take effect on and after the first day of April, 1920.

The sum of one hundred and fifty thousand dollars ($150,000), has been placed to the credit of the fund, and it is the intention of the Board to credit to the fund interest at the rate of four per cent. per annum on the unexpended balance, and also at the end of each year to make such additional appropriation as is required to restore the fund to its original amount, provided that such additional appropriation shall in no year exceed two per cent. of the company's payroll.

The provisions of the plan do not call for any contribution by the employees, the whole cost being borne by the company. The purpose which the directors have in view is not only to recognize the loyalty and devotion of the employees, but to offer greater protection to them when overtaken by illness, accident or infirmity.

The following is a summary of the provisions of the plan which require mention.

P. F. SISE,
President.

Montreal,
January 2nd, 1920.

The general outline of the plan is given as follows:

1. Committee

A Committee consisting of:
The General Superintendent
The Secretary
The General Sales Manager
The Chief Engineer
The Chief Accountant

has been appointed, called the "The Employees' Benefit Fund Committee," with general authority to administer the "Employees' Pension and Benefit Fund," and to decide all questions relating to the plan and the carrying out thereof.

2. Pensions

2. 1.—The plan provides the following as pensions for employees who are retired and who come under the classes listed below. Employees in class A may be retired on pension, either at their own request or at the discretion of the Committee. Employees in Classes B and C may be retired on pension only at the discretion of the Committee and with the approval of the president or vice-president.

2. 2.—Class A.—A male employee whose age is sixty years or more (female fifty-five or more), and whose term of employment has been twenty years or more.

2. 3.—Class B.—A male employee age is fifty-five but less than sixty years (female fifty, but less than fifty-five), and whose term of employment has been twenty-five years or more.

2. 4.—Class C.—A male employee whose age is less than fifty-five years (female less than fifty) and whose term of employment has been thirty years or more.

2. 5. Class D (Disability Pensions).—An employee whose term of employment has been fifteen years or more and who becomes totally disabled by reason of sickness or of injury other than by accidental injury arising out of and in the course of employment by the company, may, at the discretion of the Committee, and with the approval of the president or vice-president, be granted a disability pension, which shall continue for such period only as the Committee may decide.

2. 6.—The annual pension in any of the above cases shall be one per centum (1%) of the average annual pay based on the average annual pay of the ten consecutive years of service during which the retiring employee was paid the highest annual pay, multiplied by the number of years in the employee's "Term of Employment."

2. 7.—For example: An employee whose term of employment at the time of retirement has been 30 years, and whose average pay for 10 years has been $1,500 a year, will receive an annual pension equal to 30% of $1,500 or $450.00 payable in monthly amounts of $37.50.

2. 8.—The minimum pension will be twenty dollars ($20), but this is not to apply to disability pensions granted to employees of less than twenty years' service.

2. 9.—Pensions granted to employees retired on account of age or length of service shall continue from date of retirement to death of pensioner, except as otherwise provided.

2. 10.—Regular employment under a salary with this company shall suspend the pension payments to a retired employee during the period he continues in such employment.

3. Accident Disability Benefits

3. 1.—The plan p rovides the following as Accident Disability Benefits on accoun of physical disability to work by reason of accidental injury arising out of and in the ccurse of employment by the company.

3. 11.—Total Disability Benefits.—Full pay for first thirteen weeks, half pay for remainder of disability. Maximum benefits not to exceed twenty dollars ($20) a week after six years of such payments.

3. 12.—Partial Disability Benefits.—100% of loss in earning capacity for first thirteen weeks; 50% of loss in earning capacity for the remainder of payments not to exceed six years.

Sickness Disability Benefits

4. 1.—The plan provides the following as Sickness Disability Benefits, the sickness includes injury other than accidental injury arising out of and in the course of employment by the company.

4. 2.—These benefits begin on the eighth calendar day of absence on account of sickness, and are as follows:

Term of Employment (Years)				Full Pay (Weeks)	Half Pay (Weeks)
2	but less than	3		4	9
2	" " "	4		5	13
4	" " "	5		6	17
5	" " "	6		7	21
6	" " "	7		8	25
7	" " "	8		9	29
8	" " "	9		10	33
9	" " "	10		11	37
10	and over			13	39

4. 3.—Benefits are not allowed for sickness of employees for less than two years' service, nor for the first seven days absence on account of sickness. In such cases, such practice as the company may establish from time to time will be followed.

5. Death Benefits

5. 1.—The plan provides the following as Death Benefits: In case of an employee's death by either accident of sickness, death benefits shall be paid only to the dependent's wife (or husband) or wholly dependent relatives of the employee, and provided, however, that a husband, son or male relative of eighteen years of age or over shall not be entitled to receive death benefits even though dependent upon the deceased employee for support at the time of the employee's death, unless he is physically or mentally incapacitated from earning a living.

5. 2.—Sickness Death Benefits.

5. 2.—Sickness to include other than aaccidental injury arising out of and in the course of employment by the company.

5. 22.—If the employee's term of em-

GEOMETRIC

Adjustable Collapsing Taps

Have overcome all the expense and annoyance of tapping screw threads with a solid tap.

Anyone doing thread tapping knows what backing out a solid tap each time means. It usually means low production, poor threads, and worn out taps.

The mechanism of the Geometric Taps takes care of adjustment to correct diameter each time a thread is tapped, it collapses the chasers automatically, leaving a thread clean cut and perfect.

The chasers are readily reground, and when finally used up, are renewed at comparatively small cost, leaving the tap as efficient as when new.

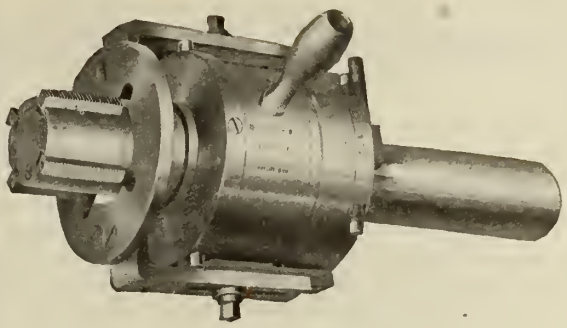
The manufacturers of the Geometric line of Collapsing Taps and Self-opening Die Heads are justly proud of the distinction which is theirs:—

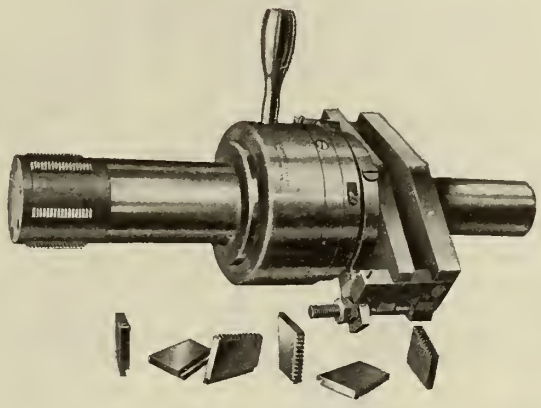
The Originators
and the
Largest and Best Known Manufacturers
of
Automatic Threading Tools

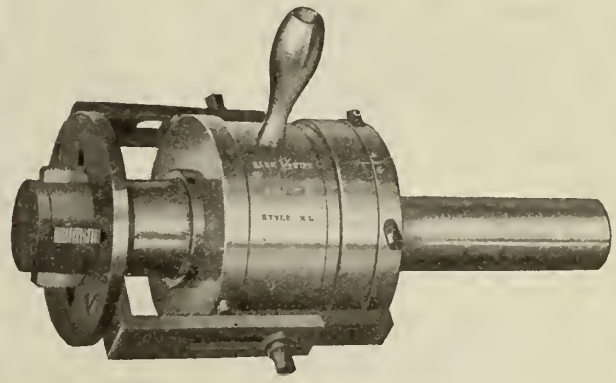
For cutting all classes of screw threads, internal and external, of any diameter and form.

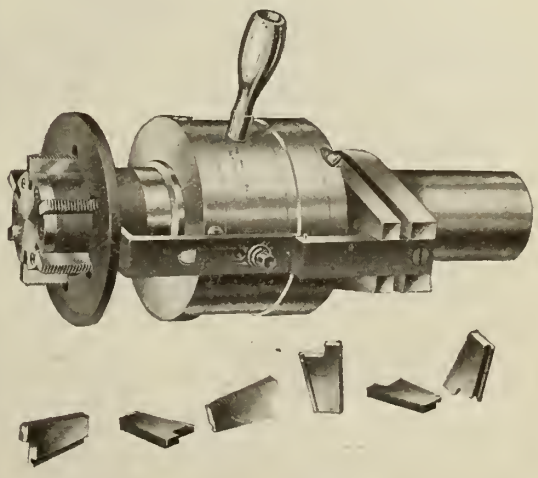
The Geometric Tool Company
New Haven, Conn., U.S.A.

CANADIAN AGENTS:
Williams & Wilson, Ltd., Montreal; The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg and St. John, N.B.; Canadian Fairbanks-Morse Co., Ltd., Manitoba, Saskatchewan, Alberta.









ployment has been ten years or more: One year's pay, not to exceed two thousand dollars ($2,000).

5. 23.--If the employee's term of employment has been five years or more, but less thann ten years: Six months' pay not to exceed two thousand dollars $2,-000).

5. 3.—Accidental Death Benefits.

Resulting from injuries arising out if and in the course of employment by the company.

5. 31.—Three years' pay, not to exceed five thousand dollars ($5,000), and the necessary expenses for burial, not to exceed one hundred and fifty dollars ($150).

6. Pay

6. 1.—The term "Pay" for pensions and death benefits shall be understood to mean the total earnings of the employee.

6. 2.—The term "Pay" for sickness and Accident Disability Benefits shall be understood to mean:

6. 21.—For monthly and weekly rated employees, the monthly or weekly rate the employee was receiving at the time the disability began.

6. 22.—For hourly rated employees, the average earnings of the employee for the previous thirteen weeks, or such shorter period as the employee has been in the company's services previous to the week of absence on acount of disability.

Notification of Disability or Death

7. 1.—Every employee who shall be absent from duty on account of sickness or injury must at once notify his immediate superior and the employee shall not be entitled to benefits for time previous to such notice, unless delay shall be shown to have been unavoidable and satisfactory evidence of disability is furnished.

7. 2.—All claims for death benefits must be made in writing within one year from the date of the death on which the claim is based.

7. 3.—All claims for disability benefits must be made within sixty days from the date of accident or from the first day of absence on acount of sickness.

8. Retirement Age

8. 1.—The plan provides that employees who become seventy years of age, shall retire from the employment of the company at the end of the month in which they reach that age, provided, however, that if such employees' usefulness is unimpaired and their superior makes request, the Employees' Benefit Fund Committee may recommend the continuance of such employees in the service, and if its recommendation is endorsed by the president or vice-president, the Board may suspend the operation of this rule in individual cases.

9. Employees' Service Record

9. 1.—A copy of this pamphlet will be given to each permanent employee at present in the service of the company, and to each such employee on entering its service hereafter. The employee shall furnish for the files of the Committee, on "Employees' Service Record" form supplied for that purpose, information regarding his age, previous service, and the name of beneficiary in case of death.

9. 2.—The employee shall advise the secretary, Employees' Benefit Fund Committee, of any changes in the information furnished on the "Employees' Service Record form, referred to in the above paragraph. The employee can obtain from his immediate superior the form which is to be used in submitting further information.

9. 3.—The expression "Term of Employment" shall mean the period of continuous employment in the service of the company. The period of continuous employment shall not be considered as interrupted on account of temporary lay-off, except as otherwise provided.

9. 4.— "Temporary Lay-off" on account of reduction of force shall not be considered as a break in the continuity of service, but when the period of absence from such cause exceeds six months in any twelve consecutive months, the entire period of absence shall be deducted in computing "Term of Employment," and all subsequent periods of temporary lay-off shall be deducted until the employee shall have been continuously engaged in the performance of duty for a period of twelve consecutive months.

9. 5.—Continuity of service shall be deemed to have been broken when:

Term of Employment	If temporary lay off before re-engagement exceeds
Less than one year	Three months
One year or more but less than two	Six months
Two years or more but less than five	One year
Five years or more	Two years

9. 6.—Leave of absence without pay for any period in excess of one month shall not be effective unless approved in writing by the Committee, and in any case in which such approval is given the Committee will indicate whether or not the period of absence is to be deducted in computing term of employment, and whether during the absence the employee shall be eligible to benefits under these regulations.

9. 7.—Military Service, 1914-1919.—All former employees who left the employ of the company for military service and who returned to our employ previous to January 1st, 1920, shall receive credit for the total period of their military service when calculating their term of employment.

10. Restrictions of the Plan

10. 1.—In case of disability or death directly or indirectly due to intoxication or to the use of alcoholic liquor as a beverage, or the use of stimulants or narcotics or to unlawful acts or immoralities, or to fighting, unless in self-defence against unprovoked assaults, or to other encounters, such as wrestling or scuffling, or to injury received in any brawl or in any liquor saloon, gambling house or other diserputable resort, or to the wilful intent of the employee to injure himself or another, or to venera diseases, no right to benefit under these regulations shall exist except at the discretion of the Committee.

10. 2.—Death or disability resulting from infection of a cut, abrasion, scratch puncture or other wound not immediately disabling and not reported at the time of the occurrence causing the injury shall not be classed as due to accident except at the discretion of the Committee.

10. 3.—Pensions or disability benefit may be suspended or terminated in the discretion of the Committee, in cases of gross misconduct or of any conduct prejudicial to the interests of the company

11. Company's Legal Obligations

Nothing contained in the plan shal create expressly or by implication or inference any contract or contractual relation nor obligation between the company and any emplowee or the legal representatives of independents of an employee. The pensions and allowance heretofore granted, or which hereaftefi heretofore granted to any such employee representative or dependent, shall be deemed alimentary and for personal use and shall not be assigned or otherwis alienated, and shall not confer upon an employee, representative, dependent o any other person, any right or interes capable of being assigned or otherwis alienated, or of being seized, attached garnished, or otherwise made subject t any process or proceeding in law or i equity.

12. Where Allowance or Compensatio is Payable Under Any Law.

12. 1.—In case any allowance or compensation account of injury or sickness or death shall be payable by the company under Federal or Provincial laws now in force or hereafter enacted, to any employee of the company, or his relatives dependents, executors or administrators or other representatives under such laws the excess only, if any, of the amoun provided for herein above the amount of such allowance or compensation prescribed by law shall be the amount of benefits which may be payable hereunder, and in cases where the benefits are payable weekly, monthly or by other instalments, the decision of the Committee, approved by the president or vice-president, as to whether there is, or will be any excess, and the amoun thereof, shall be final.

12. 2.—Should any claim be presented or suit brought against the company for damages an account of injury, sickness or death of an employee, nothing shall be payable hereunder on account of such injury, sickness or death, provided, however, that the Committee may, in its discretion, and upon such terms as it may prescribe, waive this provision if such claims be withdrawn and if such suit be discontinued.

Johansson Gages

Recognized Standards of Measurement the World Over

Johansson Gage Blocks are the fulfillment of an ideal in measuring tools heretofore unattainable. They combine the advantages of both line and end measures. Like line measures they give all sizes within their range—like end measures they are convenient, solid, non-adjustable blocks of steel. They insure the same result any number of times and in the hands of any number of mechanics. This fact has made them indispensable where the work of one shop is to be assembled with the work of others.

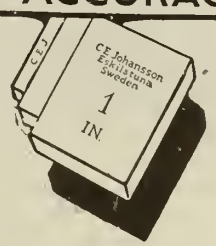
Aikenheads carry a complete stock of Johansson Sets of Standard Blocks and can make prompt shipments on all orders.

No individual to-day is independent of the machine-shop. No machine-shop to-day can afford to be independent of Johansson gages. They save time, decrease costs and increase both the quantity and quality of the work. Let us know your requirements.

Aikenhead's

Try Aikenhead tools. You'll find the service, quality and price right.

Johansson ACCURACY



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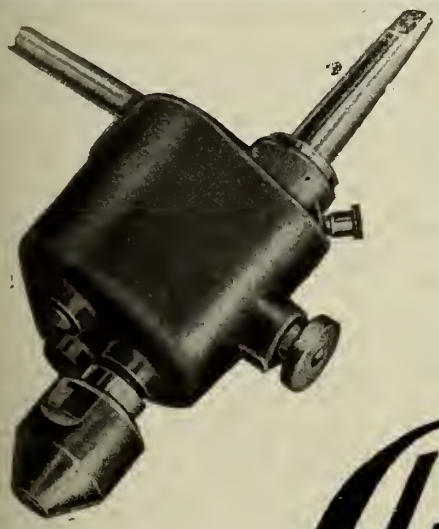
AIKENHEAD HARDWARE LIMITED

17, 19, 21 TEMPERANCE STREET, TORONTO



Wahlstrom Tapping Attachment

An Eliminator of Tap Breakage

By keeping the lands free from chips the Wahlstrom prevents the tap jamming in the hole, consequently there is no tap breakage. With the Wahlstrom tapping attachment the chips are freed by the oscillating motion which imitates the simple to-and-fro motion of hand tapping.

You can change this oscillating motion to a continuous revolution for tapping in soft materials. Also the tap reverses when the spindle is raised.

The Wahlstrom fits any drill press. It is made in two sizes. No. 1 takes taps of all sizes from 5-40 to ½ inch standard. No. 2 takes taps from ¼ inch to ¾ inch. It has nothing to get out of order. Sent on 10 days' trial.

Aikenhead's

The Home of Good Tools

You can always depend on getting what you want at Aikenheads. **When you want it.** A well stocked warehouse and an efficient staff are at your command at all times. Whenever you are in need of tools that will give maximum service at minimum upkeep cost, write or phone.

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If interested tear out this page and place with letters to be answered.

Britain Facing Much Higher Costs Now

Output Too Small to Meet Demand—Most Works Are Sold Up for the Balance of the Year at Good Prices—High Profits on the Lowest Production

By F. M. Field, British Trade Commissioner

THE outstanding feature of the iron and steel trades at the present time is that the output is insufficient to satisfy requirements and this applies to practically all classes of material. The result is that the most works are fully sold for as long a period as in the existing unsettled state of affairs they deem it prudent to commit themselves and new business is, consequently, very difficult to place. Manufacturers are nervous of committing themselves too far ahead and many decline to sell without a clause in their contracts safeguarding them against future fluctuations, or, at least, making their sales subject to increases in railway rates.

An appreciable proportion of the large amount of business now offering is due to the fact that the labor troubles in America give rise to great uncertainty as to when delivery of American material is likely to be obtained and buyers are therefore seeking to cover their requirements by concluding contracts with United Kingdom producers. It is to be regretted that the conditions obtaining in the iron and steel trades in this country at the present time do not permit of full advantage being taken of this opportunity to recover trade lost to America during the war.

Although from the point of view of individual producers the present state of affairs might be thought to be satisfactory in that the volume of business in hand is more than sufficient to absorb their output for some considerable time ahead, it must be borne in mind that the productive capacity of the industry is not being utilized to anything like its full extent, and this means, of course, that material is not being produced as economically as might otherwise be the case. This is exemplified in the continued advance in the prices of all classes of iron and steel products and constitutes a serious handicap to the development of an export trade in competition with America.

The present conditions are opposed to the best interests of the industry and of the country in general, as they tend to establish the system of high profits on a restricted output instead of inducing the maximum output with a corresponding reduction in the percentage of profit.

A considerable handicap to increased production at the present time is the very unsatisfactory state of the transport services, which results in serious delays in the delivery of fuel and raw material to works and in the carrying away from the latter of finished products. The trouble is so acute that many works have been obliged considerably to restrict their output either on account of their inability to obtain regular and adequate supplies of raw material or because their stockyards have become so congested with the accumulations of finished goods that room cannot be found for further supplies.

The uncertainty which at present exists regarding supplies of raw material, largely for the reason above stated, is not without its effect upon employment of labor, and there can be little doubt but that as soon as manufacturers can see their way to maintain their plants in operation at full capacity without fear of interruption, they will be prepared and anxious to engage additional workers.

Recent statistics compiled by the Minister of Labor show that 71 per cent. of the female labor employed at the time of the Armistice had been withdrawn by October, 1919, but that the number of male employees had been increased more than to make good the deficiency, so that the total number employed in October, 1919, was 18,300 more than in November, 1918, representing an increase of about 5½ per cent. between the dates mentioned.

Large as are the present demands upon this country for iron and steel material, there is little doubt but that further business could be secured in France, Italy, Belgium, etc., were it not that the existing state of the exchanges with those countries considerably hamper trade and an increase in the production of material in this country is necessary.

Pig Iron.—Prior to the war the United Kingdom was the third largest producer of pig iron in the world, the first and second places being taken by the United States of America and Germany, respectively, yet the exports from the United Kingdom in 1913 considerably exceeded thos eof America and Germany put together. This large export of pig iron from the United Kingdom was partly due to the fact that steel works in this country were able to absorb only a prart of the product of British blast furnaces. Owing to the extension of a part of the capacity during the last five years, however, the steel-making industry in this country will make heavier demands than formerly upon the pig iron production, and a reduction in the volume of exports of pig iron from the United Kingdom must, therefore, be expected, as it is unlikely that the production of pig iron will be increased sufficently to maintain the pre-war level of exports in addition to supplying the larger requirements of home steel makers.

The cost of production has risen enormously during the last five years, and to-day's export selling price of Cleveland No. 3 pig iron is about 180 per cent. higher than the average ruling in 1913. The total advance in price during 1919 amounted to 47s. per ton. In this connection it may be of interest to compare the present costs of the principal classes of raw material with those current in 1913.

1913

Imported Spanish ore 17s. 3d. to 20s. per ton d/d c.i.f.

Coke.....17s. 3d. to 18s. 6d. per ton.

1919

Imported Spanish ore 53s. 6d. per ton c.i.f.

Coke.....48s. to 50s. 6d. per ton.

A further advance in the price of certain grades of pig iron has been expected for some time owing to the continued rise in costs of production, and now that the revised railway rates have been announced makers will, no doubt, take the opportunity to make the necessary adjustment in their prices.

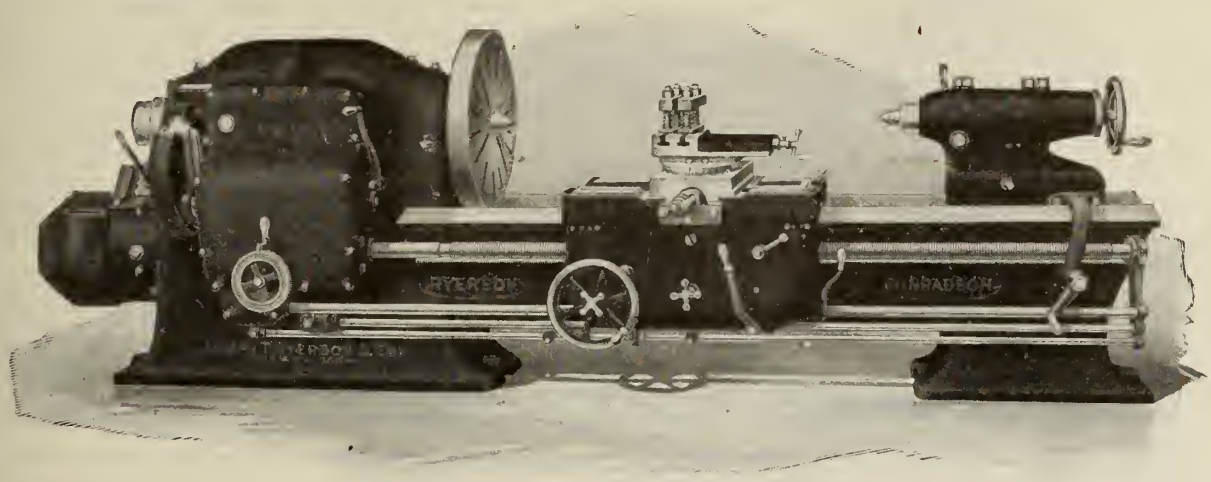
The United Kingdom production of pig iron in 1913 amounted approximately to 10,260,000 tons, and in 1918, to 9,072,000 tons. A considerable fall in output has occurred during 1919, for which the strikes amongst the coal miners and railwaymen are largely responsible. For the eleven months, January-November of 1919, the production amounted to 6,730,000; figures for December are not yet available, but assuming the monthly average to be maintained during December, the total for the year would be about 7,341,818 tons.

This is a very serious fall from the pre-war level, and although the strike above mentioned contributed very largely to this result the present unsatisfactory position of the transport services of the country imposes a very heavy handicap upon production. Owing to their inability to obtain regular and adequate supplies of raw materials manufacturers have, in many cases, been obliged to restrict their output, although the demand for pig iron both from home and foreign consumers is on an unprecedented scale.

In order to ensure adequate supplies of raw material to home industries, it has been necessary until quite recently to maintain control of exports of pig iron from United Kingdom. The restrictions, however, have now been removed and manufacturers are free to take advantage of any slackening in the home demand to fill export orders without irritating delays.

Announcing the New

Ryerson-Conradson High Power Precision Selective Head Engine Lathes



27" Lathe Arranged for Single Pulley Drive

The heavy duty work being done in railroad shops to-day demands radial drills, planers, lathes and milling machines of great speed, range and accuracy. The new line of Ryerson-Conradson machine tools is especially designed to meet this demand.

The Ryerson-Conradson High Power Precision Selective Head Engine Lathes can be successfully employed for quantity production as well as general machine shop work. The headstock is cast integral with the bed making the construction more rigid as the two mutually reinforce each other and permit the use of a large drive gearing. The bed serves as a container for oil, into which part of the gears are placed, providing a perfect oil splash at all times. The spindle is a .60 carbon alloy steel forging of exceptionally large diameter which not only reduces vibration, but also increases the bearing surface and provides for a very large hole through the spindle (4¼ in. on the 27 in. lathe).

We are manufacturing these lathes in five sizes: 15 in., 18 in., 22 in., 27 in. and 33 in. swing, with any length of bed arranged for single pulley drive, with or without spindle reversing attachment, or direct reversing motor drive.

The new Bulletin 1301-C gives complete information

ESTABLISHED 1842 INCORPORATED 1888

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CLYDE M. CARR, PRESIDENT JOSEPH T. RYERSON, VICE-PRES.

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CANADIAN REPRESENTATIVES: Garlock-Walker Machinery Co., 32 Front St. West, Toronto, Canada

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INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS PERSONAL AND TRADE NOTES

TRADE GOSSIP

U. S. Steel Earnings.—Steel Corporation earnings for the first quarter shew a trend upward from the final quarter of 1919. The aggregate earnings are $42,089,019 which represents an increase of $6,297,717. The net increase in earnings was $8,283,426 and the gain in surplus was $8,150,797.

Owners' Offer Declined.—The anthracite mine workers have notified the operators that their offer of a wage increase of 15 per cent. has been rejected, and their proposal for arbitration declined. This is according to a statement made by the sub-committee appointed to negotiate a new wage agreement.

Electric Castings at Orillia.—The electric furnace established at Orillia during the war, for the production of low phosphorous pig iron from shell turnings will be taken over by a company who will manufacture steel castings. The equipment has been idle since November 1918. It is felt that a good market is present for electric steel castings in Canada.

Switchmen Vote to Go Out.—According to advices from Buffalo, the switchmen voted to go out on all roads. This includes the roads serving the Lackawanna Steel Co. and the Rogers Brown Co., and it is stated that these firms will not have time to bank their fires. Several crews in the Buffalo yards quit work without any notice to the railroad officials.

Crow's Nest Strike Settled.—According to the Director of Coal Operations the miners' strike in the Crow's Nest Pass district, which has affected all the mines in that district for the past two months, has now been settled. It is understood that the men gained every point they were fighting for. An immediate increase of nearly 11 per cent. in wages will follow.

More Coal by Water.—The Dominion Coal Company are now negotiating for their original charter vessels to be returned to them, when they will be put into the service of the Black Diamond Line, carrying coal from Sydney to Montreal up the St. Lawrence. In addition to the vessels to be returned to them, they have purchased the 11,000 ton d.w. steamer Daghild, which will be put in the same service.

Preference for Canada—A proposal was submitted in the legislative council at Kingston, Jamaica, for representation of Jamaica at a conference to be held at Ottawa to consider trade relations and transport facilities between the Dominion of Canada and the British West Indies. The entire West Indies will be represented at the conference and an effort will be made to deflect a large portion of the West Indies trade with the United States to Canada. To this end a special tariff will be furnished, the Jamaican Government giving preference on Canadian goods going to that country.

Exhaustive Tests.—The Page Steel and Wire Company have just published a very complete pamphlet describing fully the electrical and physical properties of American Ingot Iron Wire. This is the first complete publication of this data and the result of many tests made during the past two years under the supervision of the Electrical Testing Laboratory, New York, and Frank F. Fowle, Consulting Electrical Engineer for this company. This booklet is very interesting and will be mailed to anyone desiring a copy upon request to Page Steel and Wire Company, 30 Church Street, New York.

Steel Company of Canada.—The annual meeting and election of officers of the Steel Company of Canada was held recently. The report on the company's activities was received and found satisfactory by the directors. The following

Darling in N.Y. "Tribune."

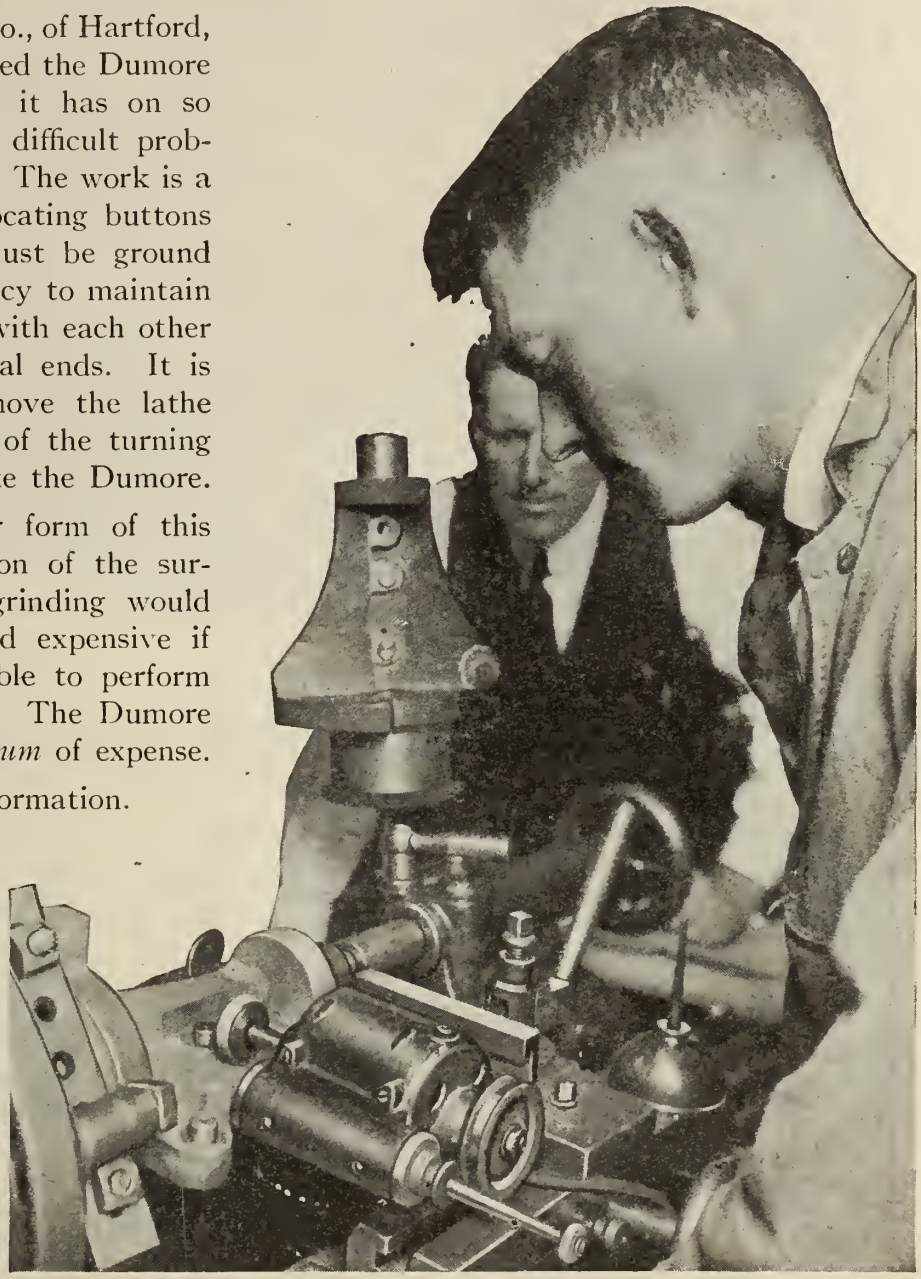
HUNTING THE PROFITEER

Planning and Producing with the Dumore

THE Reid Motor Co., of Hartford, Conn., has selected the Dumore Grinder because it has on so many occasions solved difficult problems for this Company. The work is a fixture with certain locating buttons and surfaces, which must be ground with the utmost accuracy to maintain their correct relations with each other and with the cylindrical ends. It is necessary only to remove the lathe tool at the conclusion of the turning operation and substitute the Dumore.

Owing to the peculiar form of this casting and the location of the surfaces to be ground, grinding would have been difficult and expensive if not altogether impossible to perform on any other machine. The Dumore did it—*and at a minimum* of expense.

Write for complete information.



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DUMORE HIGH SPEED GRINDERS

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HOW FAR DO YOU COME FROM BATTING 100 PER CENT. ON THIS SCORE ?

THE Canada Foundries and Forgings Co., of Welland,. are making use of this card in their plant. There is nothing compulsory or arbitrary in connection with the use of the card, but it is the intention to again send out another say in six months' time, for purposes of comparison.

Almost every man, if he wished to be perfectly honest with himself, could make use of such a card. He need not be working for Canadian Foundries & Forgings. He might be working any place. All that is necessary is that he stand himself honestly up against a high enough standard and be candid:

WHAT'S YOUR SCORE?

CANADA FOUNDRIES & FORGINGS, LTD.

Perfect Score	*ON THE LEFT is a value placed upon each factor or quality which make a perfect score.* *ON THE RIGHT---Just fill in your own self estimate.*	*My Score*
	LOYALTY	
20	Has every business act of mine been executed with the full belief that it was for the best interest of the firm? Do I realize that the firm's reputation is in my hands? Is my heart in my work?	
	PROMPTNESS	
5	Have I been at my place and assumed my duties promptly at the appointed hour? Do I put things off or do it "now"? Do I realize the importance of timely action?	
	AMBITION	
15	Am I doing my work the best way it could or should be done? Do I seek or avoid responsibility? Do I ever create new ideas or suggest improvements?	
	CONCENTRATION	
10	Do I keep my mind strictly on my work or am I wavering, intermittent and wasting time on hobbies? Do I realize the value of constancy?	
	ACCURACY	
15	How many of my mistakes do others have to correct? Do I appreciate the importance of accuracy?	
	SPEED	
5	Do I think and work quickly or do I hesitate and loiter? Do I use pluck, grit, and pep, or am I timid? Do I realize the possibilities of spare moments?	
	EXPERIENCE	
10	Have I been with this firm long enough to learn my work and have I mastered it? Am I continually bothering others for information about my work or am I giving them advice? Have I an objective in life or just working here?	
	NEATNESS	
10	Do I carry every detail through to its final logical conclusion? Am I careless of detail?	
	HEALTH	
10	Am I keeping myself physically fit or am I occasionally absent on account of sickness or other reasons? Who does my work when I am absent? Does it cause any friction or inconvenience?	
100% Perfect Score		*My Score*

.....

Sign here and keep for future comparison.

officers were elected:—Robert Hobson, president; F. H. Whitton, vice-president; Ross H. McMaster, vice-president; H. H. Champ, secretary and treasurer; Corbett F. Whitton, assistant secretary and Charles Stewart Wilcox, chairman of the executive. The directors are: Cyrus A. Birge, A. J. Brown, Lloyd Harris, Robert Hobson, Ross H. McMaster, Hon. John Milne, Sir Edmund B. Osler, Francis H. Whitton, Charles Edward Wilcox, Sir Thomas White.

Executive Meeting.—A meeting of the executive council of the Canadian Association of British Manufacturers and their representatives met at the Walker House on the 3rd instant, where many matters were discussed of interest to the association. It was unanimously decided that a special general meeting of the members should be held on May 31 at a luncheon, particulars of which will be arranged later. Each member will be advised of the time and place and the nature of the business makes it necessary that there should be a full attendance. Those present at the executive council were: Messrs. G. A. Marshall, president; John Harris, vice-president; King, Beal, H. Wilson, D. Harling and Walter E. Bunney, secretary, 39 Richmond St. East.

Clause Withdrawn.—Notification was to-day given and also to the Transportation Bureau of the Board of Trade that the Delaware and Hudson Railway had decided to withdraw the clause in their recently-issued tariff which charged prepayment in United States currency for all charges on freight coming from United States points to Canadian destinations, no matter what was the length of the haul on Canadian railways. This section is now rescinded and the railway will allow reconsignment at the border to Canadian points, thus permitting the payment for the Canadian haul to be made in Canadian currency. Merchants in some cases had decided to raise the price of coal 50 cents a ton in view of the earlier railroad order, but, on being notified of the change stated that when officially informed of it they would continue existing prices.

Steel Co. Strike.—The engineers in the steam process departments of the Steel Co. of Canada, at Hamilton, are on strike. A statement issued by the company follows:—"The Steel Company of Canada was notified by Frank Healey, international organizer, at 5 o'clock last evening, by telephone, that the strike of the engineers would be called at 6 o'clock this morning. It therefore became necessary to bank the blast furnaces and shut the open hearth furnaces, to prevent damage to these plants. The company sympathizes with the great majority of those employees who are forced to cease work by the action of the engineers and firemen walking out, but is prepared to resume operations as soon as a sufficient number of men offer themselves to run the steam power units. Full operations, however, cannot be carried on until the switchmen's strike in the United States is over and a sufficient quantity of coal

THE FILE TEST

"It is proverbial that the busy man is the one to go to if you wish things done promptly."

Every *Morrow* High Speed Forged Drill

is finally subjected to this test—if it doesn't "pass" it is thrown out. This inspector stands between you and our drill works.

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You appreciate *"Morrow"* rigid inspection. Every Morrow Drill *must* give you service. You get "more holes with less regrinding."

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Also Set & Cap Screws, Engine Studs, Semi-Finished. Nuts—Files.

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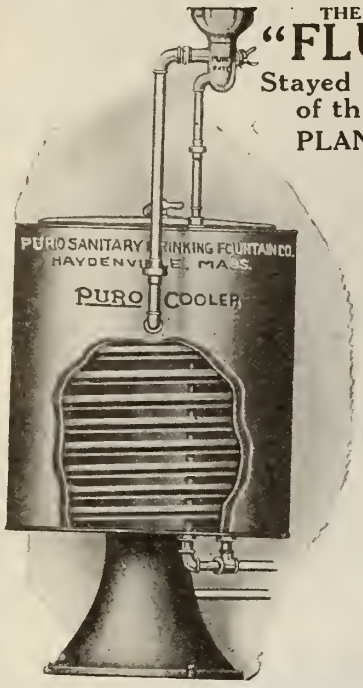
THE "FLU" Stayed out of this PLANT



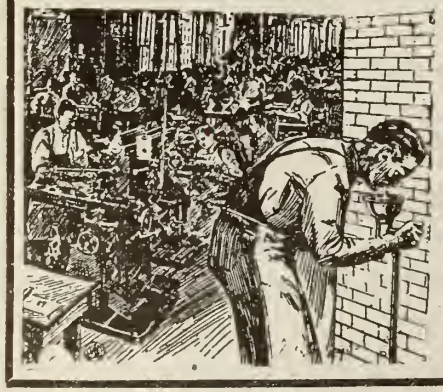
PURO SANITARY DRINKING FOUNTAIN

(MADE IN CANADA)

The only fountain with a bowl that prevents lips touching the bubbler paid its moderate cost over and above in all those well ordered plants whose precautionary measures successfully barred the Spanish influenza. PURO saves lives, time and water. Write

Puro Sanitary Drinking Fountain Co.

147 University Ave., Toronto, Canada



is received. As to when this will be the company is not in a position to say."

Patents Issued.—The following is a list of Canadian patents recently issued through the agency of Messrs. Ridout & Maybee, 156 Yonge Street, Toronto, from whom further particulars may be obtained:—Kilgour Bros., paper containers; George A. Helson, street cleaning apparatus; F. S. Harrington, pick; Philip T. Jackson, cooking apparatus; E. Beaumont Jarvis, metal framing; Evan O. Williams, reinforced concrete ships, barges, floating structures and the like; Walter Willmott, stamping book covers and the like; Wm. J. Gives, wrenches; Justus M. Silliman, demountable tires for vehicle wheels; Jabez Muskett, rubber covered rollers; F. W. Shenstone, keyboards for musical instruments; Schoichi Tamura, automatic bottle filling machine; Frank Perry, incandescent gas lighting; Dr. Wm. C. Toll, tonsillectome; A. Brokenshire, tire carrier for motor cars; G. Beechey, garden barrows and cultivators; James Novin, artificial leg.

MARINE

Ottawa.—The Government's steamships will be incorporated into individual companies, that is each boat will be a company in itself. Each vessel will be capitalized and run as a separate concern, independent of any of the others. This is a plan that is widely adopted by shipping firms in England.

St. Thomas.—Work on the harbor of Port Stanley will be started immediately according to officials of the Federal Government. The turning basin, channel and outer harbor will be dredged and the most dangerous portion of the submerged east pier will be removed. Work will also be resumed on the west pier.

London.—Sir Alfred Booth, speaking at a meeting of the Cunard Steamship Co., said that the company were quite prepared for a slump in freight rates, and that the sooner the storm was over the better. He expressed the hope that the break in freight rates would also break the vicious circle of rising wages and rising prices.

Montreal. — Canada Steamship Lines, according to Mr. W. J. Norcross, is looking forward to a very successful season. The bookings in advance for the tourist season are larger than ever before at this time of the year, and the freight business was holding up its end in a splendid way. The company is also reaping the benefit of the long term charters made when conditions were so acute.

Amherst. — The tern schooner Burpee L. Tucker was launched recently from the yard of George E. Wagstaff, Port Greville. She is a vessel of 465 tons register, and is fitted with auxiliary hoisting power and all modern improve-

Port McNicoll.—The Canadian Pacific Railway announce the opening of the seacon on the Port McNicoll and Fort William service on May 1st. There will be five sailings each week from then on. Freight for Port Arthur, Fort William, and all points to the Northwest is now being accepted for routing via Port McNicoll.

A swedish engineer, remarks "Engineer," ran several incandescent lamps at temperatures of 200 degrees Cent., while others cooled by water were worked at about 2 degrees Cent. After some hour's running in the case of the lamps at a temperature of 200 degrees the luminous intensity had dropped considerably, and they were unusable after forty hours running, whereas with the lamps run at 2 degrees the diminution of intensity was inappreciable after that period. This deterioration is apparently explained by the fact that at high temperatures the glass of the bulb becomes porous and air enters the bulb, and it also explains why, where large numbers of lamps are arranged close together in advertisement signs, etc., they rapidly deteriorate.

A good story is told of an Englishman who was being entertained by some Americans in New York City. At the conclusion of a story, told by one of the Americans, everybody except the Englishman burst out laughing. The story-teller was rather nettled at the Englishman's unsmiling face and remarked: "I have always heard that Englishmen are lacking in humor; perhaps our English friend will see the joke and laugh next year."

Very seriously the Englishman said: "No, I shan't laugh next year for the reason that I laughed at that joke last year, and I always make it a point never to laugh at the same one twice."

BRIQUETTE PLANT FOR EDMONTON

Important Development to Use Tar Sand and Coal Deposits to Make Briquettes

Edmonton, Alta.—Two Chicago capitalists recently visited Edmonton to survey the field with the idea of establishing a plan to manufacture briquettes from semi-anthracite and lignite coal which are abundant throughout the province. Part of their plan is to extract tar from the tar sands of the Athabasca River district, to be used as a binder in the briquettes.

They interviewed Premier Charles Stewart, who told them the Government would assure them aid in transporting the tar from their extraction works in the north by water route to a connection with the railway between the Peace River and Edmonton. They said they proposed to ship out from Fort McMurray, at the start, five carloads of tar daily. This output of binder would mean an immense business in briquetting. They also proposed later to supply asphalt to municipalities for road and sidewalk construction.

"There is a big future in briquetting lignite in Alberta," said Premier Stewart. "When scientifically made, lignite briquettes have a fuel value equal to anthracite. Western Canada now imports 3,000,000 tons of anthracite annually, large part of it from the United States. With an inexhaustible supply of lignite and with the briquetting industry established, Western Canada will be self-supporting as far as fuel is concerned and will save its present immense expenditure for imported coal."

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MANUFACTURERS REQUIRING MACHINERY can with advantage obtain speedy delivery, through our Surplus Plant and Machinery Dept., constituted some years ago for the handling of Surplus Plant, of Boiler Works, Ship Yards, Engineering Works, etc. New or Good Used Plant as required. Please send enquiries. Pillatt & Co., Ltd., Stapleford Iron Works, Nr. Nottingham, England.

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HEAVY DUTY MACHINE TOOLS
Planers, Engine and Axle Lathes, Slotters, Boring and Turning Mills, Horizontal Boring and Drilling Machines.
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Machine Tools, Steam Pumps, Special Machinery, Grey Iron Castings, Gear Cutting.
Well built cranes of this type with electric hoists can be designed for your shop. They will be a decided saving. Free going hand cranes can be supplied at low cost. Bring your shop up to date.
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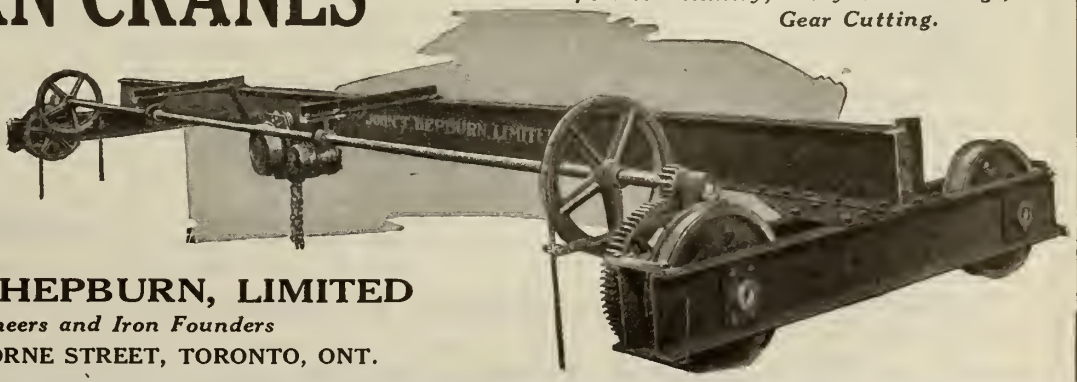
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MACHINE WORK WANTED FOR LATHES, shapers, milling machine and planer, etc Hourly or contract basis. Prompt delivery. W. H Sumbling Machinery Co., Toronto. (ctfm)

WORK WANTED FOR JOBBING FOUNDRY and machine shop, making grey iron castings, equipped with lathes, planers and drill presses. The Milton Foundry & Machine Co., Milton, Ont. (c26m)

IF what you want isn't advertised in this issue, consult our Buyers' Directory, Pages 161-178.

TENDERS WANTED

Sealed tenders for fans, blowers and motors, will be received by the Lignite Utilization Board of Canada at its office, 2 Youville Square (Old Customs Bldg.) Montreal, P.Q., until 12 o'clock noon, May 19th, 1920.

Each tender must be made upon the proposal form provided, and must be accompanied by all the information required.

Copies of specifications and form of proposal may be obtained from the Secretary of the Lignite Utilization Board upon application.

The Lignite Utilization Board of Canada does not bind itself to accept the lowest or any tender.

Montreal, P.Q.,
May 3rd, 1920.

Lesslie R. Thomson, *Secretary* — R. A Ross, *Chairman*

AGENTS WANTED

CANADIAN AGENT WANTED — AMERICAN firm whose line (high grade factory specialty) is being manufactured in Canada, wishes to get in touch with live man who will act as Provincial or Dominion representative. Box 679, Canadian Machinery.

FOR SALE

ONE No. 3 KELLER AUTOMATIC DIE-Sinking or Engraving Machine, complete with Grinding Machine and Motors. For further information wire or write General Forgings & Stampings, Ltd., Merritton, Ont. (c20m)

PATENT INQUIRIES WANTED

The proprietor of Letters Patent M.R. Matti No. 137772 "Arrangement for changing the moment of fuel injection into the combustion chamber during the run of the motor and for regulating the quantity of fuel" desires to dispose of the patent or to grant license to interested parties at reasonable terms with a view to the adequate working of the Patent in Canada.

Enquiries to be addressed to the patentees Aktiebolaget Nobel-Diesel, Nynäshamn, Sweden.

FOR SALE

Two-storey Brick Factory Building in the City of Hamilton. Size, 65 x 90 ft., with large lot 265 x 100 ft. Centrally located.

Box 676, Canadian Machinery

FOR SALE

1— 42" Boring Mill
1—2½" Gridley Automatic
1—20" x 8" American Lathe
1—18" x 6" Walcott Lathe
1— No. 5 Foster Turret Lathe
12" and 14" Power Hack Saw Blades
at special prices for quick sale.

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TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (cfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

For Sale

Enclosed liquid fuel combustion apparatus capable of generating intense heat in pipes and confined passages for heating parts of internal combustion engines and for other uses; spark ignited; blower operated. Patented April 3, 1917. Can be inspected at and for sale by H. W. Petrie Limited, Toronto.

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Rate—2 cents per word per issue; 10 cents additional for box number. Here are opportunities galore! Opportunities for toolmakers, machinists, superintendents, salesmen. Opportunities for the buyer of machinery, for the employer of help. Read these pages every week!

Canadian Machinery
Classified Advertising Section
143 University Ave., Toronto, Ont.

USED MACHINE TOOLS FOR SALE

Look Over This List and Note the Moderate Prices

7—Milholland 1⅝" x 10" hand screw machines, with cross slide, power feed to turret, double friction geared head, pan bed, automatic chuck, pump, double friction countershaft, without bar feed attachment, used 8 months, first-class condition. Each $720.00

2—1½" x 9" Acme (Cincinnati) Machine Tool Co., screw machines, double geared head, power feed to turret, pan bed, pump, cross slide, double friction countershaft, first-class condition. Each $630.00

1—Foster No. 4 hand screw machine, 10" air chuck, double friction geared head, pan bed, cross slide, no power feed to turret, used 8 months, bargain for shop with air equipment. Price $310.00

2—Smur & Kamen screw machines, 1⅝" x 10", with power feed to turret, geared head, cross slide, double friction countershaft. Each $110.00

6—Lever operated cross slides for Foster No. 4 or No. 5 screw machines, unused. Price, each $20.00

15—Air chucks (Hannifin) for screw machines 10' cylinder, unused. Price, each $25.00

1—Warner & Swasey 15" swing x 6" stroke, brass finishers, turret lathe, automatic chuck, plain head, 6 hole round turret, cross slide, good condition. Price, each $225.00

1—As above—17" swing, air chuck. Price ...$150.00

1—As above—14" swing, air chuck. Price $90.00

2—As above—15" swing, air chuck. Price ..$100.00

2—Gas muffle furnaces, small. Price, each....$5.00

3—Wahstrom drill chucks, ⅞" capacity, straight shank drill, good condition. Price, each....$35.00

3—"Modern" self opening die heads, No. 1, style B, capacity ⅞". Price, each $20.00

1—Duplex double acting steam pump, Canada Steam Pump Co., one side boiler feed, other side vacuum, for heating system..... **Offer Wanted**

1—McKechnie & Bertram, 24" x 24' 0" shafting lathe, 3 step cone, Back geared, power feed, screw cutting with 4 jaw ind. chuck, steady rest. Price....$700.00

1—Mackenzie bench drill press. Price $20.00

TRANSMISSION MATERIAL:

Large stock of used wood and steel split pulleys, used belting (some almost new). We also have 105 hangers 1 15/16 diam. all styles.

10 doz. high wooden factory stools good condition $1.25 to $1.75 each.

Motors—AC (60 cycle) and D.C.

1—International Time Clock.

The Turnbull Elevator Mfg. Co.
126 John Street, Toronto, Ont.

International

SPECIALISTS
in
Railway, Marine and Industrial Supplies

Duntley Dayton Pneumatic Tools.
Daniel's P.P.P. Packing.
Ebonite Packing.
Pump Valves.
International High Pressure Sheet Packing.
International Red Rubber Packing.
Plastic Metallic Packing for Piston Rods and Valve Stems.
Paxton & Mitchell Locomotive Rod Packing.
Rapid Hose Coupler, for all Hose Connections.

Write or Wire Your Requirements

International Machinery and Supply Company, Limited
421 St. James St., Montreal

MACHINERY FOR SALE

BARGAIN PRICES

Planer—24" x 24" x 6' London Machine Co., almost new.

Oliver Tool Room Lathe—16" x 7'—Q.C.G., taper and relieving attachments, with pan—like new.

Milling Machine—1½ Cincinnati Universal Miller —fair condition.

Punch and Shear—Single End Punch and Shear Copy ¾" through ¾", 20" throat—John Bertram & Sons—like new.

Gap Lathe—24" x 48" x 22' bed—John Bertram & Sons.

Full line other lathes, including, Lodge & Shipley, C.M.C., Giddings & Lewis, South Bend, Milwaukee, Barker 18" x 8' beds—condition equal to new.

Air Compressor—12" x 12" Nagle Compressor, with 42" x 7' reservoir—guaranteed condition.

Drill Presses—30" x 20", back geared and one lever drill. Special prices on 20" x 8' C.M.C. rebuilt lathe.

Write or phone—Main 5039.

STANDARD EQUIPMENT & TOOL WORKS
179 St. James St., Room 20
MONTREAL

We Buy Complete Plants Outright

If interested tear out this page and place with letter answered

Immediate Delivery

The 24-inch lathe, with the 30-inch pull.

The 18-inch lathe equal to most any 24-inch.

The 20-inch lathe that is new. Also 14 and 16-inch lathes.

Engine or tool room. Cone or geared head. Belt or motor driven.

Every Canadian Shop

should have one of the latest improved CISCOS. The lathe with the pull. The lathe of simplified accuracy.

Strong and powerful—efficient and accurate—economical. They will satisfy.

THE CISCO MACHINE TOOL CO., CINCINNATI, U.S.A.

Makers of Lathes

3 Phase, 25 Cycle, 550 Volt.

2—1½ H.P., Triumph	750 R.P.M.
1— 3 H.P., Canadian General Electric	750 R.P.M.
1— 5 H.P., Lincoln	750 R.P.M.
2— 7½ H.P., Westinghouse	1400 R.P.M.
1— 7½ H.P., Wagner	1400 R.P.M.
1—10 H.P., Harland	750 R.P.M.
4—20 H.P., Westinghouse	750 R.P.M.
2—25 H.P., Westinghouse	750 R.P.M.
3—30 H.P., Crocker-Wheeler	750 R.P.M.
1—30 H.P., Packard	750 R.P.M.
1—40 H.P., Crocker-Wheeler	750 R.P.M.
1—4 H.P., Westinghouse	750 R.P.M.
1—50 H.P., Canadian General Electric	750 R.P.M.
2—50 H.P., Westinghouse	750 R.P.M.
1—50 H.P., Crocker-Wheeler	750 R.P.M.
2—75 H.P., Westinghouse	750 R.P.M.
1—75 H.P., Lancashire	750 R.P.M.
1—100 H.P., Westinghouse	500 R.P.M.
1—100 H.P., Crocker-Wheeler	750 R.P.M.
1—150 H.P., Canadian General Electric	500 R.P.M.
2—200H.P., Westinghouse	500 R.P.M.

3 Phase, 25 Cycle, 2200 Volt

1— 35 H.P., Canadian General Electric	750 R.P.M.
1— 50 H.P., Westinghouse, slip ring	750 R.P.M.
2—100 H.P., Westinghouse	750 R.P.M.
1—150 H.P., Canadian General Electric	500 R.P.M.
2—200 H.P., Canadian General Electric	500 R.P.M.

3 Phase, 60 Cycle, 550 Volt.

1— 25 H.P., Westinghouse, H.S.	720 R.P.M.
3— 50 H.P., Westinghouse, H.S.	600 R.P.M.
3—100 H.P., Westinghouse, H.S.	600 R.P.M.

Transformers

5—100 K.V.A., Westinghouse, 60 cycle, 2200/550 volt.

WILSON-McGOVERN, LIMITED

LUMSDEN BUILDING TORONTO

The BARNES DRILLS

TRADE MARK W.F. & J.B.

Complete line. 8-inch to 50-inch swing

Gang Drills.—Horizontal Drills.

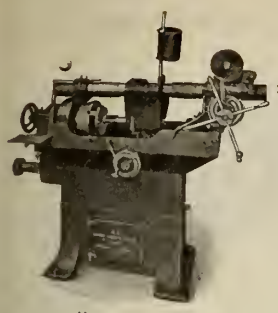
SEND FOR CATALOG.

W. F. & JOHN BARNES CO.

104 Ruby Street - ROCKFORD, ILL.

Canadian Agents; A. R. WILLIAMS MACHINERY CO.
Toronto, Winnipeg, Vancouver and St. John, N.B.
WILLIAMS & WILSON, Montreal

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.



The Swinging Head Design of Bryant Hole Grinders Doubles Their Accuracy

THE foot of the grinding wheel head—clearly shown in trade-mark—is twice as far as the grinding wheel from the shaft about which the head is pivoted. Consequently a movement of the cross feed spindle at the foot of the grinding wheel head of 2/1000 of an inch means a movement of only 1/1000 of an inch of the grinding wheel.

This is but one of the reasons why Bryant performance has been a revelation to so many of its users. Let us tell you the others. A copy of the Bryant Production Book will gladly be forwarded upon request.

BRYANT CHUCKING GRINDER COMPANY

SPRINGFIELD, VERMONT, U.S.A.

Detroit, Direct Representative, B. J. Riordan, 263 St. Paul Ave., Detroit. Chicago, Direct Representative, L. C. Gilchrist, 1262 Columbia Ave., Chicago. Motch & Merryweather Mchy. Co., Agents in Cleveland, Cincinnati and Pittsburgh. Henry Prentiss & Company, Agents in New York City, Boston, Rochester, Syracuse, Buffalo and Scranton.

NICHROLOY

HEAT RESISTING CASTINGS

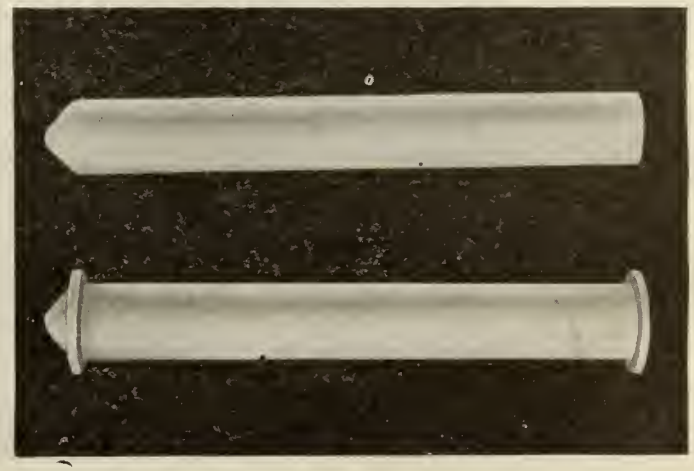
Scientifically alloying nickel, chromium, steel and tungsten so as to use the maximum heat resisting qualities of every particle of nickel and chromium and the strength producing qualities of tungsten and steel; produces in NICHROLOY a heat resisting alloy having a strength at red heat never before equalled in similar alloy castings and entirely eliminating the segregation of nickel and chromium so destructive in other alloys.

Price but a fraction of that asked for other alloys.

Sample and Bulletin on Request

Hiram Walker & Sons Metal Products, Limited

Walkerville, Ontario, Canada



60 Cam Shaft Tubes in Truck Plant Used 3,300 hours without a single burnout.

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Canadian Machinery As An Advertising Medium

By J. H. M.

THERE is a saying that no matter where we go we will meet with a doubting Thomas, and, of course, the same holds good as far as advertising is concerned.

"You've got to show me," is a favorite expression of these Missouri inhabitants, so following is proof of the most convincing character. To commence with, the writer is not connected with the advertising staff, but merely one of the editorial department. He was not in search of a glowing tale regarding the possibilities of advertising, but he was out to find how business in general was going.

The gentleman whom he interviewed was S. L. Clark, Esq., of the Perfect Machine Tool Company, Galt, Ontario.

"How's business?" was my first question, and the reply was as follows: "Splendid. We are doubling our foundry capacity and intend doubling our machine shop space directly after."

Naturally, such a reply was encouraging.

"How do you account for this rush and where is the work coming from"? was my next query.

"To your first question I would say that this is the result of producing a first-class article and advertising the same judiciously and wisely; secondly, that our orders are coming in from all over the Dominion of Canada and Great Britain," was his reply.

"Evidently you are a firm believer in advertising," I said.

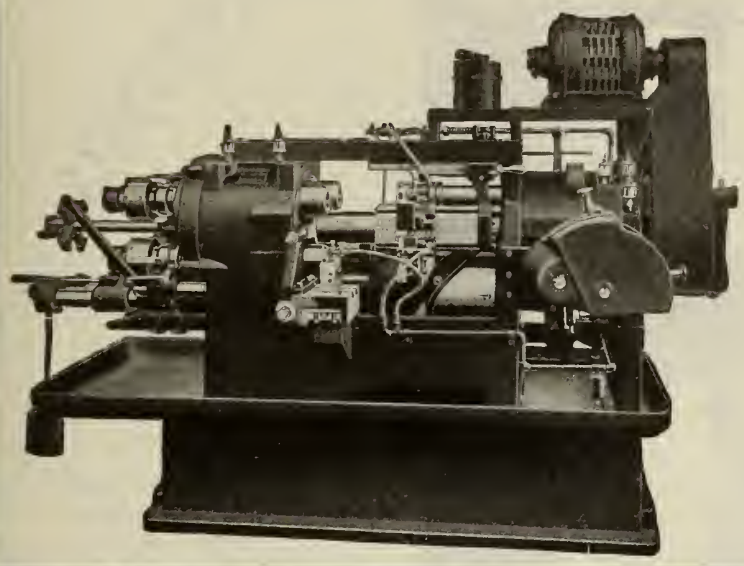
"I certainly am," was the reply. "Here are my views on the subject:

"In advertising, just the same as in anything else, good judgment must be used. You must study where to advertise, when to advertise and how to advertise. Each feature is equally important. You can spend more money foolishly through advertising than in any other way. In some cases I would not give five cents for space which they ask $10.00, $20.00 or $30.00 for, simply because I believe that no results would be obtained. In other words, I pick carefully where I advertise. I am a firm believer in the possibilities of export business and have secured inquiries from England, France, Spain and South America through judicious advertising in CANADIAN MACHINERY. We have made good connections already in England and hope soon to make connections of like nature in the other countries mentioned. The man who advertises is bound to go ahead, providing that the article he is advertising backs up every statement in his advertisement and he uses judgment in what he puts before the buying public.

"Personally, I cannot speak too strongly for the cause of advertising, and I firmly believe that CANADIAN MACHINERY, as an advertising medium, has helped us considerably in our present business expansion."

GRIDLEY-AUTOMATIC

MULTIPLE SPINDLE SCREW MACHINES



For the rapid, economical and accurate production of screw machine work—automatically.

Capacities up to 2⅝" diam.

THE NATIONAL ACME COMPANY

WINDSOR, VERMONT

General Offices, Cleveland O.
Canadian Screw Plant, Montreal, P.Q.

Branch Offices :
NEW YORK BOSTON CHICAGO
DETROIT BUFFALO

Warehouses: NEW YORK AND CHICAGO

Representatives in Foreign Countries

Makers of Gridley Single and Multiple-Spindle Automatics at Windsor, Vermont, and Acme Automatics, Collapsing Taps, Threading Dies, and Screw Machine Products at Cleveland, Ohio

Free Tool Grinding Chart

Grind your cutting tools in exactly the right way to get best results—and you save time. That's obvious. It is precisely that that this Tool Grinding Chart enables you to do.

It has been adopted as standard by many firms that found it a long way better than guess work.

CANADIAN MACHINERY would like to see this Chart in every shop in the Dominion. Mail the coupon below for your copy to-day.

Shows at a glance Correct Clearance and Rake Angles for Cutting Tools

CANADIAN MACHINERY,
153 University Avenue, Toronto.

Please send me / us free, one of your tool grinding charts.

Signed .....

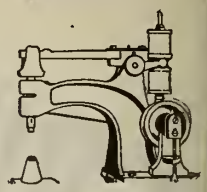
Firm Name .....

St. Address .....

City .....

Prov. .....

THE PRINCIPLE IS RIGHT
THE HAMMER WITH THE HUMAN STROKE



SHOULDERING THE WORLD'S RIVETING

THE HIGH SPEED WAY; DOING THE WORK OF FIVE HAND RIVETERS

AGENCIES:

For British Isles
Burton Griffiths & Co., Ltd.,
London, E.C.

For Sweden and Finland
Aktiebolaget Rylander
& Asplund
Stockholm, C.

For Japan and Dependencies
China, Japan & South America
Trading Company, Ltd.
Kobe

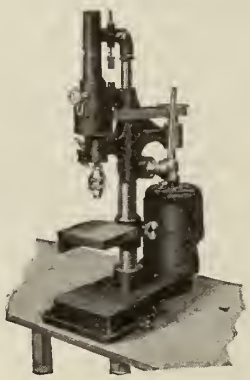
THE HIGH SPEED HAMMER COMPANY, Inc.
ROCHESTER, N.Y., U.S.A.

The High - Speed Hammer

Heads rivets cold, flush or countersunk at the rate of—

A rivet a second up to 3-16"
A rivet in 2 seconds, ¼" to 5-16"
A rivet in 3 seconds, ⅜" to ½"
A rivet in 10 to 20 seconds, ⅞" to 1½"

Finished any shape desired, tight or loose. Built in 8 sizes. Send us B/P of your work.



MODEL E-50 HIGH SPEED

MOTOR-DRIVEN
BALL-BEARING

Sensitive Bench Drill Press

SPECIFICATIONS:

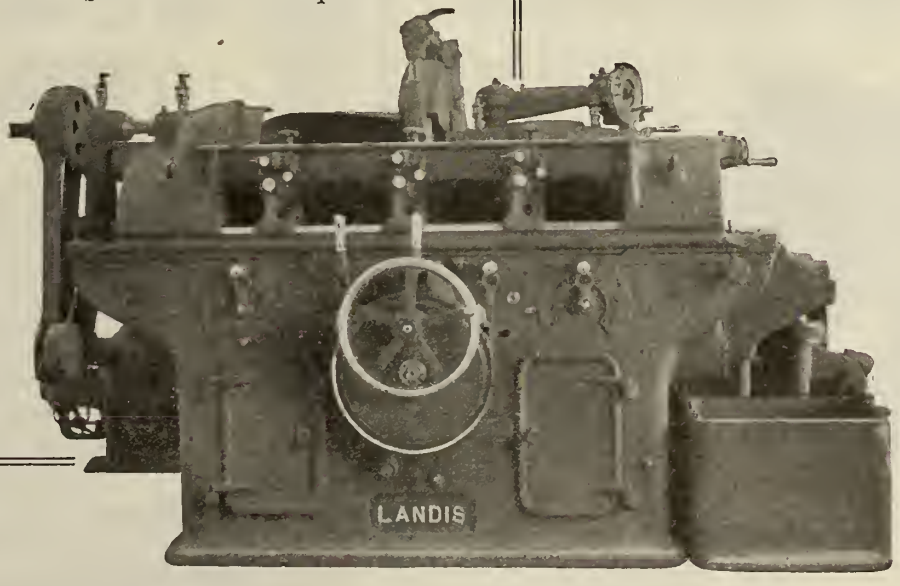
Height Over All	24"
Base	76 x 18"
Diameter of Spindle	7/16"
Spindle Feed	2¼"
Weight	62 lbs.
Capacity	From smallest to ¼" Drills

Exclusive Arrangements Considered Only With Organizations Prepared to Carry, At All Times, Representative Stocks

Without a peer for cylindrical grinding

On any cylindrical or taper job within its rated capacity, this 10 in. x 24 in. Landis Plain Grinding Machine displays an unusual combination of accuracy, speed and economy. There are many other types of Landis, each adapted to a definite range and kind of work, but each is capable of the same excellence of performance given by this machine.
For manufacturing operations the Landis is without a peer. Its ease of manipulation and its astonishing capacity for work are a combination that means big production and absolute dependability. Let us tell you how grinding operations are superseding lathe work and other methods. We would like to tell you more about the Landis—what it will do on your work. Any of the Landis literature is sent free on request.

LANDIS



Landis Tool Company, Waynesboro, Pa.

Canadian Agents: A. R. Williams Machinery Co. Toronto, Winnipeg and Vancouver
Williams & Wilson, Montreal

If interested tear out this page and place with letters to be answered

McKenzie Saw Table

A New and Better SAW TABLE

Saves Time and Space

This New McKenzie Saw Table has several outstanding features which make it the best machine of its kind to buy. Does the same work as machines of larger dimensions, costs less, takes up less space and produces work faster. It is 23½″ x 30″. Distance from saw to ripping fence is 13″. Floor space 30″ x 36″. Furnished with belt, ripping fence, two mitre fences and 9″ saw.

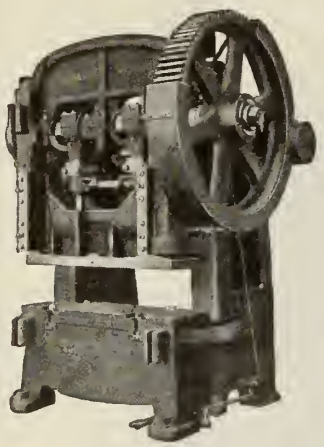
Specially suitable for pattern shops, technical and manual training schools. **Write for prices and full particulars.**

THE D. McKENZIE MACHINE CO.
GUELPH, ONT.

VICTORIA Special Machinery
DESIGNS PATTERNS
CASTINGS FORGINGS
Send for Catalogue
Victoria Foundry Co., Limited, Ottawa, Canada

Greaves-Etchells Electric Furnace
FURNACES FOR EVERY PURPOSE
Electric Furnace Construction Co.
Finance Bldg. Phila., Pa.

THE "TOLEDO"
DOUBLE CHUCK PRESSES



No. 206. For Multiple Punching, Shearing, Blanking, Forming, etc.

Really productive machines of rugged, sturdy construction embodying all the most advanced features in design.

Low maintenance cost and unusual capacity for heavy, continuous work have placed them beyond competition.

Widely used for cutting out and forming large articles of tin, brass, copper, sheet steel, cardboard, paper, cloth, etc.

We fit the press to the needs

The Toledo Machine & Tool Co.
Toledo, Ohio

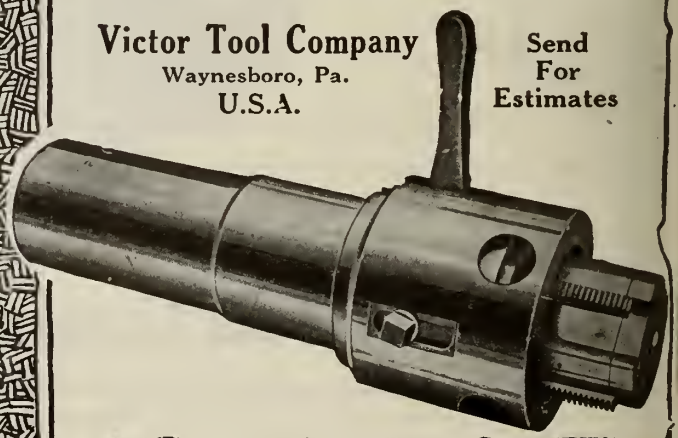
We wanted something original— this is what we got

"BOTH of these operations and half another — I'll show you later—completed in the time our old taps took to do one; that, I guess, is why we continue to use your Victor Collapsible Taps."

It was the often-heard story of time saved, of costs lowered, of all threads clean and smooth. And it was pleasant to hear.

Victor Tool Company
Waynesboro, Pa.
U.S.A.

Send For Estimates



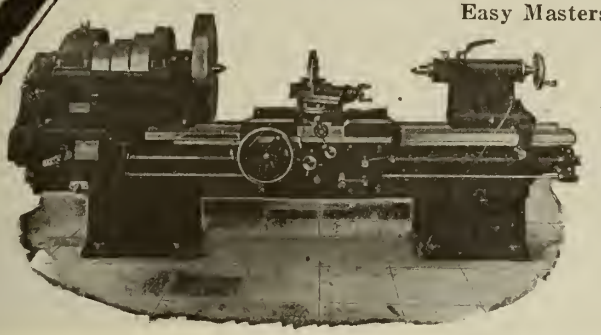
SIDNEY

FOR SERVICE

Heavy Duty Lathes

The 25-inch Heavy Duty Quick Change Sidney shown below is the last word in lathe construction. Every possible improvement will be found in this late model. Bed lengths available are 10, 12, 14, 16, 18 and 20 feet. Also built with a 27-inch swing.

Easy Masters of Big Jobs



Regardless of the severity of work, dependence put on Sidney Lathes has never been misplaced. The Sidney line has made good — with a vengeance. New Bulletin just issued on 25-inch machine. Write to-day!

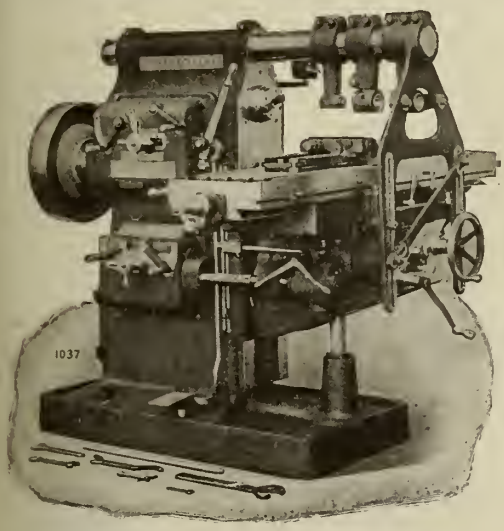
The Sidney Tool Company

SIDNEY, OHIO

CANADIAN AGENTS:

The Geo. F. Foss Machinery & Supply Co., Montreal Quebec ; H. W. Petrie, Limited: Toronto, Ontario

Cincinnati High Power Miller



One of our 9 High Power Single Pulley Plain Millers. We also make 9 cone driven plain machines, and a full line of Universals.

Unusual Spindle Power

Heat Treated Alloy Steel Gearing for the Spindle Drive

Flanged Spindle End

which makes Face Milling Cutters Interchangeable in all sizes of Machines

Handy and Easy to Operate

These are some of the reasons why you should use

Cincinnati High Power Millers

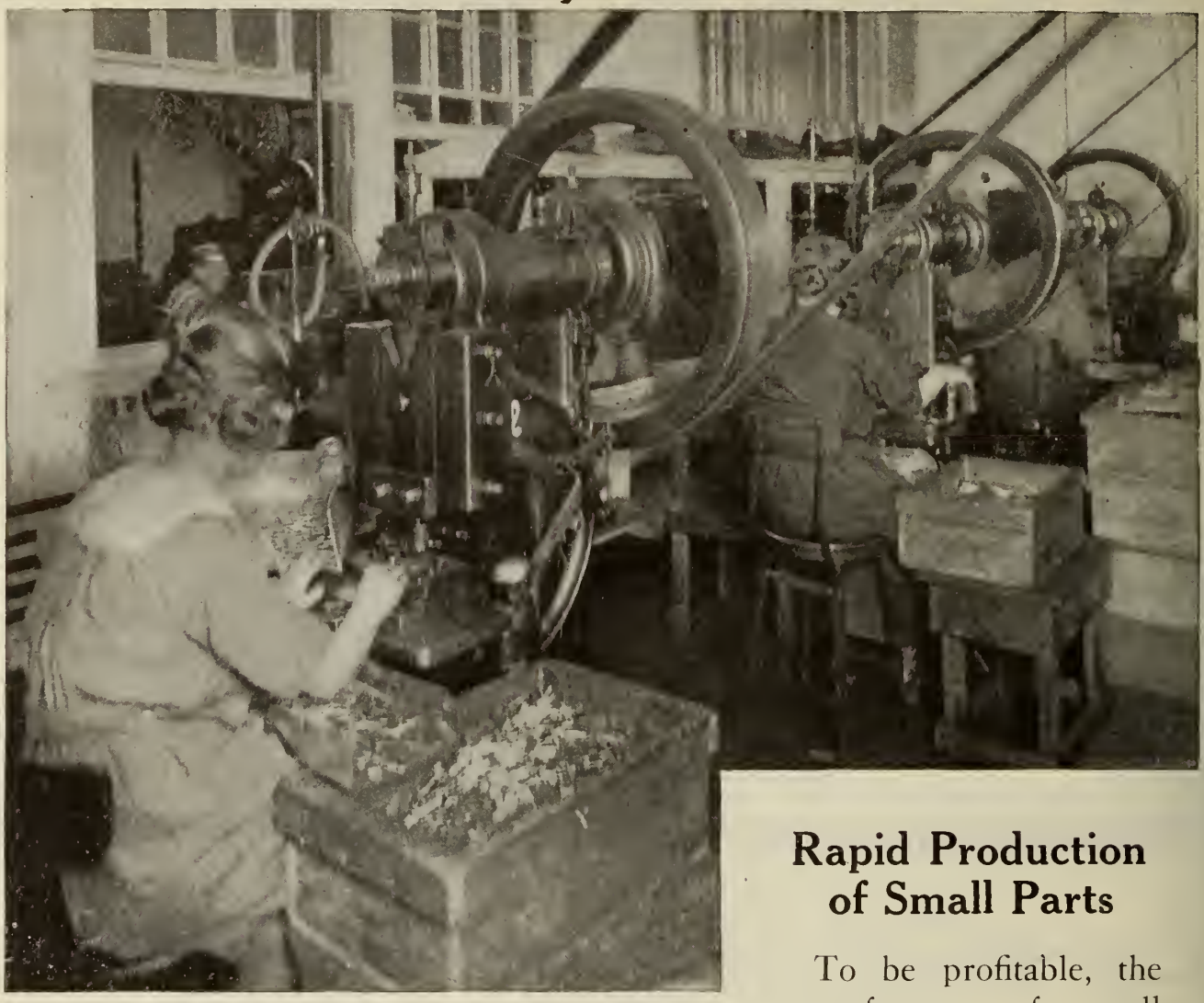
ASK FOR CATALOGUE

The Cincinnati Milling Machine Company

CINCINNATI, OHIO

Canadian Agents:

H. W. Petrie, Ltd. - - - Toronto, Ont. H. W. Petrie, Ltd., of Montreal - Montreal, Que.
General Supply Co. of Canada - Winnipeg, Man.



Rapid Production of Small Parts

To be profitable, the manufacture of small Mechanical Specialties and Mechanisms which the Greist Manufacturing Co., of New Haven, Conn., make in large quantities, must be extremely rapid, with practically no loss due to rejections.

This concern achieves these results by the use of "BLISS" Presses. Three "BLISS" No. 2 Presses are shown here working on small parts. The material used is .065" cold-rolled steel. Each press turns out its 12,000 pieces per 9½ hour day, regularly. Each has been in constant use since being installed over 5 years ago.

BLISS 1857

E. W. Bliss Company

Main Offices: BROOKLYN, N.Y., U.S.A.
American Factories: BROOKLYN, N.Y., *and* HASTINGS, MICH.

BLISS 1920

SALES OFFICES

CHICAGO, People's Gas Bldg. DETROIT, Dime Bank Bldg. CLEVELAND, Union Bank Bldg.
CINCINNATI, Union Trust Bldg. BUFFALO, Marine Bank Bldg. ST. LOUIS, Boatmen's Bank Bldg.

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LONDON, ENGLAND, Pocock Street, Blackfriars Road, S.E. PARIS, FRANCE, 100 Boulevard Victor-Hugo, St. Ouen

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

UNITED ALLOY STEEL CORPORATION

Canton, Ohio
U.S.A.

Pioneer manufacturers of Alloy Steels in America.

PRODUCTS

BARS	Hot Rolled Heat Treated Cold Drawn Rough Drawn Forged and Rough Turned
BILLETS	For forging work.
SLABS	For forging and re-rolling.

Our expert metallurgical and engineering departments are at the command of our customers.

Export Representatives:
Vulcan Steel Products Corporation
136 Liberty Street
New York City

If interested tear out this page and place with letters to be answered.

NOVO-SUPERIOR

HIGH SPEED STEEL

INTRA STEEL GIBRALTAR STEEL

Tool Steel for Every Purpose

SWEDISH LANCASHIRE IRON

Twist Drills, Taps, Hack Saw Blades, Milling Cutters, Files, Etc.
Music Wire for Springs, Steel Balls
Cold Rolled Tool Steel in Strips and Sheets

We call to your particular attention that we make a specialty of and solicit your inquiries for

Circular Saws—for wood and for hot or cold metal cutting;
Machine Knives—for cutting wood, paper, tobacco, agricultural.

PILOT STEEL & TOOL COMPANY, Limited, 322 St. James St., MONTREAL

Sole Agents for JONAS & COLVER, LIMITED Novo and Continental Steel Works, Sheffield, Eng. H. BOKER & CO., Inc. NEW YORK, N.Y.

For Light Accurate Work

11" x 6 ft. Style E Quick Change Engine Lathe

The "Star" Quick Change Engine Lathe will rapidly prove invaluable to the tool room. Whenever light work of a particularly exacting nature is to be done, there this "Star" will give the utmost satisfaction.

STAR LATHES

Further details of this "Star" will be found in the "Star" catalog. Send for your copy to-day.

The Seneca Falls Mfg. Co., Inc. 366 West Falls Street Seneca Falls, New York

THE TUBE COMPANY OF CANADA LIMITED

Electric and Oxy-Acetylene
WELDED TUBING
Also BUTT SEAM TUBING

We have a thoroughly equipped plant for Welding by Electric and Oxy-Acetylene processes. Oxy-Acetylene Welded Tubing is recommended for bending purposes; Electric for straight, or slight bends. Butt Seam Tubing is also one of our specialties. Tubing made hot or cold rolled finish.

Our Work Includes Tubing for

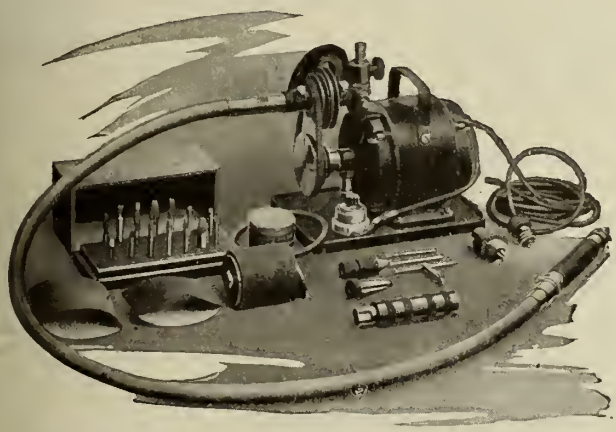
Bicycles, Bedsteads, Automobile Parts, Electric Fixtures, Gas Fixtures, etc. Round, Square, Rectangular and Special Shapes in widest range of sizes and gauges. Plant fully equipped for slitting all gauges of stock from sheets or coils.

Let us advise you of the kind of tubing that will best suit your requirements. Inquiries gladly answered.

The Tube Company of Canada LIMITED

233 Dufferin Street, TORONTO, Canada

HASKINS



Scraping Equipments

Mean:

Reduced costs and increased production in your metal pattern shop. Write to-day for complete details.

R. G. HASKINS COMPANY

27 So. Desplaines St., - CHICAGO

Montreal Representative: Geo. T. Shepard, 702 Southam Bldg.

MacKINNON STEEL CO., LTD.

Engineers, Manufacturers and Erectors of Steel Structures

Industrial Bridges, Buildings, Towers, Smoke Flues and Stacks, Chutes, Coal Bins, Ore Bins, Tanks, Cranes, Engine Houses, Grain Elevators, Derricks.

Structural Steel and Steel Plate Work, and a combination of the two lines.

Prompt Deliveries Assured

MacKINNON STEEL CO., LIMITED

Sherbrooke, Quebec

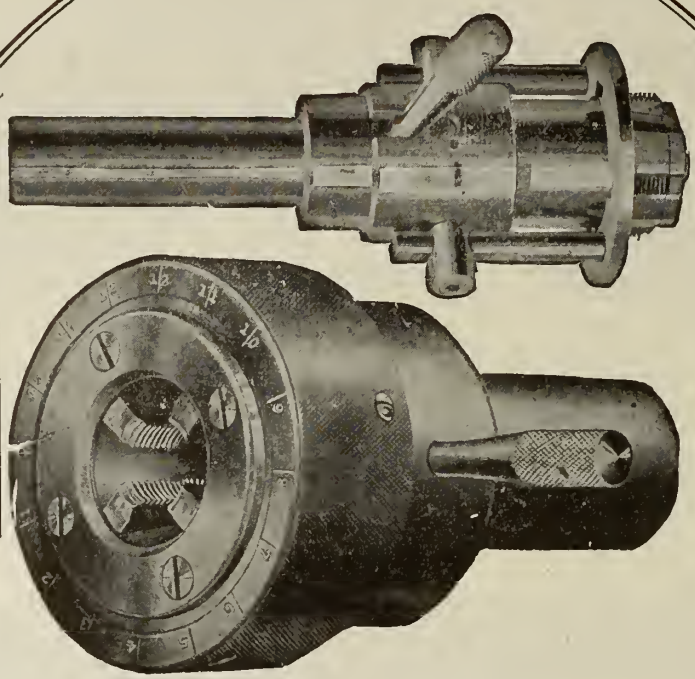
Montreal Office: 404 New Birks Building

If interested tear out this page and place with letters to be answered

MAXIMUM Production

MINIMUM Cost

Murchey Taps and Dies last longer, do better and quicker work than ordinary tools.
Every tool that comes out of the Murchey shop is the very best that years of experience can make.



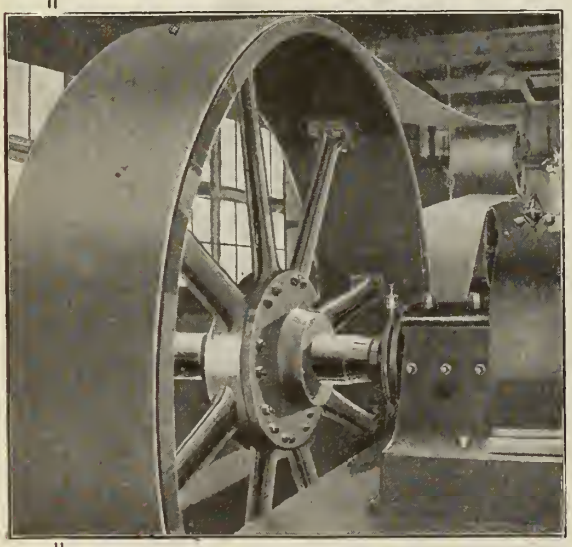
Murchey Tools will cut your tapping and threading costs and will boost production 50 per cent.
Send for a Murchey Tap and Die on approval and give it a trial. You will then secure actual proof of its value to you.

MURCHEY
Machine and Tool Company
DETROIT, MICH., U.S.A.

THE COATS MACHINE TOOL CO.
14 Palmer St., Westminster, S.W.
LONDON, ENGLAND

FENWICK FRERES & CO.
8 Rue De Rocroy
PARIS, FRANCE

RUBBER BELTING



For transmission duty in power plants on engines, pumps, compressors, etc., as well as in the machine shop for use on Grinders, Drillers, Planers, Lathes, etc.

We can furnish you with the proper Rubber Belting, regardless whether for heavy transmission duty, high speed work or conveying of materials that will show you efficiency and economy.

Mechanical Rubber Goods

Our Canadian Agents carry large stocks of Mechanical Rubber Goods, including

DANIEL'S P.P.P ROD PACKING
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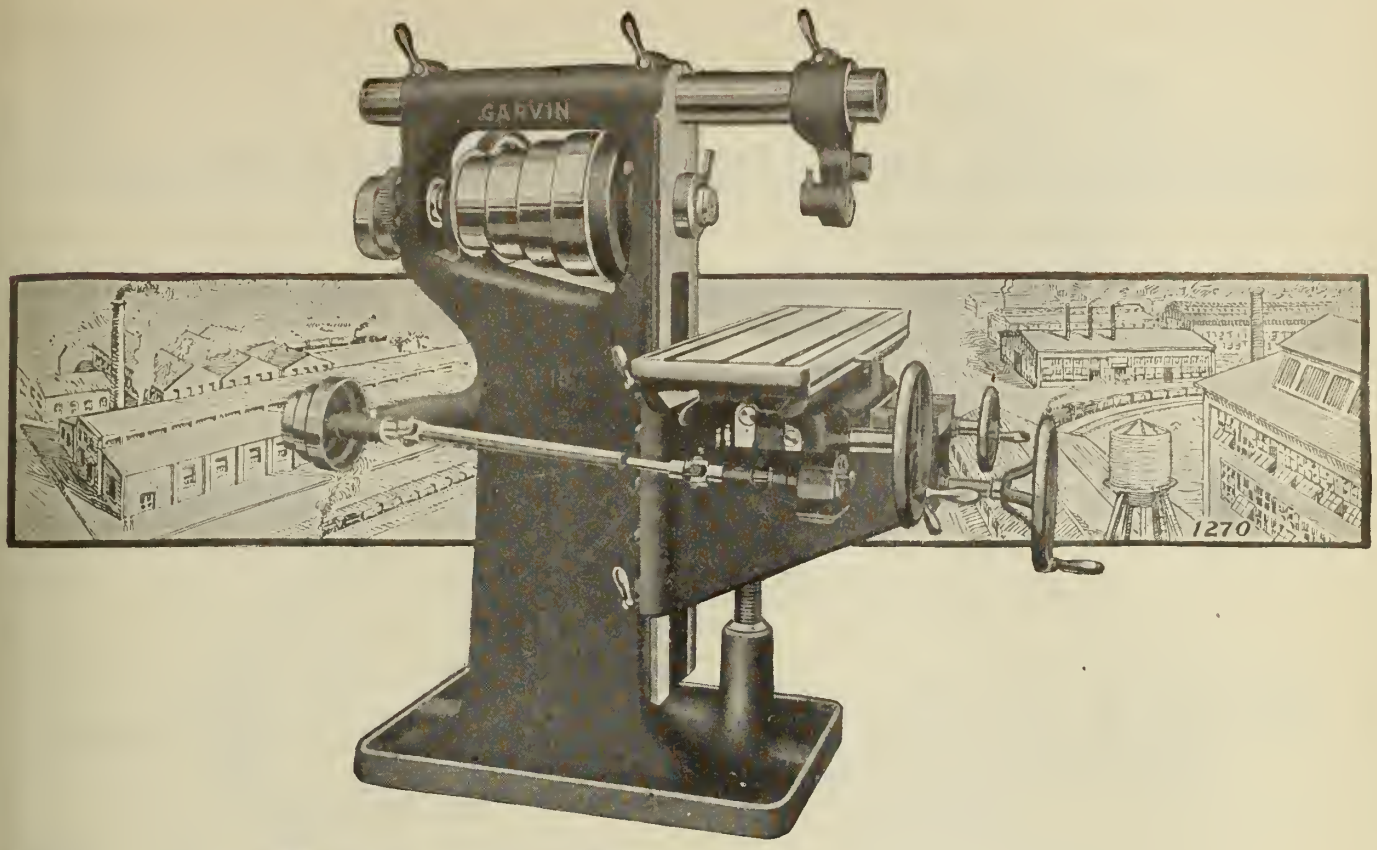

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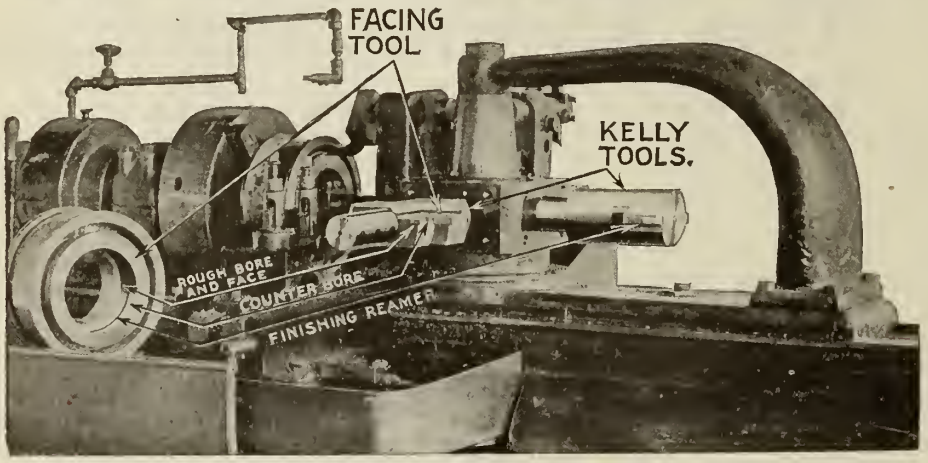

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Continued next month.

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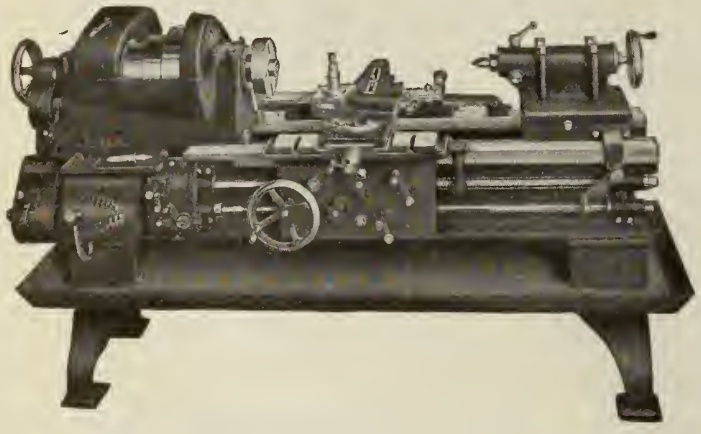

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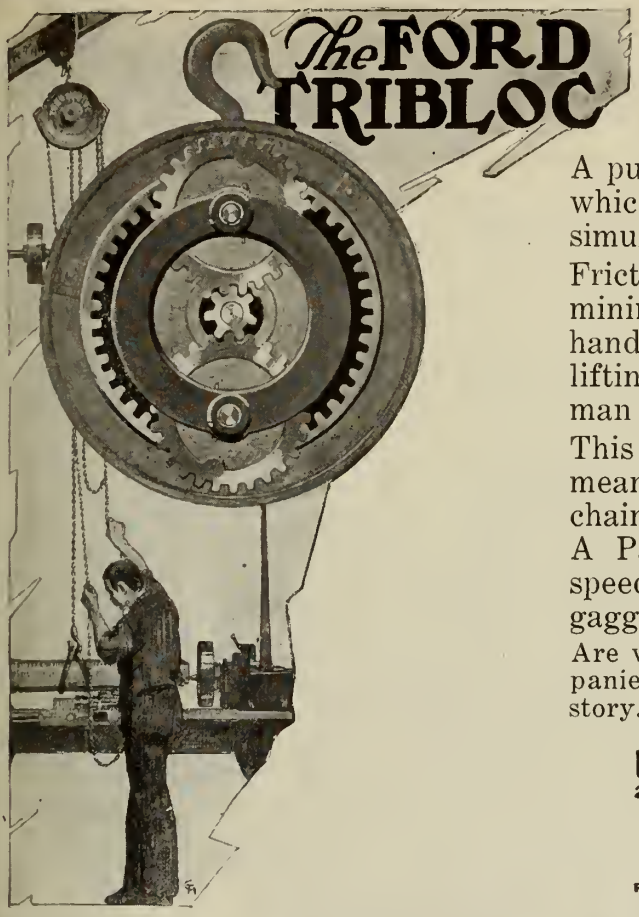

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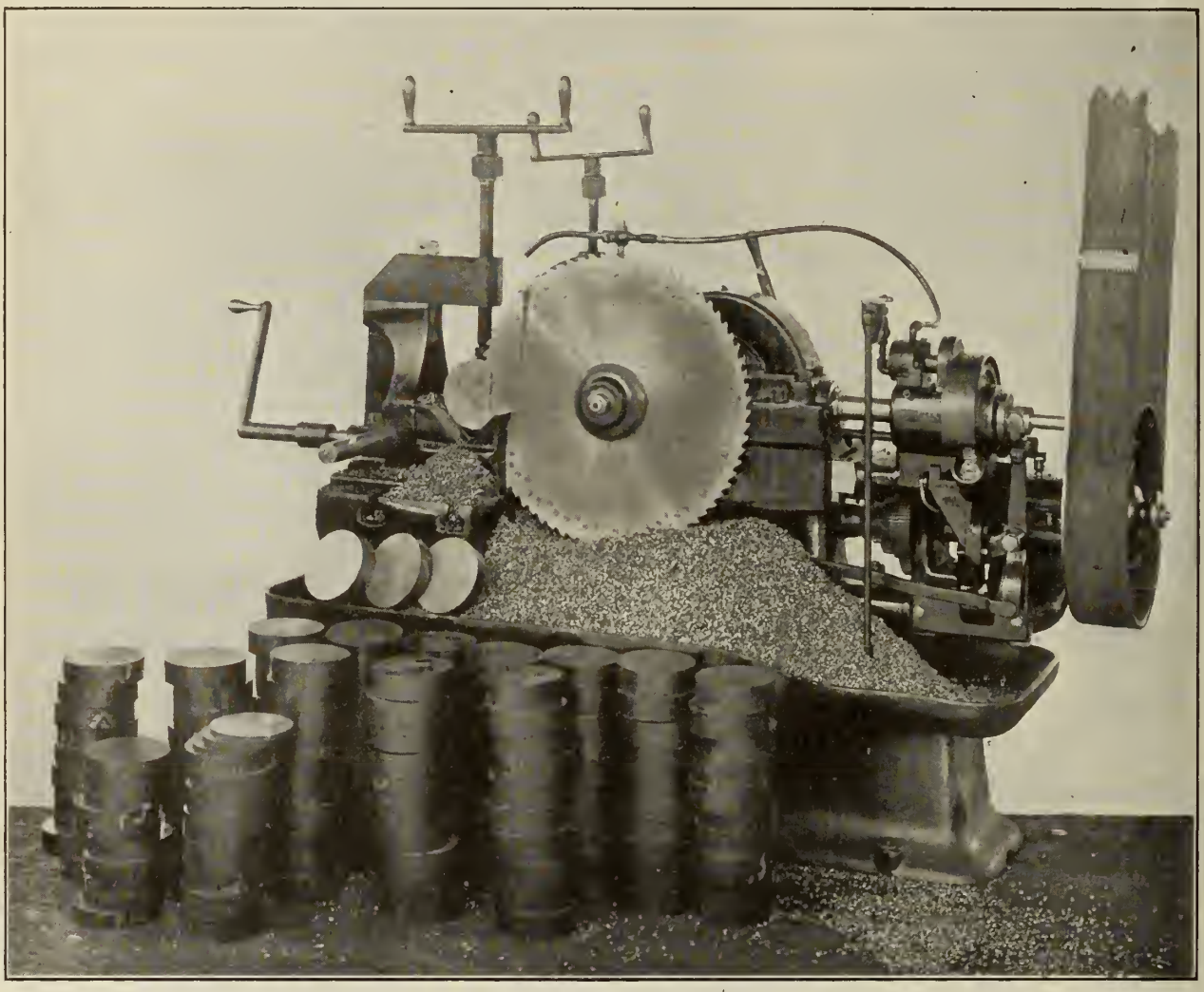

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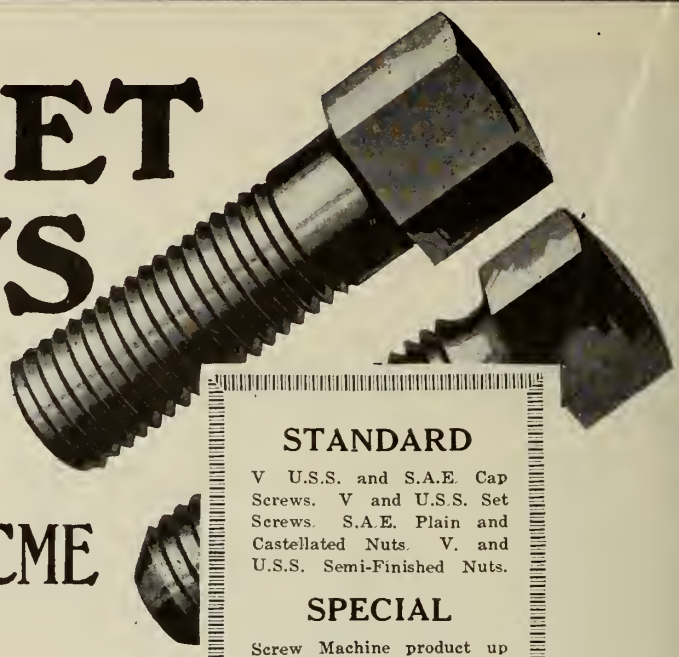

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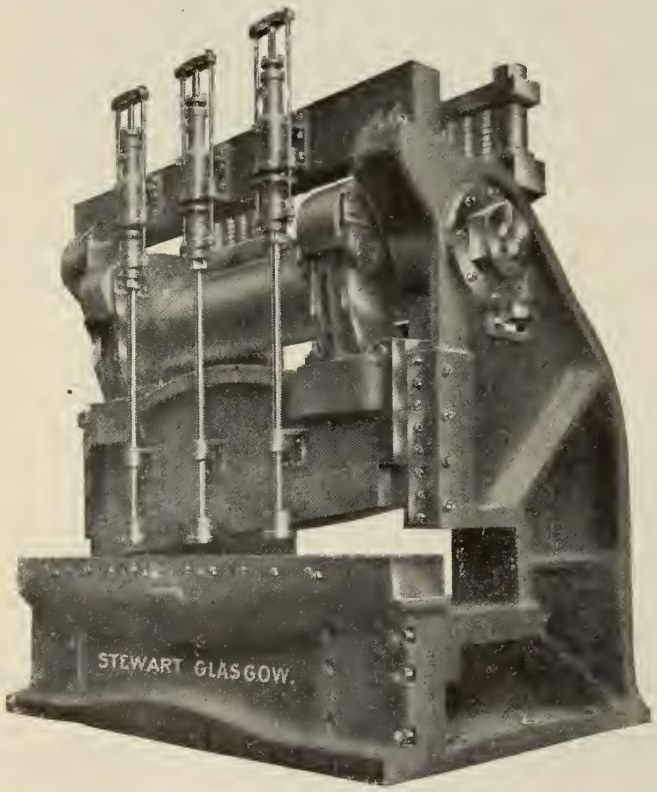

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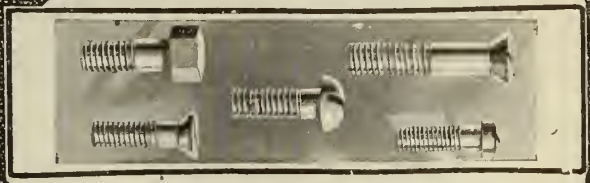

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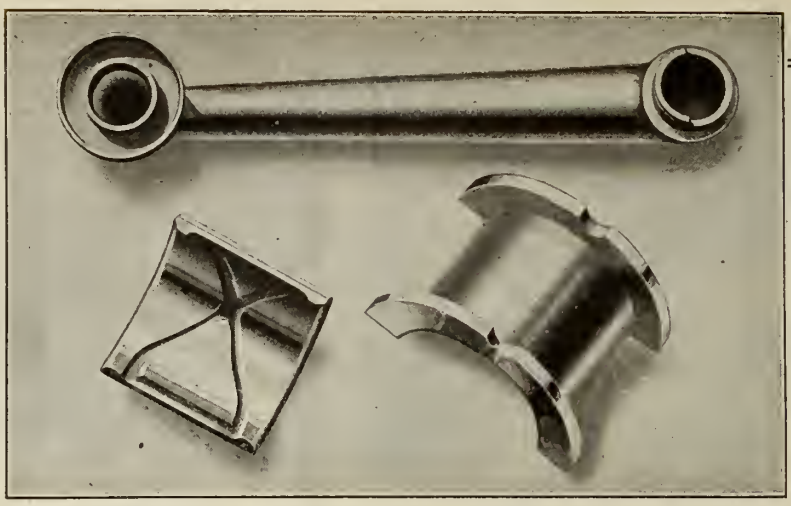

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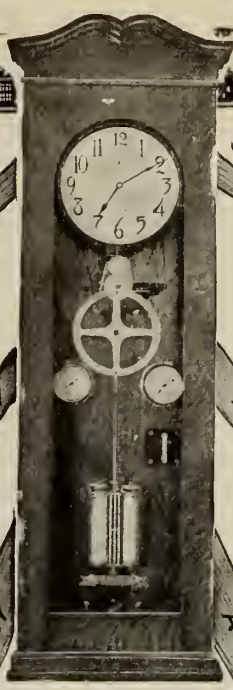

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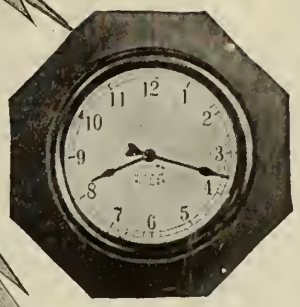

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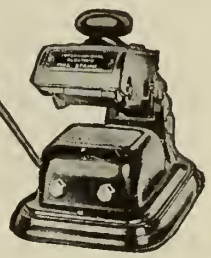

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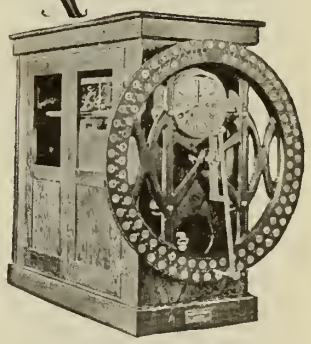

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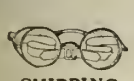

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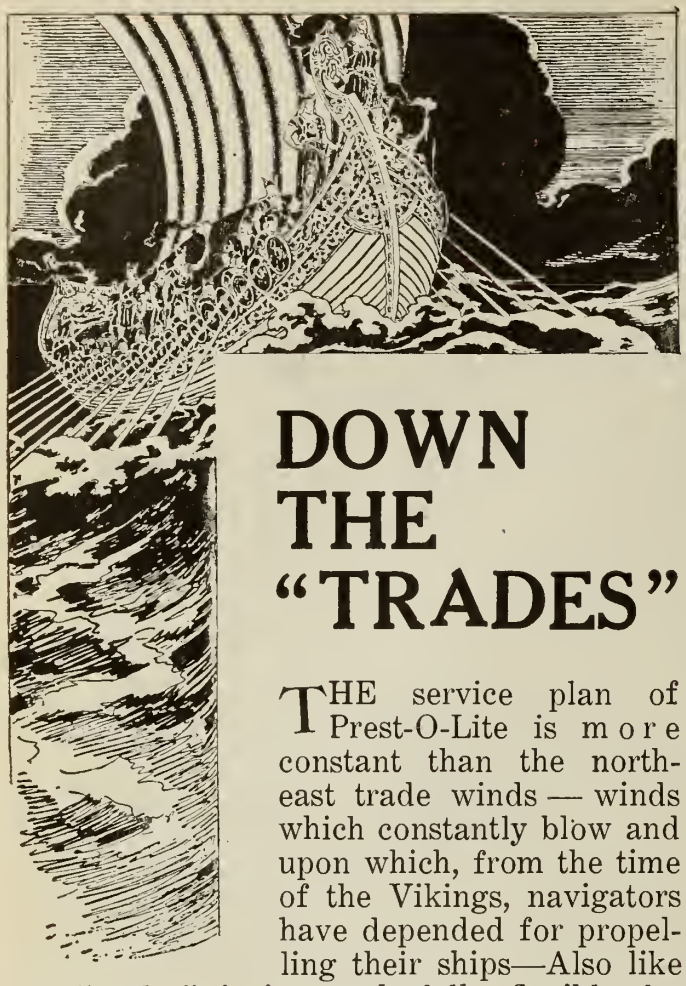

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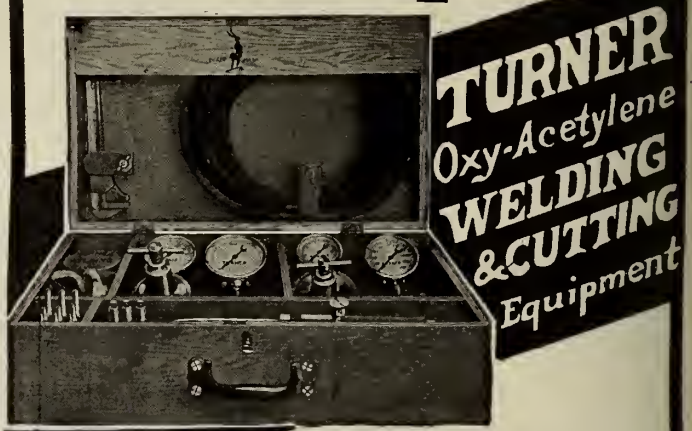
For Repairing Broken Machinery or Tools of Medium Size



These outfits will soon pay their cost in machine parts or tools reclaimed. The sectional extensions of the torch enable the operator to adjust it to any desired length or angle. The location of valves is such that the flame is controlled by one hand, leaving the other hand free for the work at all times.

For full particulars write

The Turner Brass Works
SYCAMORE, ILLINOIS, U. S. A.

ANNOUNCING

DOMINION OXYGEN COMPANY, Ltd.

The Dominion Oxygen Company, Ltd., from its very inception takes high rank among the leaders of Canadian Industry.

Product

Foreseeing an extraordinarily rapid development of Canadian business, it plans a chain of modern plants for the production of atmospheric oxygen of high purity.

Five important industrial centers have already been chosen as locations for as many plants. The building program is actually under way and is being rapidly pushed to completion.

Cylinders

Dominion Oxygen Cylinders will be of the most modern type, designed to carry the maximum quantity of gas with the least possible weight, thus insuring the lowest shipping and handling expense.

Under the comprehensive selling plan of the Company, these cylinders will be loaned to the consumer on liberal terms.

Policy

Broad in its scope, the Dominion Oxygen Company, Ltd., is still broader in its policy. It has planned and is providing a great distributing system which, through a network of centrally located warehouses and distributing stations, will insure Canadian oxygen users of a never-failing and prompt supply of pure oxygen in any quantities.

This service will be extended in all its ramifications as rapidly as new plants are completed.

By inaugurating, with its patrons, a relationship of unusual breadth and liberality, the Dominion Oxygen Company, Ltd., will be a constructive force in promoting the tremendously increased use of the oxy-acetylene process.

A Suggestion

It will be to the advantage of Canadian users of oxygen to write for more detailed information before contracting for their future oxygen requirements.

DOMINION OXYGEN COMPANY, Ltd.

265 Adelaide Street West

Toronto, Canada

If interested tear out this page and place with letters to be answered

STEEL PLATE CONSTRUCTION

Oil Storage, Gasoline Tanks, Air Receivers, Pneumatic Water Supply Tanks, Smoke Stacks, Boiler Breeching, Riveted Steel Pipe, Bins and Hoppers.

THE

TORONTO IRON WORKS

LIMITED

HEAD OFFICE: ROYAL BANK BLDG. TORONTO WORKS: CHERRY STREET

STEEL CASTINGS

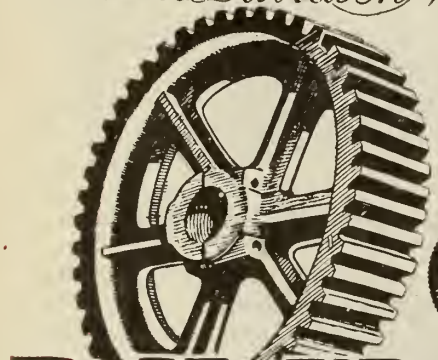
We shall be glad to supply, in addition to our General Catalogue, literature on

Steel Castings — Lithographed Ware
Galvanizing — Enamelled Signs
Wire Goods
Stoves

made by the Acid Electric process up to fifteen tons. Castings made by this process are free from blow holes, easy to machine, and superior in every way to ordinary Steel Castings.

Castings supplied for shipbuilding, cars, locomotives, all classes of machinery, etc.

The Thos. Davidson Mfg. Co. Limited



Head Office: Montreal
Branches: Toronto and Winnipeg.
Steel Foundry Division
Lachine Canal, Turcot

DAVIDSON'S STEEL CASTINGS MADE IN CANADA THE SEAL OF DURABILITY

DAVIDSON

Steel Fingers Slip into the Flutes

Grip the broken tap and back it out before you've had time to count three times sixty.

The Walton Tap Extractor

removes broken taps buried below the surface of the work without trouble or loss of time. It removes any broken tap without injuring the thread. It saves the casting or forging. Pays for itself over and over—often on the very first job.

How many do you want on trial?

The Walton Co.
Hartford - - - Conn.

DIAMONDS

For Truing Grinding Wheels

We have in stock a large, comprehensive assortment of diamonds for dressing emery wheels.
Every stone is of carefully selected quality.
Let us know your requirements.

Canadian Desmond-Stephan Mfg. Co., Limited
Hamilton, Ontario, Canada

The Acknowledged Leader

In every field of industry there is one acknowledged leader by which all others of its type are judged.

The Chasers of the HARTNESS AUTOMATIC DIE hold this enviable position. Their superior efficiency is not a mere claim, but the verdict of expert mechanics based upon exhaustive tests covering many years of service.

For precision work, we can furnish chasers with a lead guaranteed within 0.001 inch per inch of thread.

Quantity and quality of output are the predominant factors upon which their reputation is built.

Jones & Lamson Machine Company

(AUTOMATIC DIE DEPARTMENT)

American Agents for Dies and Chasers:

Boyer, Campbell Company, Detroit.
E. L. Essley Machy. Co., Chicago, Milwaukee and Moline.
Robinson, Cary & Sands Co., St. Paul and Duluth.

Foreign Agents:

France, Spain, Belgium—F. Auberty & Company, 91 Rue de Maubeuge, Paris, France.
Holland—Spliethoff, Beewukes & Company, Rotterdam, Holland.
Australia—McPherson's Pty., Ltd., Melbourne, Australia.
Japan, Manchuria, Korea, Formosa—Mitsui Bus an Kaisha, Ltd., Tokyo, Japan.

Why Pay Exchange on Your Grinding Wheels

When you buy imported wheels you not only have to pay duty, you have to foot a high exchange rate too. You buy imported wheels because you believe they have better quality. This is a mistake. Since we have been making abrasives from our own furnaces we can supply grinding wheels equal in quality to the best imported makes.

MADE IN CANADA

Dominion Wheels are Uniform in Quality

We are prepared to have you test them at our expense against any imported wheel you may be using. Quality is the big factor in grinding wheels—you'll find it in Dominion Wheels.

DOMINION ABRASIVE WHEEL CO., LTD.
MIMICO, ONT.

Heat Under Accurate Control

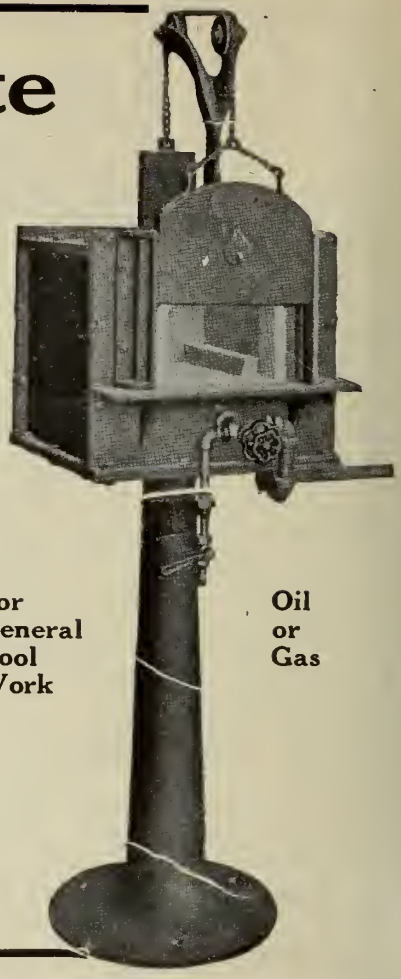
Here is an important factor in the heat treatment of metals. An intense heat, rapidly developed, and always under accurate control of the operator, are features that distinguish

BELLEVUE FURNACES

These tool forges are particularly adapted for the requirements of the small machine shop for annealing and tempering dies, cutters, reamers, etc.

Combustion is perfect and no flames come in contact with material. Built to stand the highest temperature. Doors are properly counterbalanced. In every way BELLEVUE FURNACES meet with the demand for durability, efficiency and convenience.

Let us advise you about your heat-treating problems.



For General Tool Work

Oil or Gas

Bellevue Industrial Furnace Company

Julius C. Hinz, President

703 Bellevue Ave. - Detroit, Mich.

Representative in Canada: H. W. PETRIE, LIMITED, Toronto, Canada

STEEL *for*

Every Commercial Purpose

We are the only company in Canada producing steel ingots by the "HARMET" Liquid Process, a process that makes these ingots vastly superior to the ordinary kind, improving the physical properties and reducing the waste of ingot.

We can supply forgings of all shapes and sizes made of ordinary or "HARMET" Fluid Compressed Open-Hearth Steel on the Shortest Notice.

Nova Scotia Steel and Coal Co., Limited

Head Offices:

New Glasgow, N.S.

Western Sales Offices:
Room 14 Windsor Hotel
MONTREAL

Steel Ingots *by the* **HARMET** Liquid Process

"BERNARD"
TRANSMISSION APPLIANCES

have achieved an enviable reputation in the Industrial World. Their performance under every conceivable working test has proved their dependability, and they are the most economical because of their durability.
We stand back of our products and will give dealers every assistance.

Put them to the test.

The A. Bernard Industrial Co.

Manufacturers of High-Grade Power Transmission Appliances

Offices and Works: FORTIERVILLE, Que., Canada

MATTHEWS
Pittsburgh Bevel Steel Letters and Figures

Hand Made

Matthews' Letters and Figures are hand made from carefully selected tool steel. The characters are neatly formed, producing stamps that make easily read and durable marks on all classes of products. They reduce considerably the cost of high grade marking.

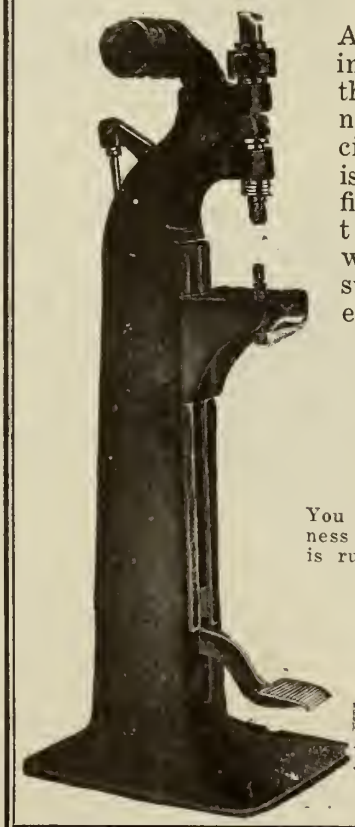
Try them! Mark your next order — "MATTHEWS' Letters and Figures."

JAS. H. MATTHEWS & CO.

3946 FORBES STREET - PITTSBURGH, PA., U.S.A.

Steel Lettering, Dies and Stamps

No Skill Required



Anybody with ordinary intelligence can operate this Rotary Rivet Spinning Machine. No special skill is required. It is a tool that perfectly fits labor conditions as they exist to-day. A woman can operate as successfully as the skilled mechanic.

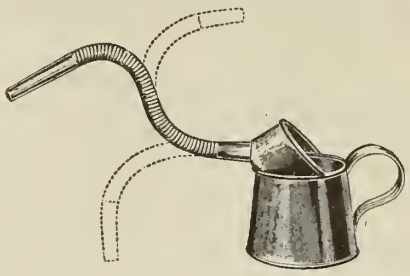
The GRANT is Noiseless

You are assured of perfect quietness wherever the Grant Rotary is running. And it spins a perfect polished rivet head every second without breaking or marring the casting. Rivets tight or loose. Write for details.

GRANT Mfg. & Machine Co.
BRIDGEPORT, CONN., U.S.A.

If interested tear out this page and place with letters to be answered

Say Good-bye to Funnels Use this "ALL-WAY" Oiler



Combination Filler and Funnel

This Filler eliminates the necessity of the use of a separate Funnel. With the Flexible Spout any part can be readily reached.

Saves much inconvenience and avoids dripping of oil.

If your dealer cannot supply you, write us.

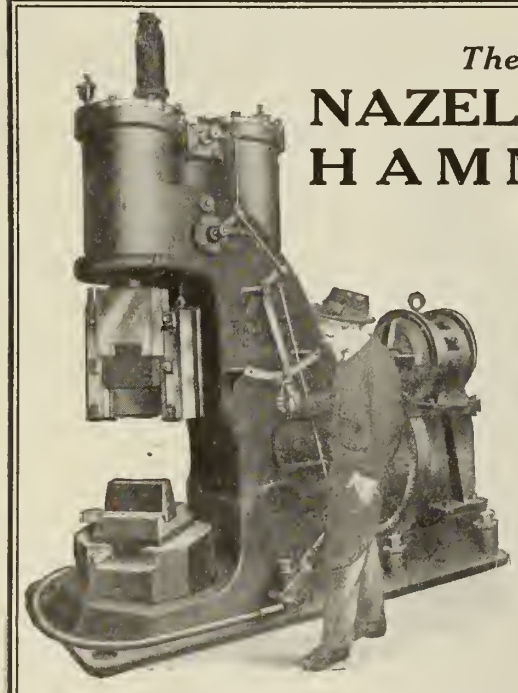
We also manufacture the well-known "All-Way" Oil can. Saves you 50% of your oil bill.

THE ALL-WAY OILER MFG. COMPANY

196 King St. West Toronto, Ont.

The

NAZEL AIR HAMMER



NOTED FOR ITS BLOW AND CONTROL

A self-contained unit, built in three types, six sizes, arranged for belt or direct motor drive, with capacities up to 7-inch square, for all manner of jobbing, manufacturing and certain classes of die forging.

Write for catalogue.

NAZEL ENGINEERING & MACHINE WORKS

DEPARTMENT F

PHILADELPHIA, Penna.

SCIENTIFIC LUBRICANTS for SCIENTIFIC LUBRICATION

MYSTIC

Cutting Compound Speeds Up Production

Used in accordance with standard practice, Mystic Cutting Compound enables you to operate your machine at the highest possible speed, without overheating. There is no burning and scoring, with Mystic. The tool and the work are always cool and free from chips. Tools cooled with Mystic hold their cutting edge for a long stretch, which means a minimum loss of time for re-sharpening. From every angle Mystic boosts production.

Give Mystic a trial

Free Sample on Request

CATARACT REFINING CO.
Limited
Toronto, Ont.

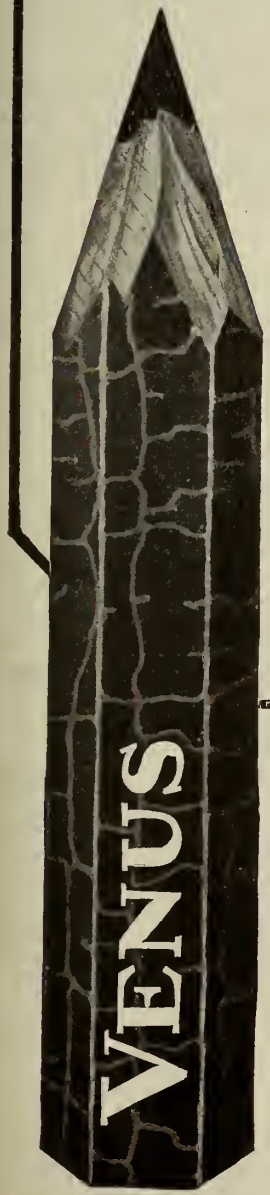
SCIENTIFIC LUBRICANTS for SCIENTIFIC LUBRICATION

VENUS PENCILS

The Largest Selling Quality Pencil in the World

ENGINEERS buy **Venus Pencils** because they know they can absolutely depend upon the quality and uniformity of each of the 17 degrees.

Venus Pencil perfection not only means pencil comfort and pencil economy—it means pencil *accuracy* as well.



17 black degrees, 3 copying

For bold heavy lines
6B-5B-4B-3B

For general writing and sketching
2B-B-HB-F-H

For clean fine lines
2H-3H-4H-5H-6H

For delicate thin lines
7H-8H-9H

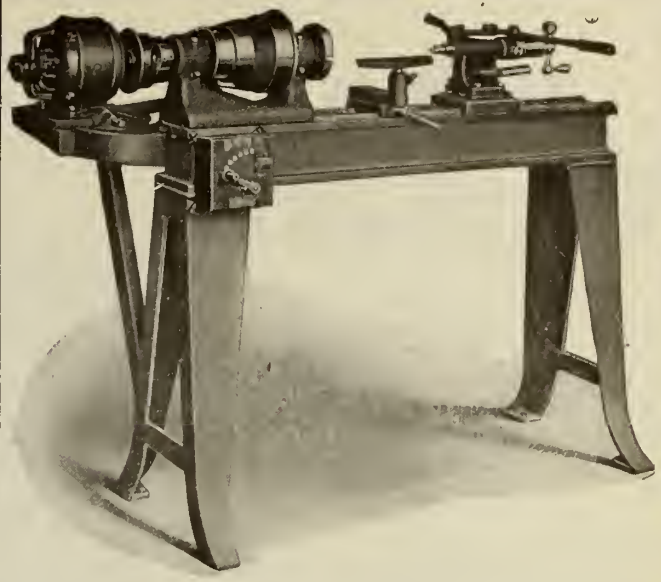
Copying for indelible uses

Plain Ends, per doz., - - $1.00
Rubber Ends, per doz., - - 1.20

At all stationers and stores throughout the world.

American Lead Pencil Co.
238 Fifth Avenue,
New York

Factory: Hoboken, U.S.A.
Factory: London, England



Built For *Service*

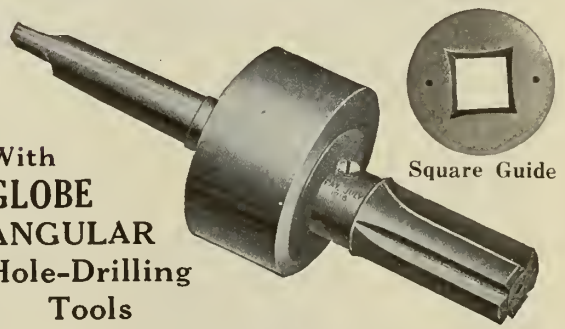
This BLOUNT Motor-driven Lathe is well adapted to all speed lathe uses. It is of late design, and has a number of features in which you will be interested. Provided with constant-speed motor. Lathe spindle made of hollow, high-carbon steel, ground to size and bored for Morse taper. Runs in self-oiling bronze bearings.

"We will accept Canadian funds at par"

J. G. Blount Co., Everett, Mass., U.S.A.

DRILL

those Square, Hexagon or other Angular Holes



With **GLOBE ANGULAR Hole-Drilling Tools**

A GREAT TIME-SAVER

A large number of Canadian manufacturers are profiting by reduced production cost — a direct result of Globe Angular Hole Drilling Tools.

Why not investigate? Let us send you full details?

McClean Machine & Tool Co., Ltd.
125 Mary St., HAMILTON, CANADA

VOLTA Electric Furnace

For economy, it is essential that the furnace be so designed and equipped as to reduce to a minimum the refining time and delay between heats.
Volta Furnaces are the result of 10 years' experience **and nothing is spared to make them efficient.**
We are capable of advising you on your steel casting proposition.

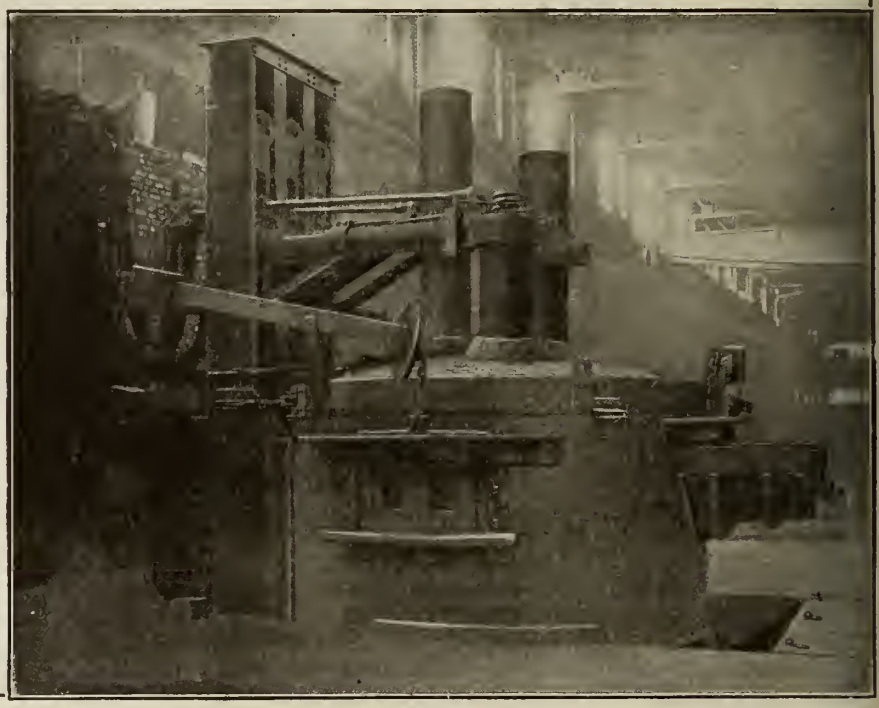
Volta Manufacturing Co., Limited

WELLAND - ONTARIO

BESIDES being cheaper, electric steel castings have other advantages over ordinary steel castings. The product has a particularly homogeneous structure, a fine grain, superior physical properties, and a chemical composition which can be perfectly controlled.

FOR QUALITY CASTINGS

Illustration shows 6-ton VOLTA Furnace in running position.

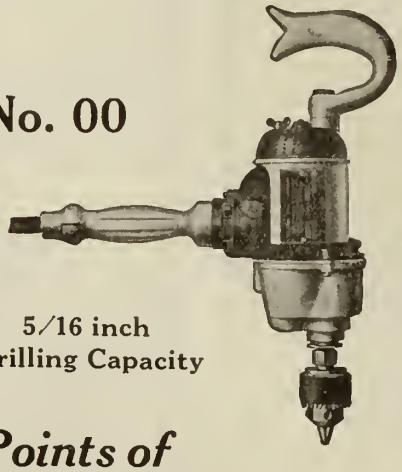


Thor

ELECTRIC DRILLS

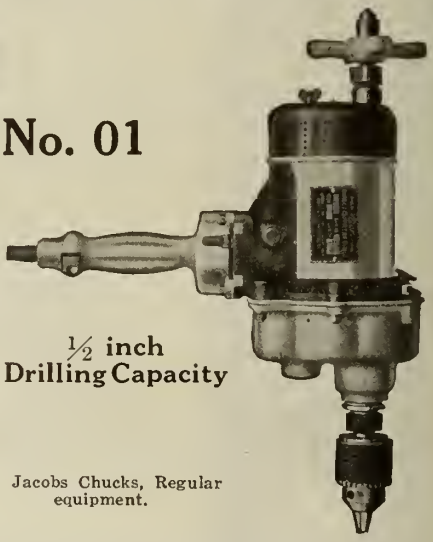
Universal motor for direct or alternating current, 110-220 volts. (Licensed under Buche Universal Motor Patent.)

No. 00



5/16 inch Drilling Capacity

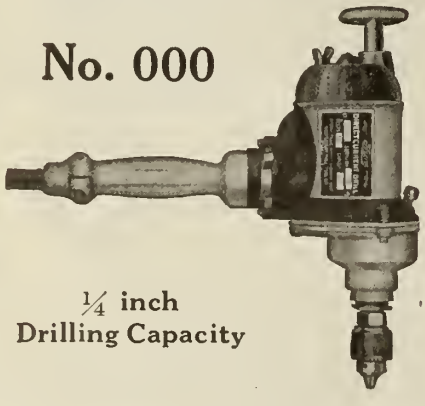
No. 01



½ inch Drilling Capacity

Jacobs Chucks, Regular equipment.

No. 000



¼ inch Drilling Capacity

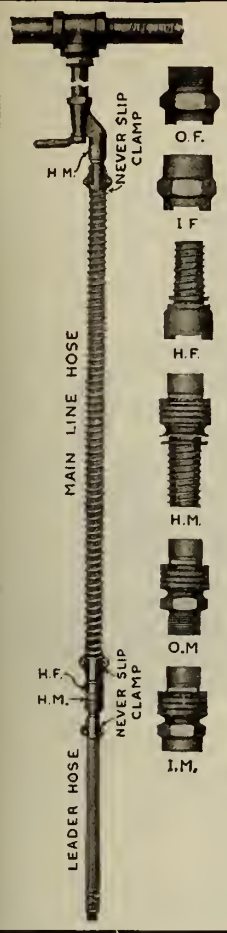
Points of Superiority:

Light weight — The internal gear driver permits the use of smaller gears and gear case—3 teeth in contact instead of one.
Small and compact—Due to the distributed pole motor construction and small gear and gear case.
Most powerful—The method of winding the field and armature, and the use of ball and roller bearings result in greater power.
Extreme Durability — Interlocking commutator bars; fully tapped and insulated coils; large brushes; and perfect automatic brush holders insure long life.
Highest Efficiency — Results from the unique motor construction and elimination of all friction.
Safety — The Thor switch breaks both sides of the line, leaving no current in the drill when idle. It would be impossible to make a switch insuring greater safety.

These features are used in Thor Electric Tools exclusively, and will not be found in any other make. Their compact construction, neat design and high grade finish is unsurpassed.

INDEPENDENT PNEUMATIC TOOL COMPANY
334 St. James St., MONTREAL

TORONTO, 32 Front Stret West. WINNIPEG, 123 Bannatyne Ave. East
VANCOUVER, 1142 Homer Street



CLEVELAND HOSE SPECIALTIES

Bowes Automatic Air Hose Couplings

Standard Equipment Everywhere

STYLE O.F. is an Outside Thread Female Pipe End. Made in sizes ⅜-inch to 1½-inch.
STYLE I.F. is an inside Thread Female Pipe End. Made in sizes ¼-inch to 1½-inch.
STYLE H.F. is a Female Hose End with spiral shank to insert into the hose and has groove for the Never Slip Hose Clamp. Made in sizes ¼-in. to 1½-in.
STYLE H.M. is a Male Hose End with spiral shank to insert into the hose and has groove for the Never Slip Hose Clamp. Made in sizes ¼-in. to 1½-in.
STYLE O.M. is an Inside Thread Male Pipe End Made in sizes ¼-in. to 1½-in.
STYLE I.M. is an Inside Thread Male Pipe End. Made in sizes ⅜-in. to 1½-in.
The Male and Female Ends of Bowes Couplings interchange in sizes ¼-in. to ¾-in. Sizes 1-in. and 1¼-in. interchange. The 1½-in. ends interchange only with themselves.

BOWES COUPLINGS

Are instantly connected or disconnected.
They are absolutely air-tight under all pressures.
They quickly pay for themselves by stopping costly leaks.
They interchange in sizes most commonly used.
They have no loose parts to be mislaid or lost.
They are made of brass and will not rust.
The U-shaped Gasket interchanges in couplings ¼-inch to ¾-in.

The Cleco Never Slip Hose Clamp

Made in same sizes as Bowes Couplings

The adjoining cut of Cleco Never Slip Hose Clamp shows the "Flanges" which engage the groove provided in all hose ends of Bowes Couplings. The "Model Hose Line" illustrated shows correct styles of couplings and valve to use and proper way to attach the clamps.

CLECO GROOVED HOSE NIPPLE

Grooved Nipples when attached to hose with the wire clamp cannot "blow-out," as one-half of the Wire Clamp lies in Nipple Groove, and the other half on the hose, uniting nipple and hose permanently.

WIRE CLAMP TOOL

To apply Wire Clamps to Grooved Hose Nipples you need the Wire Clamp Tool illustrated, a small hand-operated tool at moderate cost which we carry in stock for immediate delivery. In Stock: Riveting and Chipping Hammers, Four-piston Air Drills, Corner Drills, Emery Grinders, Sand Rammers, Holder Ons, etc.

Use Annealed Wire No. 14

Write for Bulletin 38 illustrating Cleco Hose Fittings, Couplings, Valves, etc.

IMPORTANT:—The Small Leaks in your "AIR LINE" mean serious loss in DOLLARS. Have you any idea of the amount of "Air" wasted in small leaks at your connections? Air Leakage through 1-16 in. opening equals 5.32 cu. ft. per minute at 80 lbs. It will pay you to install Bowes Couplings and stop costly leaks.

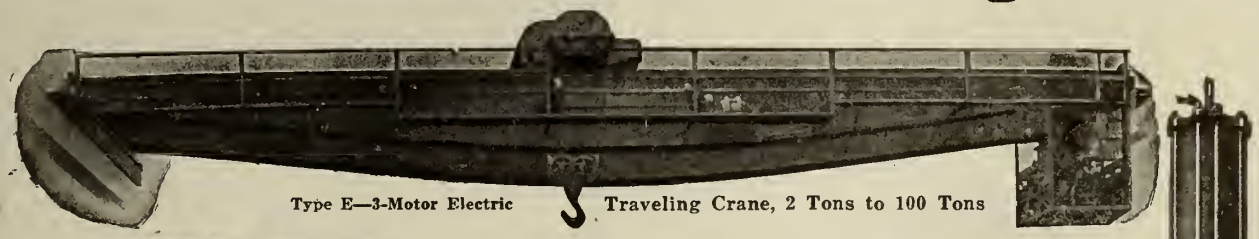
Write for Bulletin 34A, 41 and 43.

CLEVELAND PNEUMATIC TOOL CO. OF CANADA LTD., 84 Chestnut St., TORONTO

A. R. WILLIAMS MACHINERY CO., TORONTO, 337 Craig St., W., MONTREAL. WILLIAMS & WILSON, MONTREAL

CANADIAN MADE CANADIAN MADE

Electric and Hand Traveling Cranes



Type E—3-Motor Electric Traveling Crane, 2 Tons to 100 Tons

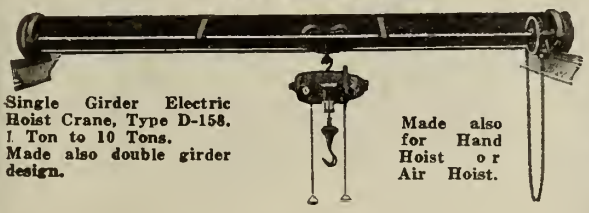
Northern Type E Crane Trolley, Rigid, Enclosed Construction. Patented in Canada.

We make a wide range of CRANE and HOIST designs. All sizes and capacities, 1 ton to 100 tons.

Type D Electric Hoists —½ to 10 Tons.

Air Hoists, Trolleys and Tracks.

Type No. 20 Air Hoist.



Single Girder Electric Hoist Crane, Type D-158. ½ Ton to 10 Tons. Made also double girder design.

Made also for Hand Hoist or Air Hoist.

Get our prices and specifications before you buy.

In asking prices, state SERVICE, CAPACITY, SIZE OR SPAN POWER, and, if electric, KIND OF CURRENT.

Catalogs free.

Northern Crane Works, Limited

Walkerville, Ontario, Canada

If interested tear out this page and place with letters to be answered.

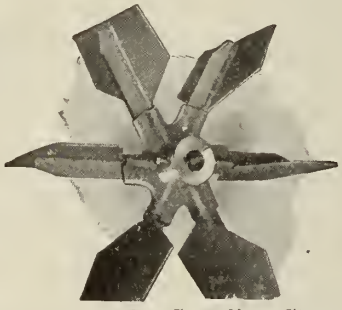
Canadian

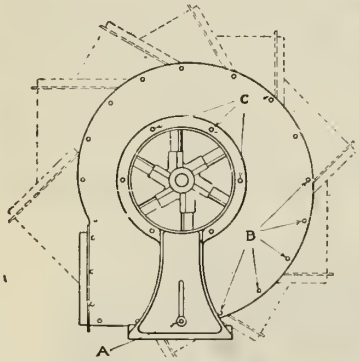
The Canadian Standard Reversible Mill Exhauster will keep your shop clean, remove sawdust, shavings, fumes, gas or any loose materials and disagreeable odors.

Insurance rates can be reduced; floors and machines covered with sawdust, chips or shavings, increase the fire risk.

Insurance companies reduce the premiums where adequate precautions have been taken to prevent fires.

Blast Wheel — This wheel is so constructed that it will handle any kind of stringy material efficiently, such as sawdust, shavings, cotton lint. Will also handle gases, fumes, smoke, etc.





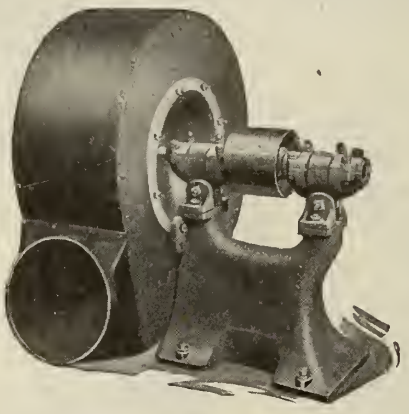
The Canadian Standard Planing Mill Exhausters have reversible housings so that the outlet can be adjusted instantly to any angle desired.

This eliminates necessity of crossed belts. Simplifies changes on alterations in piping or building.

The housing is of heavy rolled steel plate securely bolted together with angle irons. Round cast iron outlet bolted to the housing. Blast wheel mounted on heavy cast iron spider.

Every fan carefully tested by running test at speeds in excess of that required.

Write for Catalog 16



Canadian Blower & Forge Co.,

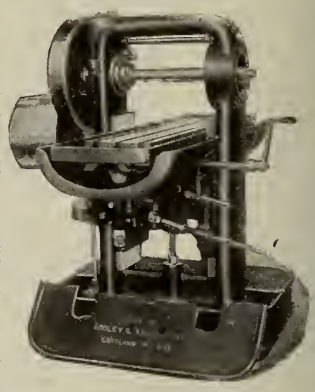
Kitchener - Ontario

BRIGGS MILLERS

Production Tools

Machine tools to-day are judged by their ability to do efficient work, save time, labor and expense. These have ever been the measures by which Briggs Millers have been designed and constructed. That our engineers have succeeded in meeting these requirements is evidenced by the increasing popularity of Briggs Millers.

No matter what the nature of the work or how severe the service the Briggs Miller will stand up to it. Its unusual rigidity, great strength and ability to take wide deep cuts when running at a high rate of speed, has established a wide reputation that is unexcelled. We would like to show how "Briggs" adaptability and convenience can increase output and lower costs for you. A letter will bring full details by return mail.

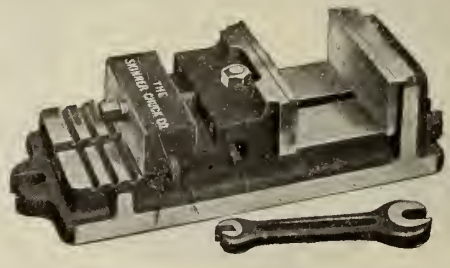


Gooley & Edlund, Inc.

CORTLAND, N.Y.

Canadian Representatives:
Garlock-Walker Machinery Company, Ltd., Toronto
Williams & Wilson, Ltd., Montreal

SKINNER DRILL PRESS VISES



The body is carefully machined and highly finished. The well proportioned jaws have steel faces. These jaws can be instantly adjusted from 0 to maximum capacity. The screws and wrench are of steel and most durable. A tool of many uses in every shop.

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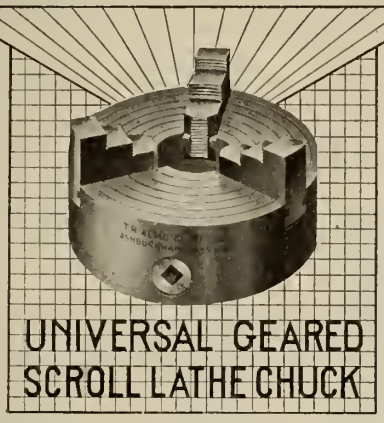

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The body is a one-piece casting which eliminates parts and chattering when under heavy cutting pressure. The jaws are made of special alloy steel and hardened through making them stronger than the usual case hardened jaws. Two styles jaws—No. 1 Common Jaws, No. 2 Reserve Jaws.

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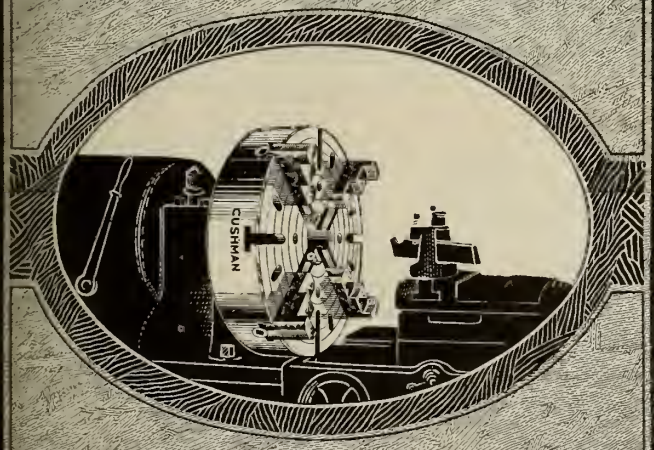

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McCrosky WIZARD Quick-Change Chucks and Collets

are continuous performers in hundreds of the largest and most modern plants of Canada and the United States.

The labor shortage has made maximum production at minimum cost a necessity. The WIZARD has always met this test.

A WIZARD will discount the lost time of your drill press. It drills, reams, taps, counterbores, sets studs, etc., without once stopping the spindle. A girl and a WIZARD can do the work of two men any day and every day.

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Wherever a chuck can be used a WIZARD cuts the cost and doubles production. Let it do this for you. The McCrosky Efficiency Book No. 7 wil convince you. Send for it.

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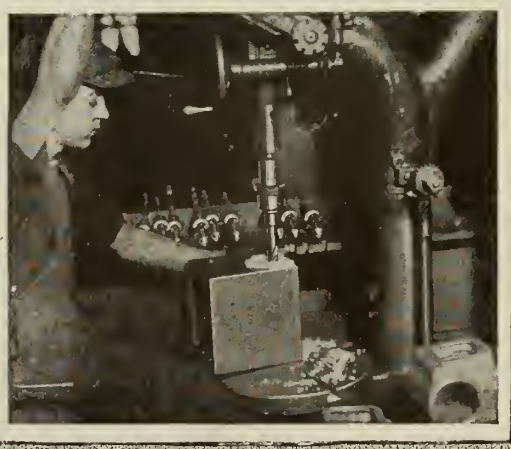
Branches and Agencies in the principal cities of Canada and U.S. For export: Benjamin Whittaker, Inc., 21 State St., New York. Benjamin Whittaker, Ltd., 56 Ludgate Hill, London, E.C. 4.



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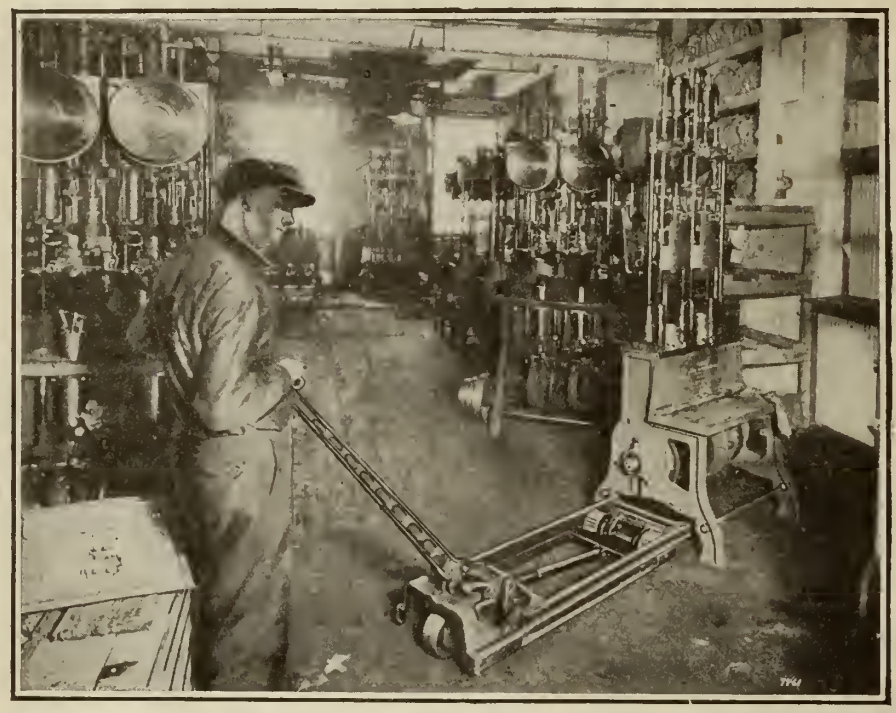

Moving Automatic Bottlers

Machine assembly on lift truck skids is now common practice in many plants.

But the McKenna Brass & Mfg. Co., builders of automatic bottling machines, have still further simplified the system by designing their bases to fit the Transveyor. Skids are dispensed with and movement at any time from erection to installation is a matter of only a few seconds.

Here is an idea that many other manufacturers could successfully adopt. It not only conveniences the builder, but is of greatest assistance to the purchaser.

THE COWAN
TRANSVEYOR
TRADE MARK REG. U. S. PAT. OFFICE

Representatives in Principal Cities---refer to Donnelley's Red Book for local address.

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I am interested in reducing the cost and increasing the efficiency of hand trucking. Send for a copy of "HOW TO APPLY THE TRANSVEYOR TO YOUR BUSINESS."

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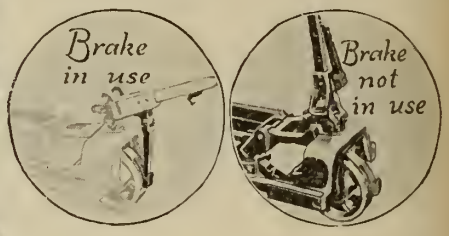
Shop Notes

A sundry collection of interesting and helpful suggestions for Factory Managers, dealing particularly with modern methods of inside Transveying and storage pieces, parts and finished products. Contributions to this column are welcomed.

How to Break the Unbreakable Transveyor



WHERE heavy loads must be negotiated down a sharp incline, it is frequently necessary to call for additional help to hold back the loaded skid. In order to keep a Transveyor a strictly one man proposition an ingenious little accessory has been devised which can be permanently attached immediately above the guide wheel of the Transveyor.

The circular illustrations shown above will give you an idea of the raybestos-lined Brake in position, and of the drop pendant by means of which pressure is applied from the handle. This Transveyor Brake is made by the Cowan Truck Co., Holyoke, Mass.

A Regular Part of Equipment

A GROWING tendency of the time is illustrated by the practice of the Porcelain Enamel & Mfg. Co., who build complete enameling plants for stove companies in different parts of the country. They are making the Cowan Transveyor a regular part of the standardized equipment which they furnish. In order to insure satisfactory operation at all times and under all conditions this practice was found advisable.

"Cobbling" Truck Platforms

When, as a result of heavy service and long use, a wooden loading platform wears down its "soles," its necessary clearance is decreased and the Tranveyor must get down and under with more or less pinching. Heretofore, a worn skid was usually scrapped, or sometimes rebuilt.

But these are times for economy even in little things. So here comes the Cowan Truck Co. with sets of light, strong malleable iron "taps" for "cobbling" the platforms. The iron feet screwed to the bottom of the worn skid will supply the proper elevation, eliminates future wear, and at least double the life of the platforms.

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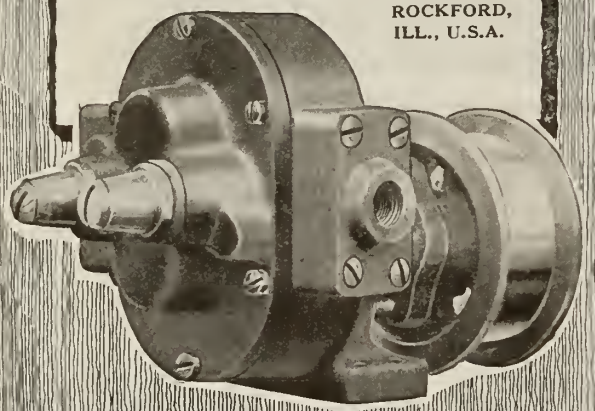
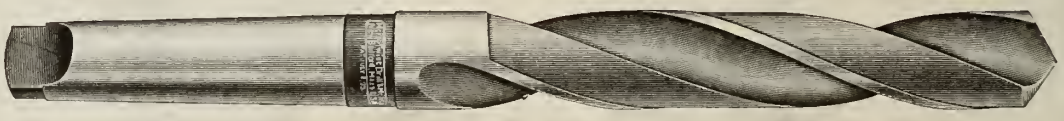


Its Producing Power Not its Cost
Shows the Worth of a Drill



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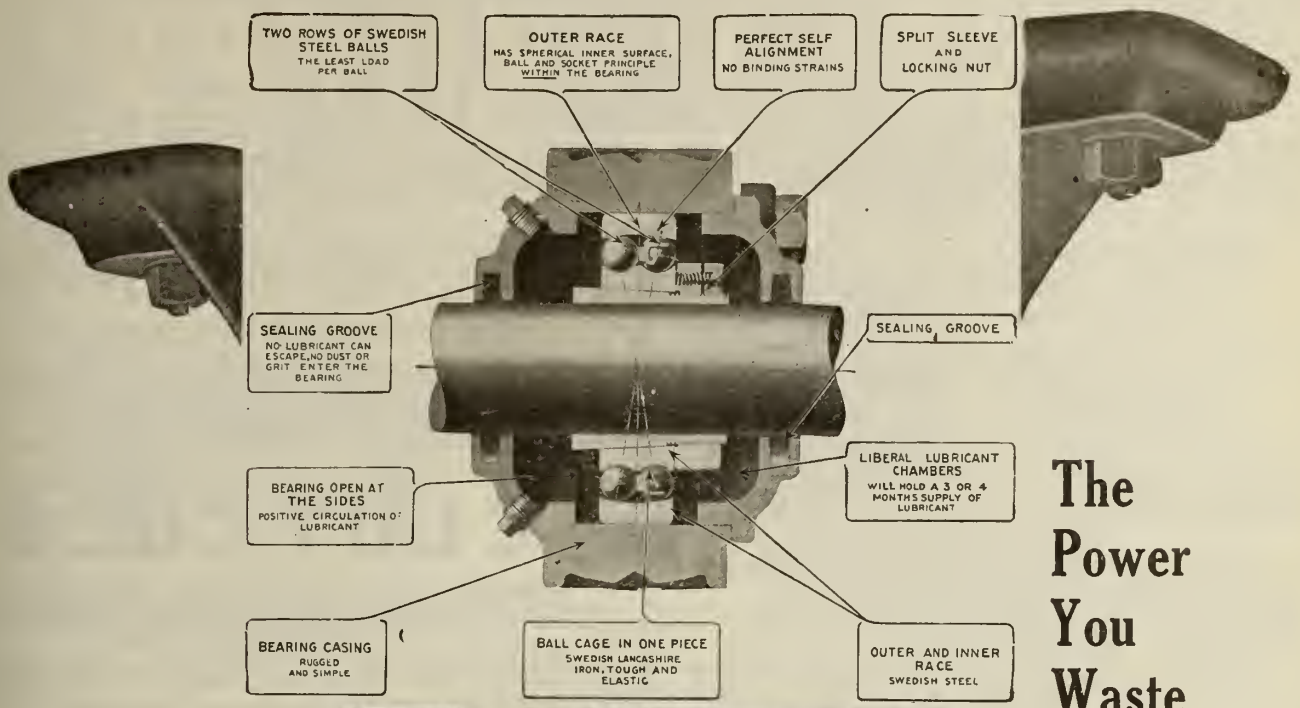
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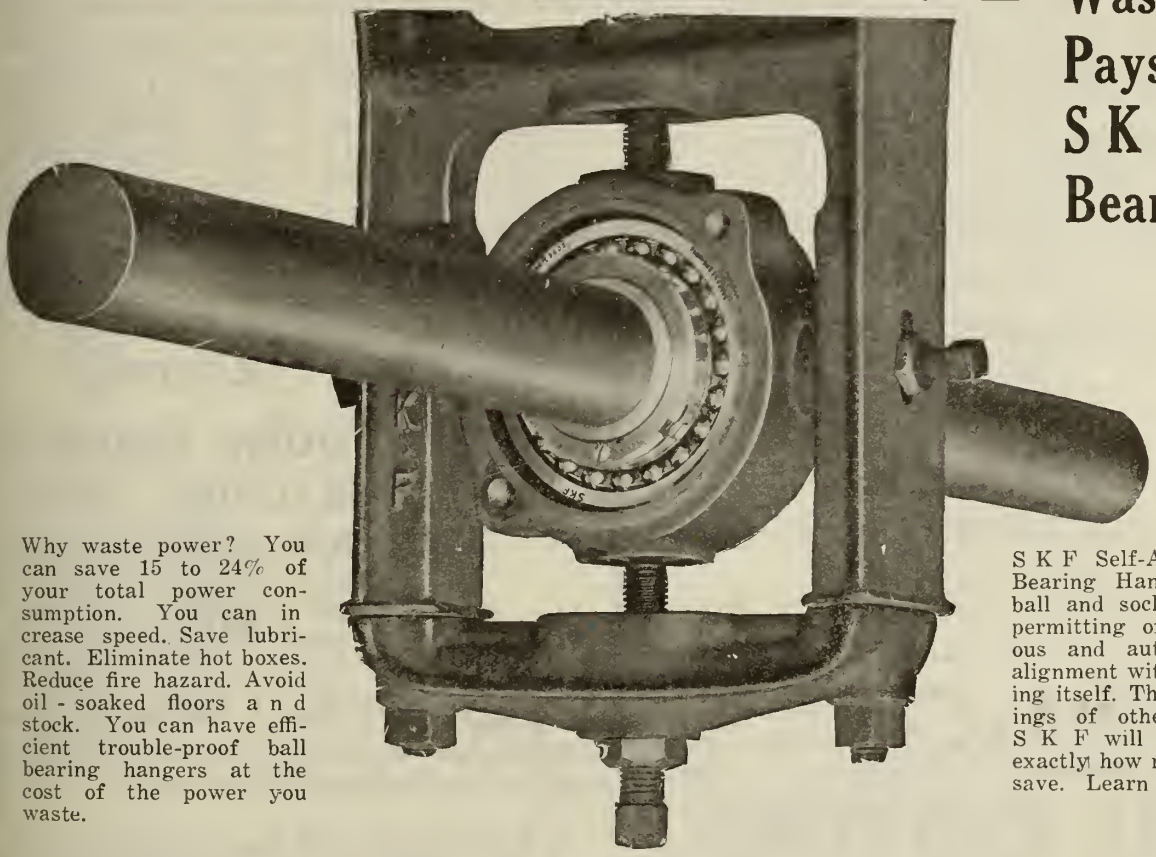

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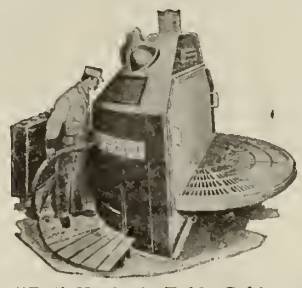

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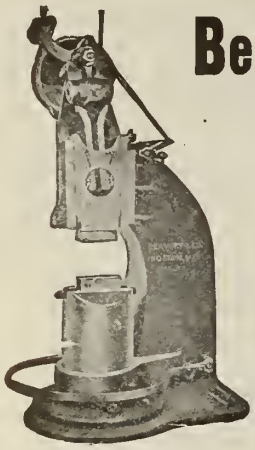

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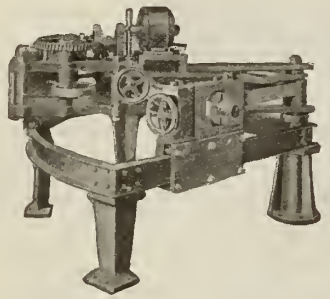

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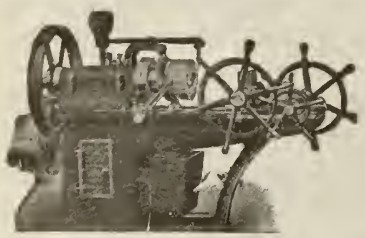

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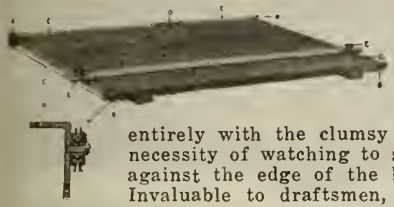

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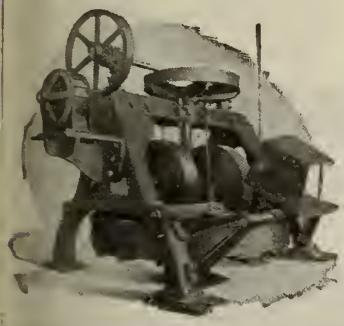

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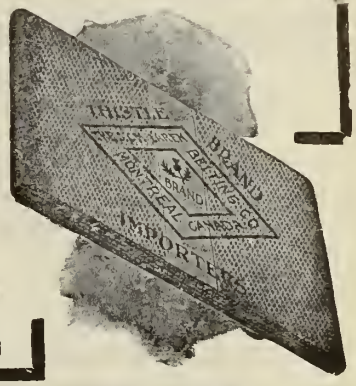

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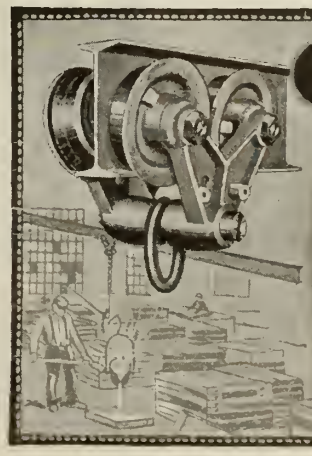

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[illegible]ence Welding Co, Ltd., Montreal

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Pratt & Whitney Co., Dundas, Ont.
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Rice Lewis & Son, Toronto, Ont.
Jones & Glassco, Montreal, Que.

CHAINS, AGRICULTURAL
Canadian Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.

CHAINS, AUTOMOBILE ENGINE
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.

CHAINS, BICYCLE, DRIVE AND BLOCK
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAINS, FOR ELEVATORS AND CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca. N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAIN, MALLEABLE, DETACHABLE AND RIVETED
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca. N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAINS, POWER TRANSMISSION
Canadian Link-Belt Co., Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, New York.
Glasgow, N.S.

CHAINS, SPROCKET WHEEL
Can. Link-Belt Co., Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca. N.Y.

CHAIN DRIVES
Can. Link-Belt Co., Toronto, Ont.
Coventry Chain Co., Coventry, England.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca. N.Y.

CHASERS
National Acme Co., Cleveland, Ohio.
Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont.

CHEMISTS
Toronto Testing Lab'tory, Ltd., Toronto

CHUCKS, AERO, AUTOMATIC
Garvin Machine Co., New York.

CHUCKS, CENTERING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKS, COLLET, AIR
Elliott & Whitehall Mach. & Tool Co. Galt, Ont.
Smalley-General Co., Inc., Bay City, Mich.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, LATHE AND UNIVERSAL
Aikenhead Hardware Co., Toronto, Ont.
Almond Mfg. Co., Ashburnham, Mass.
Bertram & Sons Co., John, Dundas.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt., & Son, Montreal.
Garlock-Walker Mach'y Co., Toronto.
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Chicago, Ill.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Jacobs Mfg. Co., Hartford, Conn.
Ker & Goodwin Machine Co., Ltd., Knight Metal Products, Toronto.
Modern Tool Co., Erie, Pa.
Rice Lewis & Son, Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, AUTOMATIC AND KEYLESS
Aikenhead Hardware Co., Toronto, Ont
Can. Blower & Forge Co., Kitchener.

CHUCKS, FRICTION AND TAP
Victor Tool Co., Waynesboro, Pa.

CHUCKS, MACHINE MILLING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKS, MAGNETIC
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

CHUCKS, RING WHEEL
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.

CHUCKS, WHEEL, CAR
Hoggson & Pettis Mfg. Co., New Haven Conn.

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Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Windsor, Vt.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Wood Turret Mach. Co., Brazil, Ind.
Williams Mchy Co., A. R., Toronto, Ont.

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Bowser Co., Ltd., S. F., Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

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Hoggson & Pettis Mfg. Co., New Haven, Conn.

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Elk Fire Brick Co., Can., Ltd., Hamilton, Ont.

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CLEANING COMPOUND
Oakley Chemical Co., New York.

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CLOCKS, WATCHMAN, PORTABLE
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Inc., Chicago, Ill.

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Crane, Ltd., Montreal, Que.

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Wright Mfg. Co., Lisbon, Ohio.

CLUTCHES, FRICTION AND PULLEY
Bernard Industrial Co., A., Fortierville, Q
Can. Link-Belt Co., Toronto, Ont.
Carlyle Johnson Mach. Co., Manchester, Conn.
Positive Clutch & Pulley Wks., Aurora, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.

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Canadian Link-Belt Co., Ltd., Toronto, Ont.
Canadian Mead-Morrison Co., Limited, Montreal, Que.

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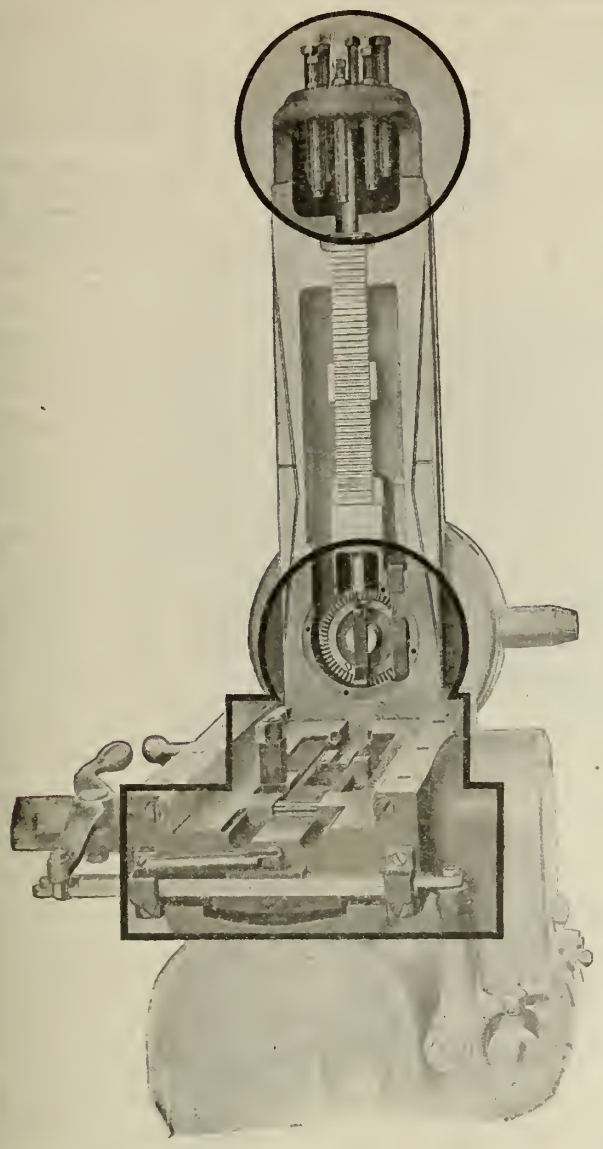
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Nova Scotia Steel & Coal Co., New



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TURRET SLIDE FEATURES

Individual stop screws shown in circle, one for each turret position, obviate exact setting of each tool.

In addition to a positive lock by means of a taper pin which aligns the turret holes with the spindle, the larger machines are automatically clamped as the turret is moved forward, by a tapered bushing controlled by the rocker arm shown in the centre of the large bevel gear.

These features of rugged construction and practical design, combined with automatic feeding and chucking of stock and centralization of all levers—points vital to production, make these machines the choice of the discriminating manufacturer who must have high production and accuracy.

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This machine is the largest in our line of five, each of which is constructed with that same care and attention to detail for which Brown & Sharpe is known throughout the world.

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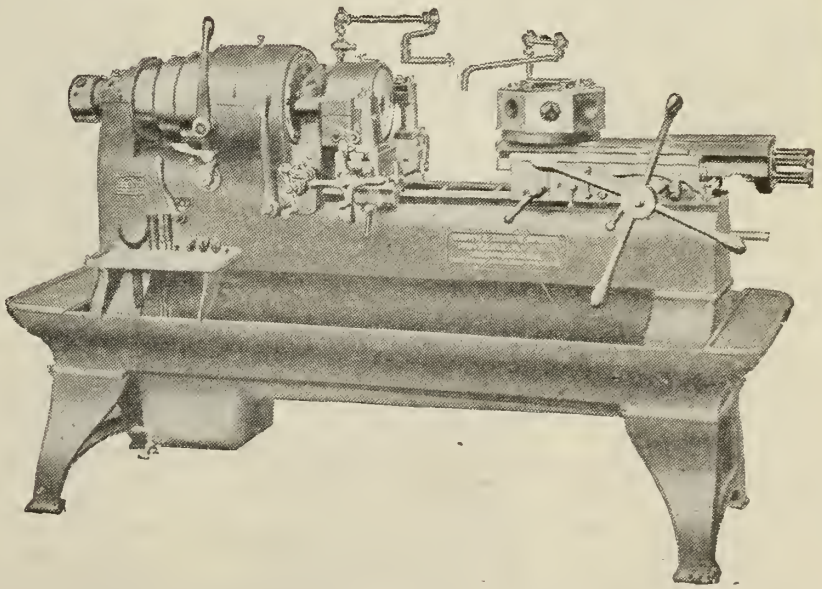

If interested tear out this page and place with letters to be answered.

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COLLARS, SHAFTING
Can. Driver-Harris Co., Ltd., Walkerville
Williams & Co., J. H., Brooklyn, N.Y

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Superior Machinery Co., London, Ont.
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MacGovern & Co., Montreal, Que.
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Canadian Mead-Morrison Co., Limited, Montreal, Que.

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Globe Engineering Co., Hamilton, Ont.
Horner & Wilson, Hamilton, Ont.
Katie Foundry, Ltd., Galt, Ont.
St. Lawrence Welding Co., Montreal.
Victoria Foundry Co., Ottawa.

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Jones & Glassco, Montreal.

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Canadian Mead-Morrison Co., Limited, Montreal, Que.

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Niles-Bement-Pond Co., New York.
Can. Blower & Forge Co., Kitchener.

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Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.

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Ford-Smith Machine Co., Hamilton, Ont.
Foster Machine Co., Elkhart, Ind.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams Mchy Co., A. R., Toronto, Ont.

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Bernard Industrial Co., The A., Fortierville, Que.
Can. Link-Belt Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

COUPLINGS, RAPID HOSE
Int. Machinery & Supply Co., Ltd., Montreal, Que.

COILING MACHINERY, WIRE AND SPRING
Garlock-Walker Machinery Co., Toronto

COKE AND COAL
Hanna & Co., M. A., Cleveland, O.

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Gardner, Robt. & Son, Montreal.
Independent Pneumatic Tool Co., Chicago

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.
Northern Crane Works, Walkerville.

CRANES, OVERHEAD, HAND AND ELECTRIC
Volta Manufacturing Co., Welland, Ont.

CUPS, OIL
Can. Winkley Co., Ltd., Windsor, Ont.

COVERS, OIL HOLE
Can. Winkley Co., Ltd., Windsor, Ont.

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Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Canadian Mead-Morrison Co., Limited, Montreal, Que.
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Northern Crane Works, Walkerville.

CRANE RUNWAYS
MacKinnon Steel Co., Sherbrooke, Que.

CRANES, JIB
Brown Hoisting Machinery Co., Cleveland, Ohio.

CRANES, LOCOMOTIVE
Brown Hoisting Machinery Co., Cleveland, Ohio.

CRANES, GOLIATH, PNEUMATIC AND PORTABLE
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Morris Crane and Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Petrie, Ltd., H. W., Toronto.

CRANES, PILLAR
Brown Hoisting Machinery Co., Cleveland, Ohio.

CRANES, TRAVELLING, ELECTRIC AND HAND POWER
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Machy. Co., St. Louis
Dominion Bridge Co., Montreal.
Hepburn, John T., Ltd., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Niles-Bement-Pond Co., New York.
Northern Crane Works, Walkerville.
Oliver Engineering Co., Montreal.

CRANK SHAFTS
Canada Found's & Forgings Ltd., Welland
Williams & Co., J. H., Brooklyn, N.Y.

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Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Graton & Knight Mfg. Co., Worcester, Mass.

CRUSHERS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Elec. Steel & Metals, Welland, Ont.

CUPOLAS
Can. Blower & Forge Co., Kitchener.
Northern Crane Works, Walkerville.

CURB PUMPS FOR OIL, GASOLINE
Bowser Co., Ltd., S. F., Toronto, Ont.

CURRENT TRANSFORMERS
Volta Manufacturing Co., Welland, Ont.

CUT-OFF COUPLINGS, FRICTION
Petrie, Ltd., H. W., Toronto.

CUTTERS, BOLT
See Bolt Cutters.

CUTTERS, GEARS
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Fellows Gear Shaper Co., Springfield Vt.

CUTTERS, FLUE
Cleveland Pneumatic Tool Co., Toronto.

CUTTER HEADS
Oliver Machinery Co. Grand Rapids, Mich

CUTTERS, PIPE (See Pipe Cutters)

CUTTERS, MILLING
Becker Milling Mach. Co., Boston, Mass.
Boker & Co., Inc., H., Montreal, Que.
Butterfield & Co., Rock Island, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
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Davidson Tool Mfg. Co., New York, N.Y.
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Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Illinois Tool Works, Chicago, Ill.
Ingersoll Mache, Co., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Pilot Steel & Tool Co., Montreal, Que
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Whitney Mfg. Co., Hartford, Conn.
Wilt Twist Drill Co. Walkerville, Ont.

CUTTER RELIEVING MACHINES
Cleveland Milling Machine Co., Cleveland.

CUTTING-OFF MACHINES
Armstrong Bros., Tool Co., Chicago.
Atkins & Co., E. C., Hamilton, Ont.
Bertram & Sons Co., John, Dundas.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Foss Mchy & S'ply Co., Geo. F., Montreal
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield, Mass
Hurlburt, Rogers Machy. Co., South Sudbury, Mass.
Hall & Sons, John H., Brantford, Ont.
Kennedy & Sons, Wm., Owen Sound.
Lyman Tube & Supply Co., Montreal, Que.
Niles-Bement-Pond Co., New York, N.Y.
Prest-O-Lite Co., Inc., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Tabor Mfg. Co., Philadelphia, Pa.
Wells Bros. of Can., Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

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Cataract Refining Co., Ltd., Toronto.
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Prest-O-Lite Co., Inc., Toronto, Ont.
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Swedish Crucible Steel Co., Windsor.

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Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Smalley General Co., Inc., Bay City, Mich

CYLINDERS, AUTOMATIC REBORING JIGS AND REAMERS
Kelley Reamer Co., Cleveland, O.

DEHUMIDIFYING
B. F. Sturtevant Co, Galt, Ont.

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Aikenhead Hardware Co., Toronto, Ont.
Dominion Bridge Co., Montreal.
Hepburn Co., Ltd., J. T., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

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Burniss, Clarke & Co., Montreal, Que.

DIAMOND TOOLS
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Furniss, Clarke & Co., Montreal, Que.
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Wheel Trueing Tool Co., Detroit.
Petrie, Ltd., H. W., Toronto.

DIAMONDS, CARBON AND BORTZ
Wheel Trueing Tool Co., Detroit.

DIAMONDS, BLACK AND ROUGH
Joyce, Koebel & Co., Inc., New York.
Wheel Trueing Tool Co., Windsor, Ont.

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Tallman Brass & Metals Ltd., Hamilton, Ont.

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Hoggson & Pettis Mfg. Co., New Haven, Conn.

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Greenfield Tap & Die Corp., Greenfield Mass.
Wells Bros. of Can., Galt, Ont.
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Crescent Mche. Co., Ltd., Montreal, P.Q.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt. & Son, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
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Marshall, Son & Bunney, Toronto.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Rickert-Shafer Co., Erie, Pa.
Stoll Co., Inc., D. H., Buffalo, N.Y.
U. S. Ordnance, Toronto, Ont.
Wells Brothers of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DIES, HAMMERED
Kimber & Hillier Mfg., Co., St. Catharines, Ont.

DIES, DROP FORGE.
Kimber & Hillier Mfg., Co., St. Catharines, Ont.

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Crescent Mche. Co., Ltd., Montreal, P.Q.
Landis Machine Co., Waynesboro, Pa.

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Crescent Machine Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

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Garvin Machine Co., New York.
Jackson Machine Tool Co, Jackson, Mich.
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Pratt & Whitney Co., Dundas, Ont.
Walcott Lathe Co., Jackson, Mich

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Butterfield & Co., Rock Island, Que.
Firth & Sons, Thos., Montreal, Que.
Landis Machine Co., Waynesboro, Pa.
Wells Brothers Co. of Canada, Galt.

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Wells Bros. of Canada, Galt, Ont.

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Geometric Tool Co., New Haven.
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Murchey Machine & Tool Co., Detroit.
Wells Brothers Co. of Can., Galt, Ont.
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Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.

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Wells Bros. Co. of Can., Galt, Ont.

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Brown, Boggs & Co., Hamilton, Canada
Globe Engineering Co., Hamilton, Ont.
Stoll Co., D. H., Buffalo, N.Y.

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A. B. Jardine & Co., Ltd., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
National-Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros., Co. of Can., Galt, Ont

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Swedish Steel & Importing Co., Montreal

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Butterfield & Co., Rock Island, Que.
Can. Blower & Forge Co., Kitchener.
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Pratt & Whitney Co., Dundas, Ont.
Sturtevant Co., B. F., Galt, Ont.

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Crane, Ltd., Montreal, Que.

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Hughes, Owens Co., Ltd., Montreal, Que.

DRAWING OFFICE SUPPLIES
Hughes, Owens Co., Ltd., Montreal, Que.

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Dominion Abrasive Co., Ltd., Mimico, Ont
Petrie, Ltd., H. W., Toronto.
Wheel Trueing Tool Co., Windsor, Ont

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Can. Blower & Forge Co., Kitchener.
Canada Machinery Corp., Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal
Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
U. S. Mach. Tool Co., Cincinnati, Ohio.
A. R. Williams Machinery Co., Toronto

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Kayser-Ellison & Co., Ltd., Montreal.
Lincoln Electric Co. of Canada, Ltd. Toronto, Ont.
Marshall, Son & Bunney, Toronto.
Swedish Steel & Importing Co., Ltd. Montreal.

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Barber Mchy. Co., Ltd., Toronto, Ont.
Bilton Mach. Tool Co., Bridgeport, Conn
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Silver Mfg. Co., Salem, Ohio.

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John Bertram & Sons Co., Dundas.
Bilton Mach. Tool Co., Bridgeport, Conn
Can. Blower & Forge Co., Kitchener, Ont
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal
Garlock-Walker Mach. Co., Toronto.
Garvin Machine Co., New York.
Hoefer Mfg. Co., Freeport, Ill.
Henry & Wright Mfg. Co., Hartford, Conn
A. B. Jardine & Co., Hespeler, Ont.
Landis Tool Co., Waynesboro, Pa.
Nat. Automatic Tool Co., Richmond, Ind
Niles-Bement-Pond Co., New York.
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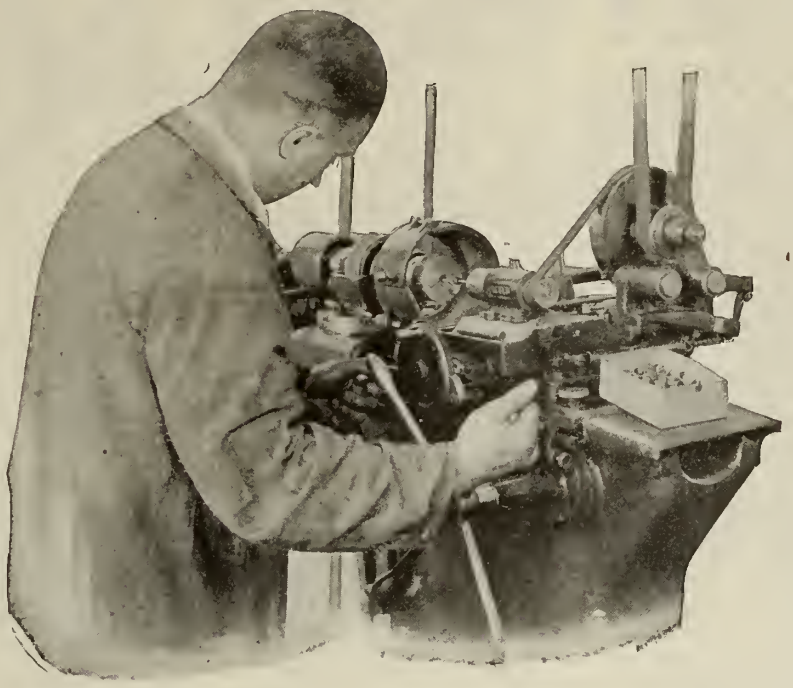

No. 1

The hole in the ball race as shown above was ¾ in. diameter by ½ in. long. It made an ideal job for the Heald Style No. 85, which handles work ¼ in. to 2 in. diameter by 2½ in. long.

Grinding Ball Races

The above photograph shows the Heald No. 85 grinding a small chrome steel ball race. Notice the simplicity of the chucking operation. The ball race was placed in a draw-in collet, the lever thrown to the left, securely holding the work. Removing it was even simpler. The pilot wheel was turned to the right, drawing the wheel from the hole, the work head automatically stopped, water was shut off and by operating the collet lever to the right, the work was released, fairly jumping into the operator's hand.

Other features are a positive stop accurately governing the travel of the table, flexible wheel head idler, automatic wheel guard water attachments, and simple single countershaft.

May we send you literature on this or our larger internal grinders?

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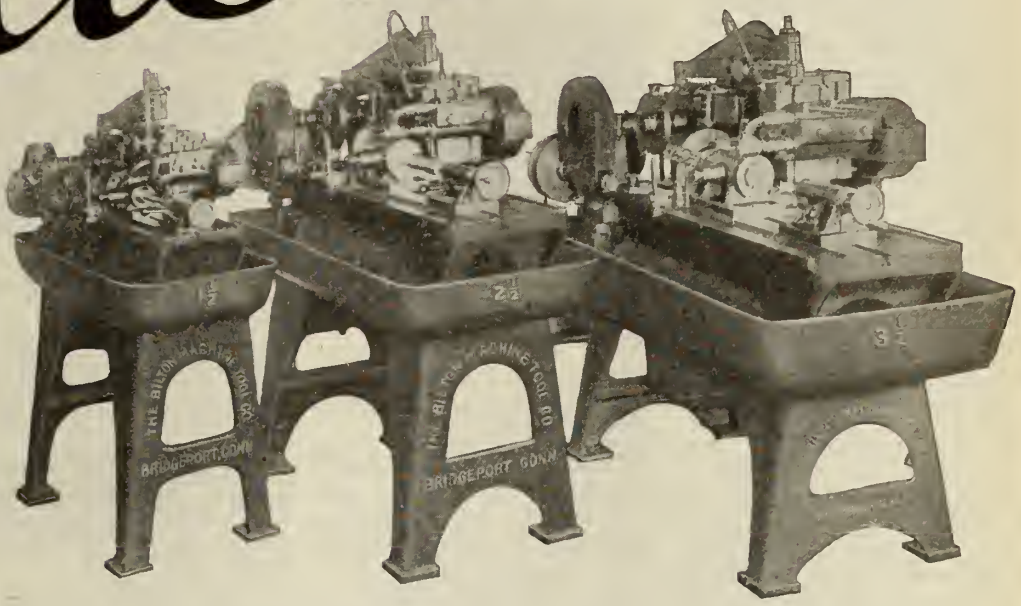

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Dom. Steel Products Co., Ltd., Brantford.
Dominion Bridge Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Elliott & Whitehall, Galt, Ont.
Gardner, Robt., & Son, Montreal.
Hamilton Gear & Machine Co., Toronto.
Hull Iron & Steel Found., Ltd., Hull, Q
Jones & Glassco, Montreal.
Wm. Kennedy & Sons, Ltd., Owen Sound, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia
Victoria Foundry Co., Ottawa.

GEARS, RAWHIDE
Gardner, Robt., & Son, Montreal.
Grant Gear Works, Boston, Mass.
Hamilton Gear & Machine Co., Toronto.
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia
A. R. Williams Machy. Co., Toronto.

GENERATORS, GEAR
Fellows Gear & Shaper Co., Springfield, V

GEARS, SILENT CHAIN
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, SPRING
Morse Chain Co., Ithaca, New York.

GEARS, SPUN, BENCH, SPIRAL
Brown & Sharpe Mfg. Co., Providence, R.I.

GENERAL MACHINE WORK
Elliott & Whitehall, Galt, Ont.
St Lawrence Welding Co, Ltd., Montreal

GENERATORS AND CONVERTORS
Northern Elec. Co., Ltd., Montreal, P.Q.

GENERATORS, MOTOR
MacGovern & Co., Montreal.
Northern Elec. Co., Ltd., Montreal, P.Q.
Sturtevant Co., B. F., Galt, Ont.
U. S. Ordnance, Toronto, Ont.

GENERATORS, STEAM TURBO
Can. Link-Belt Co., Ltd., Toronto, Ont

GILDING
Brown's Copper and Brass Rolling Mills.
New Toronto.

GLOVES, ASBESTOS, ACID PROOF WATERPROOF, ETC.
Strong, Kennard & Nutt Co., Cleveland

GLUE HEATERS
Oliver Machinery Co., Grand Rapids, Mich

GLASSES, SAFETY
Strong, Kennard & Nutt Co., Cleveland
Willson & Co., Inc., T. A., Reading, Pa

GRAPHITE
Aikenhead Hardware, Ltd., Toronto.
Rice Lewis & Son, Toronto.

GOGGLES
Consolidated Optical Co., Toronto.
Standard Optical Co., Geneva, N.Y.
Strong, Kennard & Nutt Co., Cleveland
Welding & Supplies Co., Montreal

GRAB BUCKETS—CLAMSHELL and ORANGE PEEL
Canadian Link-Belt Co., Ltd., Toronto, Ont.
Canadian Mead-Morrison Co., Limited, Montreal, Que.

GRAVITY CARRIERS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

GREASE CUPS, PRESSED STEEL, BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES (See Lubricants)

GRINDERS, AUTOMATIC KNIFE
Canada Machinery Corp., Galt, Ont.
Foss Mchry. & S'ply Co., G. F., Montreal
Garlock-Walker Machinery Co., Toronto.

GRINDERS, BENCH
Superior Machinery Co., London, Ont.

GRINDERS, CENTRE COLUMN, PEDESTAL AND BENCH
Can. Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Gaskins & Co., R. C., Chicago, Ill.
Wisconsin Electric Co., Inc., Racine, Wis
Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto.
Katie Foundry, Galt, Ont.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford.
Niles-Bement-Pond Co., New York, N.Y.
Perfect Machine Co., Galt, Ont.
United States Elec. Tool Co., Cincinnati.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, CUTTER
Brown & Sharpe Mfg. Co., Providence, R.I
Cincinnati Milling Mach. Co., Cincinnati.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Globe Engineering Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield, M.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Norton Co., Worcester, Mass.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, DIE AND CHASER
Haskins & Co., R. C., Chicago, Ill.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
National-Acme Co., Cleveland, Ohio.

GRINDERS, DISK
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., E. C., Hamilton, Ont.
Ford-Smith Mach. Co., Hamilton.
Gardner Machine Co., Beloit, Wis.
Heald Machine Co., Worcester, Mass.

GRINDERS, FLEXIBLE CASTING
Manhattan Machine & Tool Co., Grand Rapids, Mich

GRINDERS, DRILL
Aikenhead Hardware Co., Toronto.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield,
Petrie, Ltd., H. W., Toronto.
United States Elec. Tool Co., Cincinnati.
Wells Bros. of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, CYLINDER, INTERNAL
Barber Mchy. Co., Ltd., Toronto, Ont
Brown & Sharpe Mfg. Co., Providence, R.I
Foss Mchy. & S'ply Co., G. F., Montreal.
Greenfield Machine Co., Greenfield, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, PORTABLE, ELECTRIC HAND, TOOL POST, FLOOR AND BENCH
Baird Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Ford-Smith Mach. Co., Hamilton, Ont.
Haskins & Co., R. C., Chicago, Ill.
Grant Mfg. & Mach. Co., Bridgeport, Conn
Garlock-Walker Machinery Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Independent Pneumatic Tool Co., Chicago
Petrie, Ltd., H. W., Toronto.
United States Elec. Tool Co., Cincinnati
Wisconsin Electric Co., Inc., Racine, Wis.
Williams Mchy Co., A. R., Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.

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Barber Mchy. Co., Ltd., Toronto, Ont.
Universal Grinding Mach. Co., Fitchburg, Mass.

GRINDERS, HOLE, HOLE AND AND DEEP HOLE
Barber Mchy. Co., Ltd., Toronto, Ont.
Bryant Chucking Grinder Co., Springfield, Vermont.
Heald Machine Co., Worcester, Mass.

GRINDERS, PLAIN CYLINDRICAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Fitchburg Grinding Mach. Co., Fitchburg, Mass.

GRINDERS, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal.
Cleveland Pneumatic Tool Co., Toronto.
Garlock-Walker Machinery Co., Toronto.
Heald Machine Co., Worcester, Mass.
Independent Pneumatic Tool Co., Chicago
MacGovern & Co., Montreal. Que.

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Cleveland Milling Machine Co., Cleveland.

GRINDERS, ROTARY SURFACE
Brown & Sharpe Mfg. Co., Providence, R.I
Bristol Machine Tool Co., Bristol, Conn.
Manhattan Machine & Tool Co., Grand Rapids, Mich.

GRINDERS, TOOL AND HOLDER
Armstrong Bros. Tool Co., Chicago.
W. F. & John Barnes Co., Rockford, Ill.
Blount & Co., J. G., Everet, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I
Ford-Smith Machine Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield
National-Acme Co., Cleveland, Ohio.
Tabor Mfg. Co., Philadelphia, Pa.
Wells Bros. of Canada, Galt, Ont.

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Barber Mchy. Co., Ltd., Toronto, Ont.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Modern Tool Co., Erie, Pa.
Norton Co., Worcester, Mass.
Williams Mchy Co, Ltd., A. R., Montreal

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Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Co., Montreal.
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Norton Co., Worcester, Mass.
Williams Mchy Co., A. R., Toronto, Ont.

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Atkins & Co., E. C., Hamilton, Ont.
Wausau Abrasives Co., Chicago, Ill.

GRINDING AND POLISHING MACHINES, PORTABLE, PNEUMATIC AND SPRING FRAME
Can. Fairbanks-Morse Co., Montreal.
Cincinnati Elec. Tool Co., Cincinnati, O.
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal.
Garvin Machine Co., New York.
Garlock-Walker Machy. Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Haskins & Co., R. C., Chicago, Ill.
Hall & Sons, John H., Brantford, Ont.
Niles-Bement-Pond Co., New York, N.Y.
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Wisconsin Electric Co., Racine, Wis.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDING MACHINES, CAR WHEEL, CUTTER, CYLINDRICAL, CRANKSHAFT
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I
Norton Co., Worcester, Mass.

GRINDING WHEELS
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Brantford Emery Wheel Co., Brantford
Can. Fairbanks-Morse Co., Montreal.
Carborundum Co., Niagara Falls, N.Y.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Mchy. & S'ply Co. G. F., Montreal.
Norton Co., Worcester, Mass.

GRINDING WHEEL DRESSER
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.

GUARDS, WINDOW AND MACHINE
Canada Machinery Corp., Galt, Ont.
Canada Wire & Iron Goods Co., Hamilton
Dennis Wire & Iron Works, London, Ont
B. Greening Wire Co., Hamilton, Ont.
Page Steel & Wire Co., Adrian, Mich.
St Lawrence Welding Co, Ltd., Montreal
Strong, Kennard & Nutt Co., Cleveland

GUTTERS AND SKYLIGHTS
H. H. Robertson, Ltd., Sarnia, Ont.

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Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Boker & Co., Inc., H., Montreal, Que
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Wks., Buffalo.
Ford-Smith Machine Co., Hamilton, Ont
Kayser-Ellison & Co., Ltd., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal
Plewes, Ltd., Winnipeg, Man.
Pilot Steel & Tool Co., Montreal, Que
Petrie, Ltd., H. W., Toronto.
Racine Tool & Machine Co., Racine, Wis
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
L. S. Starrett Co., Athol, Mass.
Standard Machy. & Supplies, Montreal
Victor Saw Works, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.
Williams Mchy Co., A. R., Toronto, Ont.

HANDLES, BALANCE, CRANK AND MACHINE
Williams & Co., J. H., Brooklyn, N.Y.

HANGERS, SHAFT
Can. Link-Belt Co., Ltd., Toronto, Ont

HACK SAW FRAMES
Aikenhead Hardware Co., Toronto.
Atkins & Co., E. C., Hamilton, Ont.
Can. Fairbanks-Morse Co., Montreal.
Ford-Smith Machine Co., Hamilton, Ont
Garvin Machine Co., New York City.
Victor Saw Works, Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont

HACK SAWS, POWER
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Wks., Buffalo
Foss Mchy. & S'ply Co., G. F., Montreal
Ford-Smith Machine Co., Hamilton.
Perfect Machine Co., Galt, Ont.
Starrett Co., L. S., Athol, Mass.
Victor Saw Works, Hamilton, Ont.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Nazel Eng. & Mach. Wks., Philadelphia.

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Haskins & Co., R. C., Chicago, Ill.

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2 Track Insulation
3 Wire Manifolds etc.
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4 Bobbins, Roving Cans, Trucks, Mill Boxes, & Baskets etc.
6 Bushings, Switch Handles Insulations etc.
7 Waste Baskets etc.
8 Trunk Fibre, Cases etc.
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Superior to metal, rubber, porcelain, wood and leather for a great variety of purposes. Made in sheets, rods, tubes and special parts machined to your specifications.

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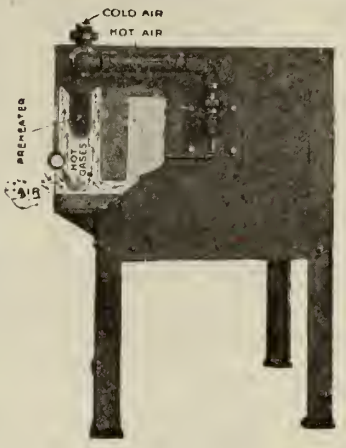
When it's too hot to work—production drops and overhead rises.



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Section showing deflection of hot gases, with induced air **toward** the furnace, and the preheating of air for combustion.

A forging is the result of a working combination of machine, furnace **and man.** The man is the weak link in the operation; when he's idle, expensive equipment is idle.

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the novel construction of shield deflects the hot gases and—

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Cincinnati, Ohio, U.S.A.

If interested tear out this page and place with letters to be answered

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Jardine & Co., A. B., Hespeler, Ont.
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West Tire Setter Co., Rochester, N.Y.
Williams Mchy Co, Ltd., A. R., Montreal

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Can. Ingersoll-Rand Co., Montreal, Que.
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Independent Pneumatic Tool Co., Chicago.
Nazel Eng. & Mach. Wks., Philadelphia.

HAMMERS, MARKING
Matthews & Co., Jas. H., Pittsburgh, Pa.

HAMMERS, NAIL MACHINE
Rice Lewis & Son, Toronto, Ont.
United Hammer Co., Boston, Mass.

HAMMERS, POWER
Nazel Eng. & Mach. Wks., Philadelphia

HAMMERS, STEAM
Canada Machinery Corp., Galt, Ont.
Niles-Bement-Pond Co., New York.

HAND PLANERS
Oliver Mchry. Co., Grand Rapids, Mich.

HAND PLANING AND JOINTING MACHINERY
Oliver Engineering Co., Montreal, P.Q

HAND LEATHERS OR PADS
Graton & Knight Mfg. Co., Montreal

HANDLES, FIBRE
Diamond State Fibre Co., Bridgeport, Pa.

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Brown & Sharpe Mfg. Co., Providence, R.I
Canadian Link-Belt Co., Ltd., Toronto, Ont.

HANGERS, SHAFT
Algoma Steel Corp., Sault Ste. Marie.
Chapman Double Ball Bearing Co., Toronto.
Gray Ball Bearing Co., Ltd., Toronto.
Baird Machine Co., Bridgeport, Conn.
Can. S K F Co., Toronto, Ont.
Gardner & Son, Robt., Montreal.
Jones & Glassco, Montreal.
Williams Mchy Co, Ltd., A. R., Montreal

HARDNESS TESTING INSTRUMENTS
Shore Instrument & Mfg. Co., New York.

HEAD, AUXILIARY
Hoefer Mfg. Co., Freeport, Ill.

HEATING AND VENTILATING ENGINEERS
Can. Blower & Forge Co., Kitchener, Ont.
Sheldons, Ltd., Galt, Ontario.
Sturtevant Co., B. F., Galt, Ont.

HEAT TREATMENT OF STEEL
Gray Ball Bearing Co., Ltd., Toronto.

HEAT GAUGES, HARDENING AND ANNEALING
Shore Instrument & Mfg. Co., New York

HELMETS, SANDBLAST, AMMONIA
Strong, Kennard & Nutt Co., Cleveland

HIGH SPEED STEEL
See Steel.

HINGE MACHINERY
Baird Machine Co., Bridgeport, Conn.

HINGES
Butterfield & Co., Inc., Rock Island, Que.
London Bolt & Hinge Wks., London, Ont.

HOBS
Greenfield Tap & Die Co., Greenfield, Mass
Pratt & Whitney Co., Dundas, Ont.
Taylor, J. A. M., 318 Stair Bldg., Toronto
Wells Bros. of Canada, Galt, Ont.

HOISTING MACHINERY
Canadian Mead-Morrison Co., Limited, Montreal, Que.

HOISTS, AIR
Can. Ingersoll-Rand Co., Ltd., Sherbrooke
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

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Can. Ingersoll-Rand Co., Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Ford Chain Block & Mfg., Philadelphia.
Independent Pneumatic Tool Co., Chicago
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.
Williams Mchy Co, Ltd., A. R., Montreal

HOISTS, ELEC., STATIONARY, MONO RAIL
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
A. Leatty & Sons, Ltd., Welland, Can.
Oliver Engineering Co., Montreal.
Volta Mfg. Co., Welland, Ont.

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Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Montreal, Que.
Electric Steels & Metals Ltd., Welland.
Kennedy & Sons, Owen Sound, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

HODLERS, ADJUSTABLE
Eclipse Counterbore Co., Ltd., Walkerville, Ont.

HOLDERS, STEEL DIE FOR MARKING
Matthews & Co., Jas. H., Pittsburgh, Pa.

HOLDERS, ELECTRIC
Electric Steels & Metals, Ltd., Welland

HOOKS, BELT LACING
Clipper Belt Lacer Co., Grand Rapids.

HOPPERS
MacKinnon Steel Co., Ltd., Sherbrooke.
Dominion Bridge Co., Montreal, Que.
William Hamilton Co., Peterboro, Ont.
Toronto Iron Works, Ltd., Toronto, Ont.

HOSE, FIRE PROTECTION
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal

HOSE, PNEUMATIC
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Gutta Percha & Rubber, Ltd., Toronto.
Independent Pneumatic Tool Co., Chicago.
Quaker City Rubber Co., Philadelphia, Pa.
Wells Bros. Co. of Canada, Galt, Ont.

HOSE, ALL KINDS
Goodyear Tire & Rubber Co., of Canada, Ltd., Toronto.
Gutta Percha & Rubber, Ltd., Toronto.
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.

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Pangborn Corporation, Hagerstown, Md.
Goodyear Tire & Rubber Co. of Can., Ltd. Toronto
Quaker City Rubber Co., Philadelphia, Pa.
Intern'l. Machine Tool Co., Indianapolis.

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Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.

HUMIDIFIERS
Sturtevant Co., B. F., Galt, Ont.

HYDRAULIC ACCUMULATORS
Dom. Steel Products Co., Ltd., Brantford.

HYDRAULIC MACHINERY
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Machinery Co., Toronto.
Dom. Steel Products Co., Ltd., Brantford.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
West Tire Setter Co., Rochester, N.Y.
Victoria Foundry Co., Ottawa.

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Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

HYDROMETERS, HYGROMETERS, HYGRODNIKS
Taylor Instrument Co., Rochester, N.Y.

INDICATORS, SPEED
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol, Mass.

INDEX CENTRES
Brown & Sharpe Mfg. Co., Providence, R.I.
Dickow, Fred. C., Chicago, Ill.
Ford-Smith Machine Co., Hamilton, Ont.
Garvin Machine Co., New York.
Petrie, Ltd., H. W., Toronto.

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Taylor Instrument Co., Rochester, N.Y.

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Can. Kron Scale Co., Montreal.

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Thomas Moore & Son, Montreal.

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Electric Steel & Metals Co., Welland.

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Hanna & Co., M. A. Cleveland, O.

IRON, WROUGHT, ROLLED, PIG
Swedish Steel & Impt. Co., Ltd., Montreal

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Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Globe Engineering Co.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Norton, A. O., Coaticook, Que.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.

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Canadian Fairbanks-Morse Co., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Northern Crane Works, Walkerville.

JAWS, FACE PLATE
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford.
Skinner Chuck Co., New Britain, Conn.

JOINTERS
Gray Ball Bearing Co., Ltd., Toronto.

JIGS, TOOLS, ETC.
Brown Engineering Corp., Toronto.
Crescent Mach. Co., Ltd., Montreal, P.Q.
Elliott & Whitehall Mach. & Tool Co., Galt.
Gashot Machine Co., Madison, Wis.
Globe Engineering Co., Ltd., Hamilton.
Homer & Wilson, Hamilton, Ont.
Jones & Lamson, Springfield, Vt.
Toronto Tool Co., Toronto, Ont.

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Canada Foundries & Forgings, Welland.
Dominion Foundries & Steel Ltd., Hamilton, Ont.

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Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Morton Mfg. Co., Muskegon Heights, M.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.

KEYS, MACHINE
Whitney Mfg. Co., Hartford, Conn.
Williams & Co., J. H., Brooklyn, N.Y.

KILNS
Can. Blower & Forge Co., Kitchener, Ont.
General Combustion Co., Ltd., Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Sturtevant Co., B. F., Galt, Ont.

KNIVES, MACHINE
Atkins & Co., E. C., Hamilton, Ont.

KNIFE GRINDERS
Gray Ball Bearing Co., Ltd., Toronto.

LABELS AND TAGS
Matthews & Co., Jas. H., Pittsburgh, Pa.

LABORATORIES, INSPECTION AND TESTING (see Chemists)

LADLES, FOUNDRY
Northern Crane Works, Walkerville.

LACING MACHINES
Clipper Belt Lacer Co., Grand Rapids, M.

LAG SCREW GIMLET POINTERS
National Machy. Co., Tiffin, Ohio.

LATH
Robertson, Ltd., H. H., Sarnia, Ont.

LATHES, CHUCKING
Acme Machine Tool Co., Cincinnati, Ohio.
Petrie, Ltd., H. W., Toronto.
Wood Turret Machine Co., Brazil, Ind.

LATHE CHUCKS (See Chucks)

LATHE DOGS AND ATTACHMENTS
Armstrong Bros. Tool Co., Chicago.
Hendey Machine Co., Torrington, Conn.
Williams & Co., J. H., Brooklyn, N.Y.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.
Wood Turret Machine Co., Brazil, Ind.

LATHES, AXLE
Barber Mchy. Co., Ltd., Toronto, Ont.
Betts Mach. Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.

LATHES, BORING
Barber Mchy. Co., Ltd., Toronto, Ont.
Bridgeford Mach. Tool Works, Rochester.
Canada Machinery Corp., Galt, Ont.
Ledge & Shipley, Cincinnati, O.
Petrie, Ltd., H. W., Toronto.

LATHES, PRECISION, BENCH
W. F. & John Barnes Co., Rockford.
J. G. Blount & Co., Everett, Mass.
Canadian Fairbanks-Morse Co., Montreal.
Geo. F. Foss Machy. & Supply Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Hardinge Bros., Chicago, Ill.
Pratt & Whitney Co., Dundas, Ont.
Seneca Falls Mfg Co., Seneca Falls, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

LATHES, BRASS
Acme Machine Tool Co., Cincinnati, Ohio.
Hardinge Bros., Chicago, Ill.
Wood Turret Machine Co., Brazil, Ind.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

LATHES, ENGINE
Acme Machine Tool Co., Cincinnati, Ohio.
Barber Mchy. Co., Ltd., Toronto, Ont.
John Bertram & Sons Co., Dundas.
Canada Machinery Corp., Galt, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cisco Machine Tool Co., Cincinnati, Ohio.
G. F. Foss Mchy. & S'ply Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis
Kennedy & Sons, Wm., Owen Sound, Ont
Lehman Mach. Co., St. Louis, Mo.
R. McDougall Co., Galt.
Miles-Bement-Pond Co., New York.
Perfect Machine Co., Galt, Ont.
Rae Mach. Tool Co., Ramilton.
Smalley-General Co., Inc., Bay City, Mich.
Standard Equipment & Tool Wks. Montreal, P.Q.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Sidney Tool Co., Sidney, Ohio.
U. S. Ordnance, Toronto, Ont.
Walcott Lathe Co., Jackson, Mich.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.
A. R. Williams Machy. Co., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.
Worcester Lathe Co., Worcester, Mass.

LATHES, FOOT POWER
Seneca Falls Mfg. Co., Seneca Falls, N.Y.

LATHES, HORIZONTAL
Intern'l. Mchy. Supplies Ltd., Montreal.
Wood Turret Machine Co., Brazil, Ind.

LATHES, JOURNAL TRUEING
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.

LATHE MANDRELS, HARDENED AND GROUND
Elliott & Whitehall, Galt, Ont.

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Can. Machinery Corp., Galt.
Wood Turret Machine Co., Brazil, Ind.
G. F. Foss Mchy. & S'ply Co., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.

LATHES, POLISHING
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

LATHES, SCREW CUTTING
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas, Ont.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Cisco Machine Tool Co., Cincinnati, O.
Foss Mchy. & S'ply Co., G. F., Montreal.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Toronto, Ont.
Hardinge Bros., Inc., Chicago, Ill.
Hepburn Ltd., John T., Toronto, Ont.
Lehman Machine Co., St. Louis, Mo.
Niles-Bement-Pond Co., New York.
Rae Mach. Tool Co., Ramilton.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
U. S. Ordnance, Toronto, Ont.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.
Williams Machy. Co., A. R., Toronto.
Wood Turret Machine Co., Brazil, Ind.
Worcester Lathe Co., Worcester, Mass.

LATHES, SPINNING
Bliss Co., E. W., Brooklyn, N.Y.

LATHES, TOOL ROOM
Barber Mchy. Co., Ltd., Toronto, Ont.
Cisco Machine & Tool Co., Cincinnati, O.
Canada Machinery Corporation, Galt, Ont.
Knight Metal Products, Toronto.
Lehman Machine Co., St. Louis, Mo.
Rae Mach. Tool Co., Ramilton.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Worcester Lathe Co., Worcester, Mass.

LATHES, QUICK CHANGE
Lehman Machine Co., St. Louis, Mo.

LATHE SAWS
Atkins & Co., E. C., Hamilton, Ont.

LATHES, TURRET
Hardinge Bros., Chicago, Ill.
Acme Machine Tool Co., Cincinnati, Ohio

LEAD, PIG AND BAR
British Smelting & Refining Co., Ltd., Montreal, Que.

LEAD BURNING
St. Lawrence Welding Co., Montreal.

LEAD BURNING OUTFITS
Turner Brass Works, Sycamore, Ill.

LEATHER STRAPPING
Graton & Knight Mfg. Co., Worcester, M.

LENSES FOR GOGGLES
Standard Optical Co., Geneva, N.Y.

LETTERS AND FIGURES, METAL
Hoggson & Pettis Mfg. Co., New Haven, Conn.

LEVELS
Hughes, Owens Co., Ltd., Montreal, Que.

LIDS, SCREW TOP AND HINGE
Can. Wintley Co., Ltd., Windsor, Ont.

LINK BELTING
See Belting, Chain.

LIFT TRUCKS
Can. Kron Scale Co., Montreal.

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LOCKERS, STEEL WARDROBE AND STEEL MATERIAL
Canada Wire & Iron Gds. Co., Hamilton.
Dennis Wire & Iron Works, London, Ont.

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Cataract Refining & Mfg. Co., Toronto.
Swan & Finch, Inc., New York.

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Oakley Chemical Co., New York, N.Y.

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Elliott & Whitehall, Galt, Ont.
Williams Machy. Co., A. R., Toronto.
Foss Mchy. & S'ply Co., G. F., Montreal
Garlock-Walker Machy. Co., Toronto, Ont.

MACHINERY GUARDS (See Guards)

MACHINERY SUPPLIES
Crescent Machine Co., Ltd., Montreal.
Globe Engineering Wks., Hamilton, Ont.
Knight Metal Products, Toronto.

MACHINERY, SPECIAL
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Crescent Machinery Co., Ltd., Montreal, Que.
Globe Engineering Co., Ltd., Hamilton.
Hoggson & Pettis Mfg. Co., New Haven, Conn.

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Brown & Sharpe Mfg. Co., Providence, R.I.

MAGNETIC BRAKES FOR ELECTRIC MOTORS
Volta Mfg. Co., Welland, Ont.

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Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.

MARKING DEVICES
Pritchard-Andrews Co. of Can., Ottawa.
Matthews & Co., Jas. H., Pittsburgh, Pa.

MARKING MACHINERY
Brown, Boggs Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Perrin, Wm. R., Toronto.
Petrie, Ltd., H. W., Toronto.

MASKS, WELDING, SMOKE, FUME, GAS, ETC.
Strong, Kennard & Nutt Co., Cleveland

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Canadian Mead-Morrison Co., Limited, Montreal, Que.

MATS, RUBBER MATTING
Quaker City Rubber Co., Philadelphia, Pa
International Mchy. Sply., Ltd., Montreal

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Bowser Co., Ltd., S. F., Toronto, Ont.

MEASURING TAPES AND RULES
Chesterman & Co., Jas., Sheffield, Eng.

MERCHANTS, IRON AND STEEL
Samuel Osborne (Can.), Ltd., Montreal.

METALLURGISTS
See Chemists.

METAL CLEANERS
Oakley Chemical Co., New York, N.Y.

METAL CUTTING MACHINES
Atkins & Co., E. C., Hamilton, Ont.
Lyman Tube & Supply Co., Montreal, Que.

METAL SAWS
See Saws.

METAL, ANTI-FRICTION
Thos. Moore & Son, Montreal.

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E. C. Atkins & Co., Inc., Indianapolis.
Hoefer Mfg. Co., Freeport, Ill.
Lyman Tube & Supply Co., Montreal, Que.

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British Smelting & Refining Co., Ltd., Montreal, Que.
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Canada Metal Co., Toronto, Ont.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.

METAL, STAMPINGS, SMALL
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METERS, OIL, GASOLINE, KEROSENE, ETC.
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General Combustion Co., Ltd., Montreal, Que.

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Taylor, J. A. M., 518 Stair Bldg., Toronto.
Petrie, Ltd., H. W., Toronto.

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MILLS, SAND
Frost Mfg. Co., Chicago, Ill.

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Alexander Fleck, Ltd., Ottawa.
Greenfield Tap & Die Corp., Greenfield
Wells Bros. of Canada, Galt, Ont.

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Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee Wis.

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Brown & Sharpe Mfg. Co., Providence
Canada Machinery Corp., Galt, Ont.
Cincinnati Milling Machine Co., Cincinnati
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal
Hardinge Bros., Inc., Chicago, Ill.
Hendey Mach. Co., Torrington, Conn.
Hinckley Machine Works, Hinckley, Wis.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Taft-Peirce Mfg. Co., Woonsocket, R.I.

MILLING MACHINES, AUTOMATIC
Bilton Mach. Tool Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Betts Machine Co., Rochester, N.Y.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.

MILLING CUTTERS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Milling Machine Co., Cleveland.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Marshall, Son & Bunney, Toronto.
Petrie, Ltd., H. W., Toronto.
Wilt Twist Drill Co., Walkerville, Ont.

MILLING MACHINES, HAND
Bristol Machine Tool Co., Bristol, Conn

MILLING MACHINES, THREAD
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Inc., Chicago, Ill.
Gray Ball Bearing Co., Ltd., Toronto.
United States Mach. Tool Co., Cincinnati.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Smalley Gen. Co., Inc., Bay City, U.S.A.
Standard Equipment & Tool Wks., Montreal, P.Q.

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Bristol Machine Tool Co., Bristol, Conn
Brown & Sharpe Mfg. Co., Providence
Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Garlock-Walker Machy. Co., Toronto, Ont
Gooley & Eglund, Cortland, N.Y.
Hardinge Bros., Inc., Chicago, Ill.
Kearney & Trecker Co., Milwaukee, Wis
Knight Metal Products, Toronto.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Rockford Milling Mach. Co., Rockford, Ill
United States Mach. Tool Co., Cincinnati.
U. S. Ordnance, Toronto, Ont.
Whitney Mfg. Co., Hartford, Conn.
Williams Machy. Co., A. R., Toronto

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Bilton Mach. Tool Co., Bridgeport, Conn
Brown & Sharpe Mfg. Co., Providence
Canada Machinery Corp., Galt, Ont.
Cleveland Milling Machine Co., Cleveland.
Cincinnati Milling Machine Co., Cincinnati
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
National Machy. Co., Tiffin, Ohio.
Gooley & Eglund, Inc., Cortland, N.Y.
Hardinge Bros., Inc., Chicago, Ill.
Hendey Machine Co, Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Knight Metal Products, Toronto.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.
U.S. Ordnance, Toronto, Ont.

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Can. Fairbanks-Morse Co., Montreal.
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Garvin Machine Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Brown & Sharpe Mfg. Co., Providence.
Ford-Smith Mach. Co., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dominion Bridge Co., Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.

MINING MACHINERY
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Elec. Steel & Metals, Welland, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., A. R., Toronto, Ont

MIXERS, SAND
Frost Mfg. Co., Chicago, Ill.

MORTISING MACHINES
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machy. Co., Toronto, Ont
Gray Ball Bearing Co., Ltd., Toronto.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
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MacGovern & Co., Montreal, Que.
Northern Elec. Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
U. S. Ordnance, Toronto, Ont.
Volta Mfg. Co., Welland, Ont.
Williams Mach'y Co., A. R., Toronto.

MOTOR SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

MOTORCYCLE FRAME AND FORK
The Dunbar Brothers Co., Bristol, Conn.

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Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Hoggson & Pettis Mfg. Co., New Haven, Conn.

MULTIPLE INDEX CENTRES
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Graton & Knight Mfg. Co., Worcester, M.

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Nat. Automatic Tool Co., Richmond, Ind.

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Turner Brass Works, Sycamore, Ill.

NICHROME CASTINGS
Can. Driver-Harris Co., Ltd., Walkerville

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Pilot Steel & Tool Co., Montreal, Que.

NICKEL STEEL
See Steel.

NICKEL SILVER—SHEETS, ROLLS, PLATES and RODS
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Garvin Machine Co., New York.
National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
Victor Tool Co., Waynesboro, Pa.

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Bertram & Sons Co., John, Dundas, Ont
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
Hall & Son, J. H., Brantford, Ont.
Jardine & Co., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.

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Canadian Mead-Morrison Co., Limited, Montreal, Que.

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Cleveland Pneumatic Tool Co. of Canada Toronto.

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MacKinnon Steel Co., Sherbrooke, Que.

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Davis-Bournonville Co., Toronto, Ont.
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Gutta Percha & Rubber, Ltd., Toronto.
International Mach. Sply., Ltd., Montreal
Petrie, Ltd., H. W., Toronto.
Quaker City Rubber Co., Philadelphia, Pa

PANS, WET AND DRY
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Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Gutta Percha & Rubber, Ltd., Toronto.
MacKinnon Steel Co., Sherbrooke, Que

PARTITIONS, WIRE
See Guards

PAPER MILL MACHINERY
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Garlock-Walker Machinery Co., Toronto.
MacKinnon Steel Co., Sherbrooke, Que.

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Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Oliver Machy. Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto.

PATTERN MAKERS' LATHES
See Lathes.

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Marion & Marion, Montreal.
Ridout & Maybee, Toronto.

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Steel Co. of Canada, Ltd., Hamilton, Ont.

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Morrow Screw & Nut Co., J., Ingersoll, Ont

PINS, BELT-LACING
Clipper Belt Lacer Co., Grand Rapids.

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Crane, Ltd., Montreal, Que.

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Curtis & Curtis Co., Bridgeport, Conn.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield
Hall & Sons, John H., Brantford.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
McDougall Co., R., Galt.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt, Ont.
Williams Tool Co., Erie, Pa.
Williams Machy. Co., A. R., Toronto.

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PIPE RIVETED STEEL
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William Hamilton Co., Peterboro, Ont.

PIERCING
Oliver Machy. Co., Grand Rapids, Mich.

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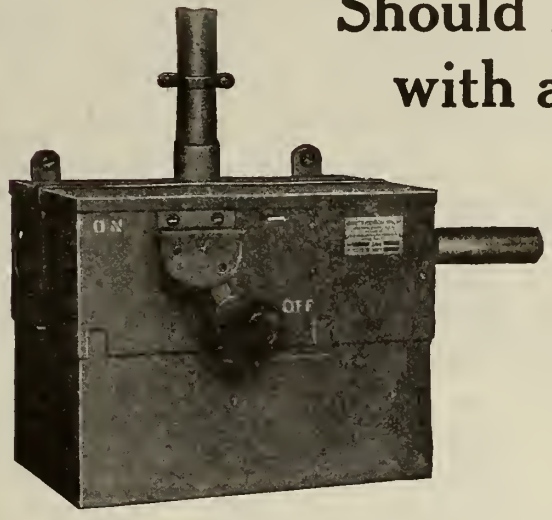
Curtis & Curtis Co., Bridgeport, Conn.
Greenfield Tap & Die Corp., Greenfield
Hall & Sons, Ltd., John H., Brantford
Wells Bros. Co. of Canada, Galt, Ont.

CONDIT

No Power Circuit Should be Broken with a Knife Switch!



CONDIT Type N-2 Oil Switch has a maximum capacity of 60 amperes and 600 volts and is ideal for protecting small lighting and power circuits. It is single throw and made either two, three or four pole, non-automatic or automatic with under-voltage release and overload protective fuses.
Made with knock-outs for Conduit Connections.

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LONDON WINNIPEG REGINA EDMONTON
CALGARY VANCOUVER

CONDIT: *the Synonym of Safety in Electrical Protective Equipment*

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PIPE TOOLS AND DIES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE CUTTERS AND REAMERS
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE STOCKS AND THREADERS
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE TAPS AND VISES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE WRENCHES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PISTON AND PISTON RING MACHINES
National Acme Co., Windsor, Vt.

PLANER BOLTS
Atkins & Co., E. C., Hamilton, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont

PLANER JACKS
Armstrong Bros. Tool Co., Chicago.

PLANERS, STANDARD AND ROTARY
Betts Machine Co., Rochester, N.Y.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Oliver Machy. Co., Grand Rapids, Mich.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal
Gardner & Son, Robt., Montreal.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Morton Mfg. Co., Muskegon Heights, Mich
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.

PLANING AND SHAPING MACHINERY
Barber Mchy. Co., Ltd., Toronto, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal
Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
Niles-Bement-Pond Co., New York.
Ohio Mach. Tool Co., Kenton, Ohio.
Perrin, Ltd., William, Toronto.
Williams Mchy Co. Ltd., A. R., Montreal

PLANER-SHAPER, COMBINED OPEN SIDE
Lynd-Farquhar Co., Boston.
Petrie, Ltd., H. W., Toronto.

POWER HAMMERS
Quickwork Co., St. Marys, Ohio.

PLANING MILL EXHAUSTERS
Can. Blower & Forge Co., Kitchener, Ont
MacGovern & Co., Montreal, Que.
Niles-Bement-Pond Co., New York.
Sturtevant Co., B. F., Galt, Ont.

PLATES, Q.M., SHEARED AND CHEQUERED
Peckovers, Ltd., Toronto, Ont.

PLATING, PLANTS & SUPPLIES
Can. Hanson Van Winkle Co., Ltd., Toronto, Ont.

PLIERS
Aikenhead Hardware Co., Toronto.
Can. Billings & Spencer, Ltd., Welland.
Peck, Stow & Wilcox Co., Southington, Ct.
Rice Lewis & Son, Toronto, Ont.

PNEUMATIC TOOLS
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland P'matic Tool Co., Can., Toronto
Curtis Pneumatic Machy. Co., St. Louis
Garlock-Walker Machy. Co., Toronto.
Int. Mach. & Supply Co., Ltd., Montreal.
Independent Pneumatic Tool Co., Chicago

POWER CRANES, HAND
MacKinnon Steel Co., Sherbrooke, Que.

POLISHING MACHINES
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto.

POLISHING PLATES
Greenfield Tap & Die Corp., Greenfield.
Petrie, Ltd., H. W., Toronto.
Wells Bros. of Canada, Galt, Ont.

POLISHING PAPER
H. H. Barton & Son Co., Philadelphia.

POTS AND KETTLES, CAST STEEL
Elec. Steel & Metals, Welland, Ont.

POWER HOUSE CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Herbert. Niagara Falls, Ont.
St Lawrence Welding Co, Ltd., Montreal

PORTABLE MACHINERY
Haskins & Co., R. C., Chicago, Ill.

POWER TRANSMISSION MCHY.
Canadian Link-Belt Co., Ltd., Toronto, Petrie, Ltd., H. W., Toronto.

PRESSED STEEL PARTS
Gray Ball Bearing Co., Ltd., Toronto.

PRESSERS, ARBOR
Athas Press Co., Kalamazoo, Mich.
Metalwood Mfg. Co., Detroit, Mich.
Petrie, Ltd., H. W., Toronto.

PRESSES, BROACHING, FORGING AND FLANGING
Atlass Press Co., Kalamazoo, Mich.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Dom. Steel Products Co., Ltd., Brantford
Metalwood Mfg. Co., Detroit, Mich
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
Stoll Co., D. H., Buffalo, N.Y.
Williams Mchy Co., Ltd., A. R., Montreal

PRESSES, CAM, TOGGLE, EYELET
Baird Machine Co., Bridgeport, Conn.
Bliss Co., E. W., Brooklyn N.Y.
Toledo Machine & Tool Co., Toledo.
Stoll Co., D. H., Buffalo, N.Y.

PRESSES, FILTER
Perrin, Ltd., William R., Toronto.
Smalley-General Co., Inc., Bay City, Mich.

PRESSES, PNEUMATIC
Barber Mchy. Co., Ltd., Toronto, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Metalwood Mfg. Co., Detroit, Mich.
Toledo Machine & Tool Co., Toledo.

PRESSES, DROP AND FORGING
Barber Mchy. Co., Ltd., Toronto, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton.
Can. Fairbanks-Morse Co., Montreal.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co, Toledo.
U. S. Ordnance, Toronto, Ont.

PRESSES, HYDRAULIC
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Dom. Steel Products Co., Ltd., Brantford.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
Stoll Co., Inc., D. H., Buffalo, N.Y.
U. S. Ordnance, Toronto, Ont.
West Tire Setter Co., Rochester, N.Y.
Williams Machy. Co., A. R., Toronto.

PRESSES, HYDRO-PNEUMATIC
Eastern Production Co., Detroit, Mich.

PRESSES, BALING
Perrin, Ltd., William R., Toronto.

PRESSES, POWER
Baird Machine Co., Bridgeport, Conn.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo.
U. S. Ordnance, Toronto, Ont.
Williams Machy. Co., A. R., Toronto.

PRESSES, SPRING FOOT
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Ont.
Toledo Machine & Tool Co., Toledo.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal

PRESSES, SCREW
Barnes & Co., W. F. & Jno., Rockford, Ill
Bliss Co., E. W., Brooklyn, N.Y.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.

PRESSES, SEAL
Hoggson & Pettis Mfg. Co., New Haven, Conn.

PRESSES, TIRE
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,

PRESSES, TRIMMING
Bliss Co., E. W., Brooklyn, N.Y.
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.

PROJECTORS, FLOOD LIGHTING
Lyman Tube & Supply Co., Montreal, Que

PROPELLERS
Kennedy & Sons, Wm., Owen Sound.

PROTECTIVE COATINGS
H. H. Robertson, Ltd., Sarnia, Ont.

PSYCROMETERS, SLING
Taylor Instrument Co., Rochester, N.Y.

PULLEYS
Algoma Steel Corp., Sault Ste. Marie, Ont
American Pulley Co., Philadelphia.
Baird Machine Co., Bridgeport, Conn.
Bernard Industrial Co., Fortierville, Que.
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Diamond State Fibre Co., Bridgeport, Pa.
Ford-Smith Machine Co., Hamilton, Ont.
Kennedy & Sons, Ltd., W., Owen Sound.
Positive Clutch & Pulley Works Ltd., Toronto.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.

PULLEYS, STEEL SASH, STEEL BELT
American Pulley Co., Philadelphia, Pa.

PULLEYS, FRICTION, CLUTCH
American Pulley Co., Philadelphia, Pa.
Baird Machine Co., Bridgeport, Conn.
Bernard Industrial Co., A., Fortierville, Q
Can. Link-Belt Co., Toronto, Ont.
Carlyle Johnson Mch. Co., Manchester, Ct.
Positive Clutch & Pulley Works, Toronto.
Jones & Glassco, Montreal.
Petrie, Ltd., H. W., Toronto.

PULP MILL MACHINERY
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
MacKinnon Steel Co., Sherbrooke, Que.

PUMPS, AIR LIFT
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,

PUMPS, BOILER FEED
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,

PUMPS, CENTRIFUGAL
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Ingersoll-Rand Co., Montreal, Que.
Darling Bros., Ltd., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

PUMPS, FUEL OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Darling Bros., Ltd., Montreal, Que.
Trahern Pump Co., Rockford, Ill.

PUMPS, GEARED
Darling Bros., Ltd., Montreal, Que.
Globe Engineering Co., Hamilton, Ont.

PUMPS, HIGH PRESSURE
Perrin, Ltd., William R., Toronto.

PUMPS, HYDRAULIC
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Clarke & Co., Furniss, Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Darling Bros., Ltd., Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
Metalwood Mfg. Co., Detroit, Mich.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

PUMPS, LUBRICATING, OIL STORAGE
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, RETURN AIR
Can. Ingersoll-Rand Co. Ltd., Sherbrooke,

PUMPS, SPECIAL
Elec. Steel & Metals, Welland, Ont.

PUMPS, RUBBER CEMENT
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, KEROSENE, OIL, SELF-MEASURING
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, LUBRICANT, OIL, WATER
Darling Bros., Ltd., Montreal, Que.
Trahern Pump Co., Rockford, Ill.

PUMPS — ROTARY
General Combustion Co., Ltd., Montreal, Que.

PUMP LEATHERS
Graton & Knight Mfg. Co., Worcester.

PUNCHES AND DIES
Atkins & Co., Ltd., Wm., Sheffield, Eng.
E. W. Bliss Co, Brooklyn, N.Y.
Boker & Co., Inc., H, Montreal, Que.
Brown, Boggs Co., Ltd., Hamilton, Can.
Can. Blower & Forge Co., Kitchener, Ont.
Crescent Mach. Co., Ltd., Montreal, P.Q.
Can. Fairbanks-Morse Co., Montreal.
Elliott & Whitehall Machine and Tool Co., Galt, Ont.
Gardner & Son, Robert, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Marshall, Son & Blunney, Toronto.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Williams Mchy Co., A. R., Toronto, Ont.

PUNCHES, POWER
John Bertram & Sons Co., Dundas, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd, Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
A. B. Jardine & Co., Hespeler, Ont.
Long & Allstatter, Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
D. H. Stoll Co., Buffalo, N.Y.
Williams Mchy Co., A. R., Toronto, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertrams, Ltd., Edinburgh, Scotland.
Bertrams & Sons, John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton, Ont.
Garlock-Walker Mach'y. Co., Toronto.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

PYROMETERS
Bristol Co., Waterbury, Conn.
Shore Instrument & Mfg. Co., New York
Taylor Instrument Co., Rochester, N.Y.
U.S. Ordnance, Toronto, Ont.

QUARTERING MACHINES
Bertram & Sons, John, Dundas, Ont.
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Niles-Bement-Pond Co., New York.

QUARRY HOISTS
Canadian Mead-Morrison Co., Limited, Montreal, Que.

RAIL BENDERS
Algoma Steel Corp., Sault Ste. Marie, Ont.

PUNCHES, HAND
Niles-Bement-Pond Co., New York.

RAILROAD TOOLS
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Petrie Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

RASPS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.

RAWHIDE PINIONS (See Gears)

REAMERS
Butterfield & Co., Inc., Rock Island, Que.

REAMERS, ADJUSTABLE
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Elliott & Whitehall Machine and Tool Co., Galt, Ont.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Machy. Co., Ingersoll, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Plewes, Ltd., Winnipeg, Man.
Pratt & Whitney Co., Dundas, Ont.
The Kelly Reamer Co., Cleveland, O.
J. A. M. Taylor, 315 Stair Bldg., Toronto.
Wells Bros. of Can., Galt, Ont

REAMERS, BRIDGE, EXPANDING AND HIGH SPEED
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Aikenhead Hardware Co., Toronto.
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Elliott & Whitehall Machine and Tool Co., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Lyman Tube & Supply Co., Montreal, Que
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Samuel Osborne, Ltd., Montreal, P.Q.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
U.S. Ordnance, Toronto, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, STEEL TAPER AND SELF-FEEDING
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
A. B. Jardine & Co., Hespeler, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, CHUCKING
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Elliott & Whitehall Machine and Tool Co., Galt, Ont.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Machy. Co., Ingersoll, Ont.
Marshall, Son & Bunney, Toronto.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wells Bros. of Canada, Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, HAND
Butterfield & Co., Inc., Rock Island, Que.
Elliott & Whitehall, Galt, Ont.
Greenfield Tap & Die Corp., Greenfield.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wells Bros. of Can., Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, PIN
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Morrow Screw & Nut Co., John, Ingersoll.
Wells Bros. of Can., Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMER FLUTING MACHINES
Garvin Machine Co., New York.

REAMING MACHINES, PNEUMATIC
Cleveland Pneumatic Co. of Can., Toronto
Garlock-Walker Machinery Co., Toronto.

RECORDING INTRUMENTS
Bristol Co., Waterbury, Conn.
Gisholt Machine Co., Madison, Wis.
Taylor Instrument Co., Rochester, N.Y.

REELS, WIRE AND TEXTILE MFG.
American Pulley Co., Philadelphia, Pa.

REGULATORS, AUTOMATIC
Electric Steels & Metals, Ltd., Welland.

REGULATORS, PRESSURE, TEMPERATURE
Can. Fairbanks-Morse Co., Montreal.
Taylor Instrument Co., Rochester, N.Y.

REPAIR WORK — SAWS
Atkins & Co., E. C., Hamilton, Ont.

REPAIR WORK, ALL KINDS
Elec. Steel & Metals, Welland, Ont.
St Lawrence Welding Co, Ltd., Montreal

RESPIRATORS
Strong, Kennard & Nutt Co., Cleveland.

RIVETS,
Aikenhead Hardware Co., Toronto, Ont.
Parmenter & Bulloch Co., Ganonoque.
Rice, Lewis & Son, Toronto.
Steel Co. of Canada, Ltd., Hamilton.

RIVETERS, PNEUMATIC, HYDRAULIC, HAMMER, COMPRESSION
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Montreal.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.

RIVETING MACHINES, ELASTIC, ROTARY BLOW
Grant Mfg. & Machine Co., Bridgeport.
High-Speed Hammer Co., Rochester.
Petrie, Ltd., H. W., Toronto.
F. B. Shuster Co., New Haven, Conn.

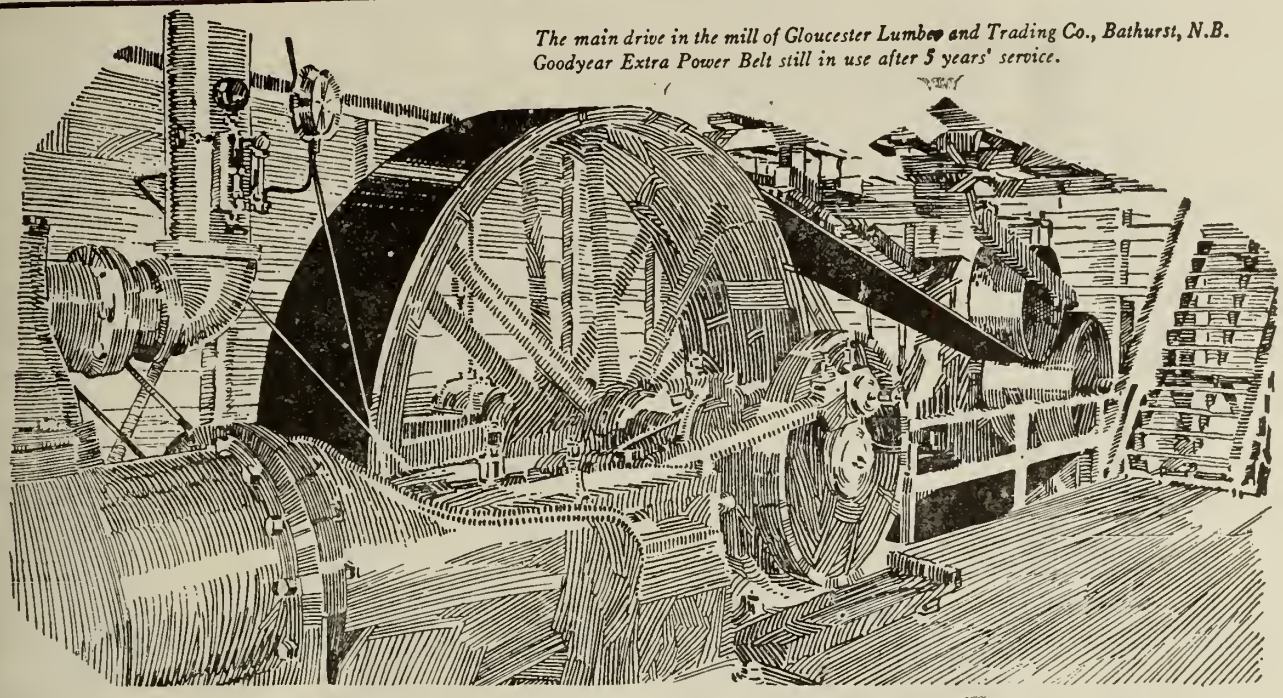
ROAD BUILDING EQUIPMENT
Can. Ingersoll-Rand Co., Ltd., Sherbrooke.

ROAD-MAKING MACHINERY
G. F. Foss Mchy & Sply. Co., Montreal.

RODS, ROPE AND SPRING
Page Steel & Wire Co., Adrian, Mich.

RODS, PURE NICKEL, MONEL METAL, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville.

ROLL ENGRAVING
Hoggson & Pettis Mfg. Co., New Haven, Conn.



The main drive in the mill of Gloucester Lumber and Trading Co., Bathurst, N.B. Goodyear Extra Power Belt still in use after 5 years' service.

Master Belts of Industry

Goodyear has solved the problem of belting the great main drives of industry—the backbone of production.

Experience, in a thousand Canadian plants, says Goodyear Extra Power Belts.

Because these belts are *strong*—with the strength of properly selected fabric, every thread perfect.

Yet *flexible*, hugging pulleys, taking advantage of every inch of pulley surface. Flexible because in Goodyear Extra Power Belting high-grade rubber is forced through and through the fabric in generous quantities. Every strand is cushioned in it. No stitching to stiffen or weaken the belt. No separation of plies.

Its *friction* surface grips, even through dampness or dust. No slipping with Extra Power. No need for extra tight belts, pulling pulleys out of line. No need for belt dressing. No lost power.

The testimony for Goodyear Extra Power on main drives is very complete. For instance:—

The Norfolk Milling Company, of Simcoe, writing about their main drive belt, purchased a year ago, say:—

"Has been in continuous operation for one year, and has not stretched nor given us the slightest bit of trouble."

There are many others—some selected at random are:—

Swedish Crucible Steel Company, Ltd., Windsor, Ont.
Dominion Sugar Company, Ltd., Chatham, Ont.
Dominion Forge and Stamping Co., Ltd., Walkerville, Ont.
Page Wire Fence Company of Canada, Ltd., Walkerville, Ont
Echo Flour Mills, Ltd., Gladstone, Man.
P. Burns Company, Ltd., Edmonton, Alta.
Hollinger Consolidated Gold Mines Co, Ltd., Timmins, Ont.
Dome Mines Company, Ltd., South Porcupine, Ont.
Burrard Saw Mills, Ltd., Vancouver, B.C.
Silverton Lumber and Power Company, Ltd., Silverton, B.C.
Woodstock Electric Railway, Light and Power Company, Ltd., Woodstock, N.B.
Gloucester Lumbering and Trading Company, Bathurst, N.B.
Amherst Foundry Company, Ltd., Amherst, N.S.
Hull Iron and Steel Foundries, Ltd., Hull, Que.
Quebec Graphite Co., Ltd., Buckingham, Que.

The complete story of Goodyear Extra Power Belts on main drives is interesting. There are facts about other types of drives just as important to you. Let a Goodyear belting man call and talk to you. No obligation. Just phone, wire or write the nearest branch.

The Goodyear Tire & Rubber Co. of Canada, Limited

Branches:—Halifax, St. John, Quebec, Montreal, Ottawa, Toronto, Hamilton, London, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Vancouver. Service stocks in smaller cities.

GOODYEAR

MADE IN CANADA

EXTRA POWER BELTING

ROLLER CHAINS
Can. Link-Belt Co., Toronto.
Jones & Glasco, Montreal.
Lyman Tube & Supply Co., Montreal, Que

ROLLS, BENDING, STRAIGHTENING
John Bertram & Sons Co., Dundas.
Brown, Boggs Co., Ltd., Hamilton.
Can. Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto
Niles-Bement-Pond Co., New York.
Petrie Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo, O.

ROLLS CRUSHING
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

ROLLS AND TABLES
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Elec. Steel & Metals, Welland, Ont.

ROOFING
H. H. Robertson, Ltd., Sarnia, Ont.

ROPE, GALX, MONEL METAL.

BRONZE, TILLER AND SASH CORD
Can. Driver-Harris Co., Ltd., Walkerville

ROTARY SHEARS
The Quickwork Co., St. Mary's, Ohio.

ROOF COOLERS
Electric Steels & Metals, Ltd., Welland

ROLLING MACHINES, SHEET METAL
Manhattan Machine & Tool Co., Grand Rapids, Mich.

ROLLING MILL MACHINERY
Dom. Steel Products Co., Ltd., Brantford
Mesta Machine Co., Pittsburgh, Pa.

ROLL LATHES
Mesta Machine Co., Pittsburgh, Pa.

ROLLS, BENDING, STRAIGHTENING
Manhattan Machine & Tool Co., Grand Rapids, Mich.

ROLLS, CRUSHING
Can. Link-Belt Co., Toronto.

ROLL ENGRAVINGS
Hoggson & Pettis Mfg. Co., New Haven Conn.

RUBBER MFRS.' SUPPIES
Hoggson & Pettis Mfg. Co., New Haven Conn.

RUBBER MOULDS AND CORES
Elliott & Whitehall, Galt, Ont.

RUBBER MILL DRIVES
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dom. Steel Products Co., Ltd., Brantford
Can. Link-Belt Co., Toronto.

RUBBER MILL MACHINERY
Bertrams Ltd., Edinburgh, Scotland.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dom. Steel Products Co., Ltd., Brantford

RUBBER MOULDS & CORES
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

RUBBER PRODUCTS, MECHANICAL
Dunlop Tire & Rubber Goods Co., Ltd Montreal.

RUBBING BRICKS
Dominion Abrasive Co., Mimico, Ont.

RULES
Brown & Sharpe Mfg. Co., Providence.
James Chesterman & Co., Ltd., Sheffield
Hine, Lewis & Son, Toronto.
L. S. Starrett Co., Athol, Mass.

RULES, STEEL, STRAIGHT, AND FOLDING
Lufkin Rule Co. of Can., Windsor.

RULES, BOXWOOD, FOLDING
Lufkin Rule Co. of Can., Windsor.

RULES, BOARD AND LONG
Lufkin Rule Co. of Can., Windsor.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N.Y.

SAW MILL CONVEYORS
Can. Link-Belt Co., Toronto.
Petrie, Ltd., H. W., Toronto.

SAFETY DEVICES
Strong, Kennard & Nutt Co., Cleveland

SAND MILLS
Frost Mfg. Co., Chicago, Ill.

SAND-BLAST EQUIPMENT

SAND BLAST SUPPLIES AND ACCESSORIES
Pangborn Corporation, Hagerstown, Md
Lawrence Welding Co. Ltd., Montreal

SAFETY APPLIANCES
Strong, Kennard & Nutt Co., Cleveland

SAFETY APPLIANCE GOGGLES
T. A. Willson Co., Inc., Reading, Pa

SAND BLAST ABRASIVES
Pangborn Corporation, Hagerstown, Md

SAND MIXING MACHINERY
Frost Mfg. Co., Chicago, Ill.

SANITARY DRINKING FOUNTAINS
Puro Sanitary Drinking Fountain Co. Haydenville.

SANDING MACHINES
Canada Machinery Corp., Galt.

SAW MILL MACHINERY
Can. Fairbanks-Morse Co., Montreal
Canada Machinery Corp., Galt.
Robert Gardner & Son, Montreal.
Curtis Pneumatic Machy Co., St. Louis
A. R. Williams Machy Co., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

SASH SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

SAWS FOR EVERY USE
Atkins & Co., E. C., Hamilton, Ont.

SAWS, CIRCULAR METAL
Atkins & Co., E. C., Hamilton, Ont.
Wm. Atkins & Co., Ltd., Sheffield, Eng
Hunter Saw & Machine Co., Pittsburgh
Marshal, Son & Bunney, Toronto.
Plewes Ltd., Winnipeg, Man.
Simonds Mfg. Co., Fitchburgh, Mass.
Tabor Mfg. Co., Philadelphia, Pa.

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Greenfield Tap & Die Corp., Greenfield.
Hunter Saw & Machine Co., Pittsburgh
Wells Bros. of Can., Galt, Ont.

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J. A. M. Taylor, Stair Bldg., Toronto
Atkins & Co., E. C., Hamilton, Ont.
Elliott & Whitehall Machine and Tool Co., Galt, Ont.

SAWS — HIGH-SPEED FRICTION
Atkins & Co., E. C., Hamilton, Ont.

SAWS — PATTERN SHOP
Atkins & Co., E. C., Hamilton, Ont.

SAWS — SWING
Atkins & Co., E. C., Hamilton, Ont.

SCALES
Jas. Kron Scale Co., Montreal, P.Q.
U. S. Ordnance, Toronto, Ont.

SCALES, MECHANICS'
Lufkin Rule Co. of Can., Windsor.

SCLEROSCOPES
Shore Instrument & Mfg. Co., New York.
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SCREENING MACHINERY
Can. Link-Belt Co., Toronto.

SCREW EXTRACTORS
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Can. Fairbanks-Morse Co., Montreal.
Foster Machine Co., Elkhart, Ind.
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Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield.
A. B. Jardine & Co., Hespeler.
National Acme Co. Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
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John Morrow Screw & Nut Co., Ingersoll.
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Steel Co. of Canada, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.

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John Morrow Screw & Nut Co., Ingersoll.

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Brown & Sharpe Mfg. Co., Providence, R.I.

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Butterfield & Co., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
A. B. Jardine & Co., Hespeler.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto.
J. A. M. Taylor, Stair Bldg., Toronto
Wells Bros. of Can., Galt.
Wilkinson & Kompass, Hamilton

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Robt. Gardner & Son, Montreal.
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Fellows Gear & Shaper Co., Springfield, V.
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Can. Fairbanks-Morse Co., Montreal.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Jones & Glasco, Montreal.
Niles-Bement-Pond Co., New York.
Can. Drawn Steel Co., Hamilton.
Peckovers, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas.
Rice, Lewis & Son, Toronto.
A. R. Williams Machy. Co., Toronto.
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Bertrams Ltd., Edinburgh, Scotland.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
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Petrie, Ltd., H. W., Toronto.
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Williams Mchy Co., A. R., Toronto, Ont.

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The Quickwork Co., St Mary's, Ohio.

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SHEARS, SPLITTING
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Peck, Stow & Wilcox Co., Southington, O.
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Kayser-Ellison & Co., Ltd., Montreal.

SHEETS, BLACK AUTO AND GALVANIZED
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SHEETS, NICKEL, RESIST. ALLOY
Can. Driver-Harris Co., Ltd., Walkerville.

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Dennis Wire & Iron Works, London.

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J. H. Williams & Co., Brooklyn, N.Y

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SLEDGES
Aikenhead Hardware Co., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont

SLEDGES, CAST IRON
Katie Foundry, Galt, Ont.

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Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
National-Acme Co., Cleveland, Ohio.
Niles-Bement-Pond Co., New York.

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Rice Lewis & Son, Toronto, Ont.

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Katie Foundry, Galt, Ont.

SOLDERING IRONS
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Brown, Boggs & Co., Hamilton, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.

SOLDER
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Aikenhead Hardware Co., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
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Brown Engineering Corp., Toronto, Ont.
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Norton, Ralph B., Agent, Montreal.
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STEEL, OPEN HEARTH
Illingworth Steel Co., John, New York

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Lyman Tube & Supply Co., Ltd., Montreal
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St. Lawrence Welding Co., Montreal, Que.
Toronto Iron Works, Ltd, Toronto.

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MacKinnon Steel Co., Sherbrooke, Que.
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Toronto Iron Works, Ltd., Toronto.

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Modern Tool Co., Erie, Pa.
Murchy Machine & Tool Co., Detroit.
Niles-Bement-Pond Co., New York.
Rickert-Shafer Co., Erie, Pa.
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Ingersoll Mach. Co., Ingersoll, Ont.
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Pilot Steel & Tool Co., Montreal, Que.
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Greenfield Tap & Die Corp., Greenfield, Mass.
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TAPS, MACHINE SCREW
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, PIPE
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
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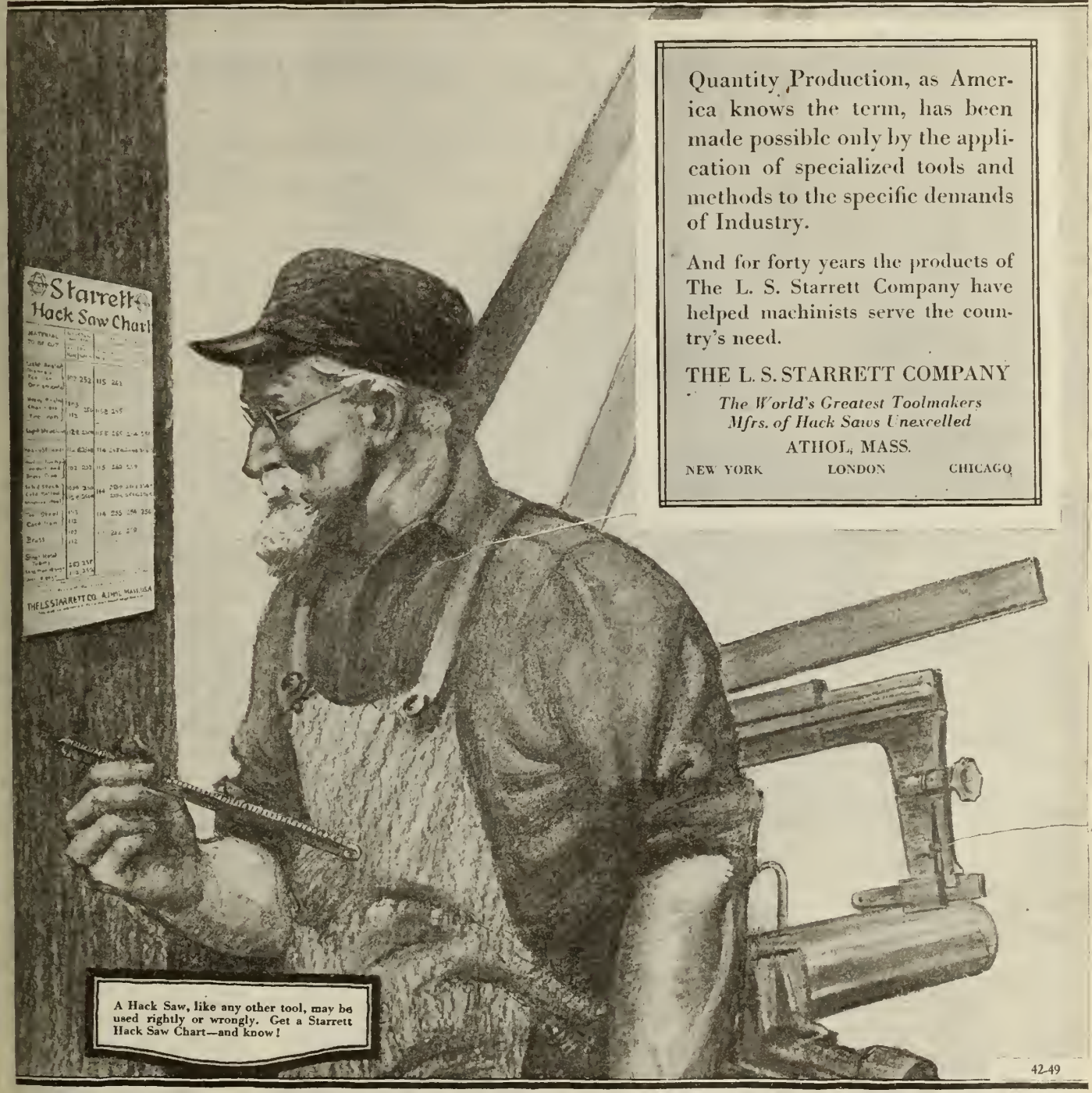
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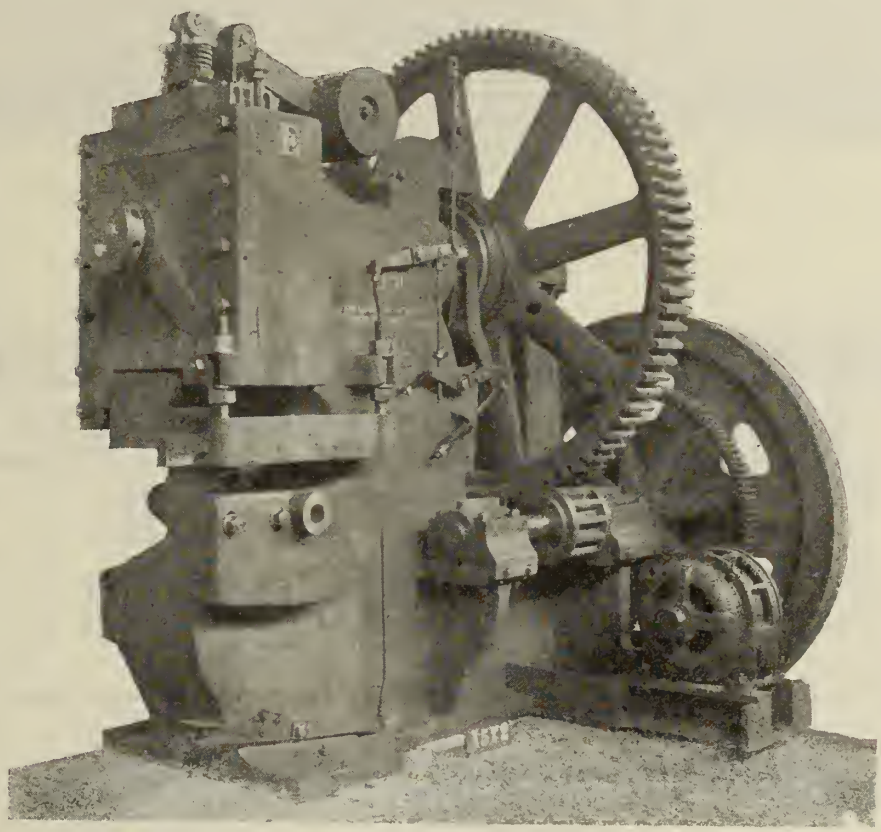

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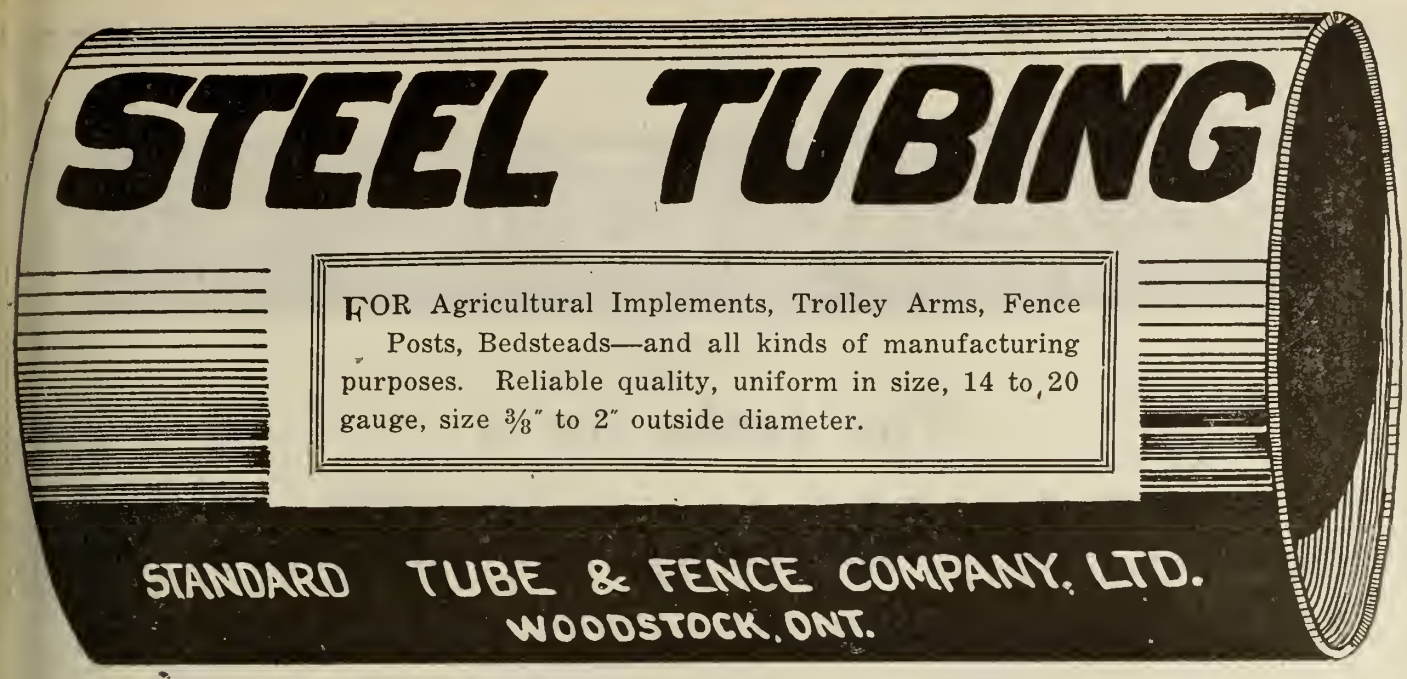
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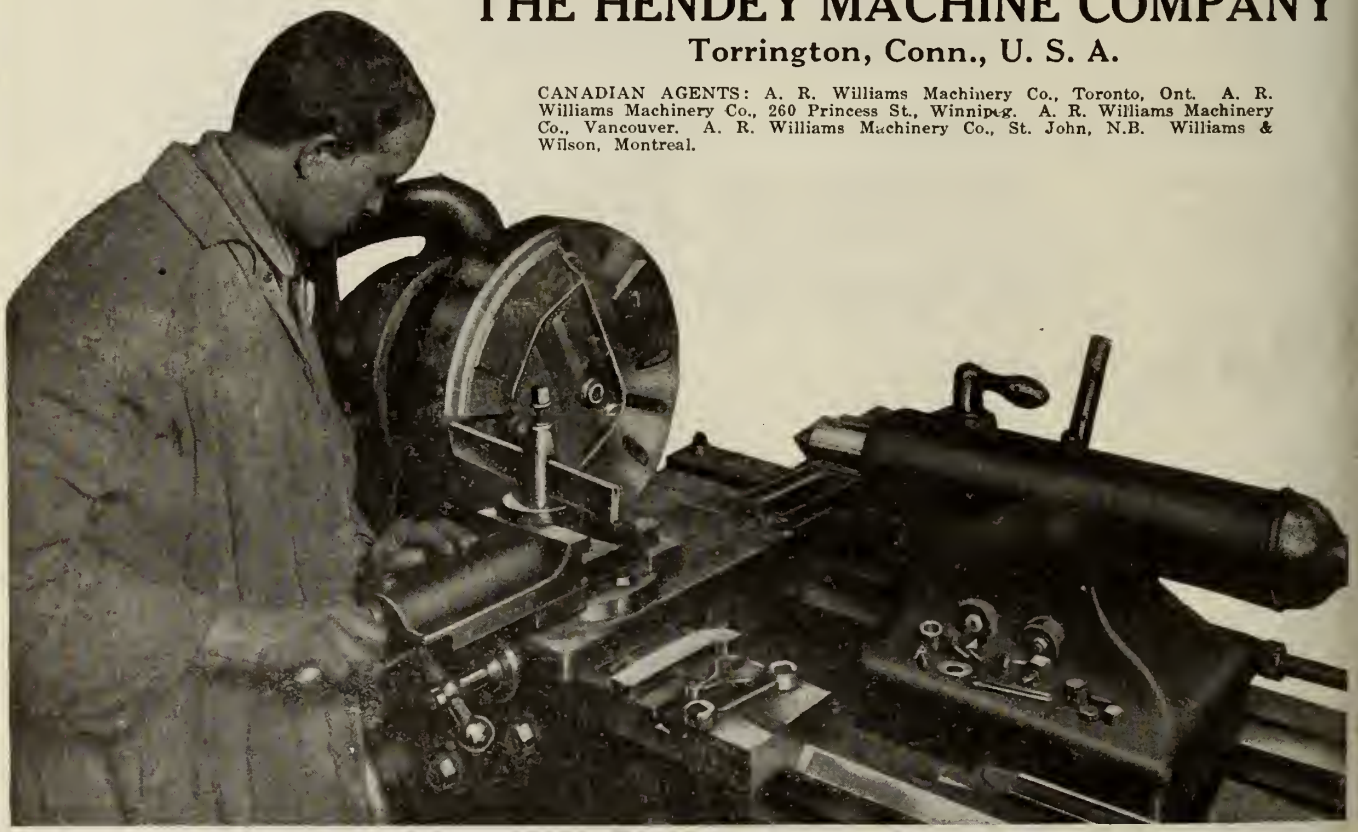

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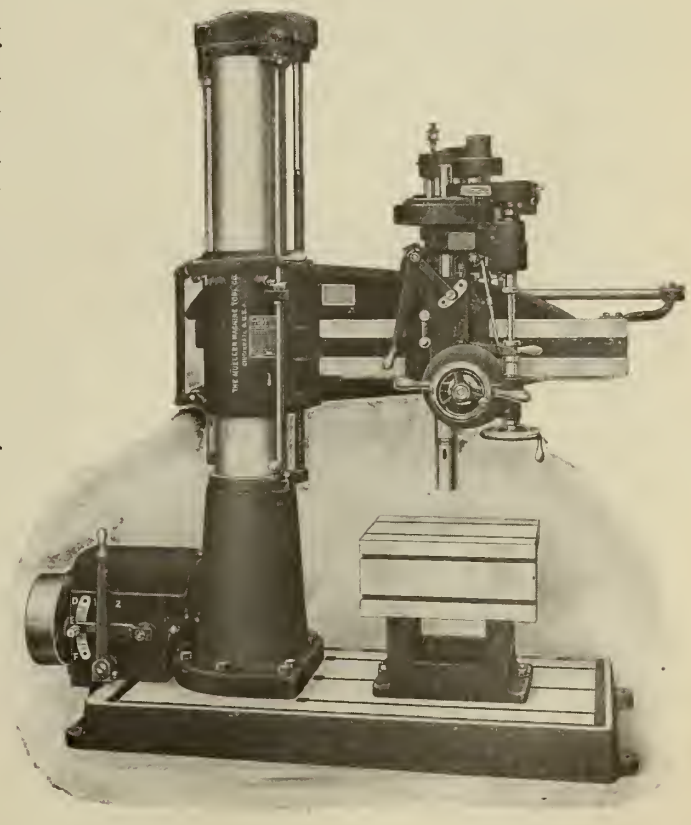

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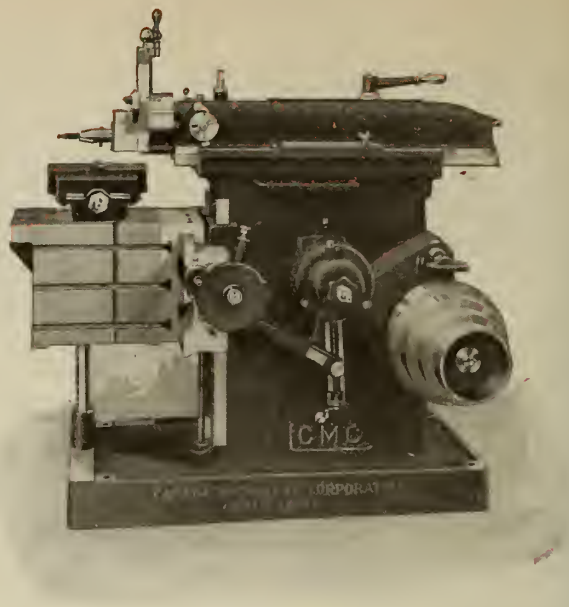

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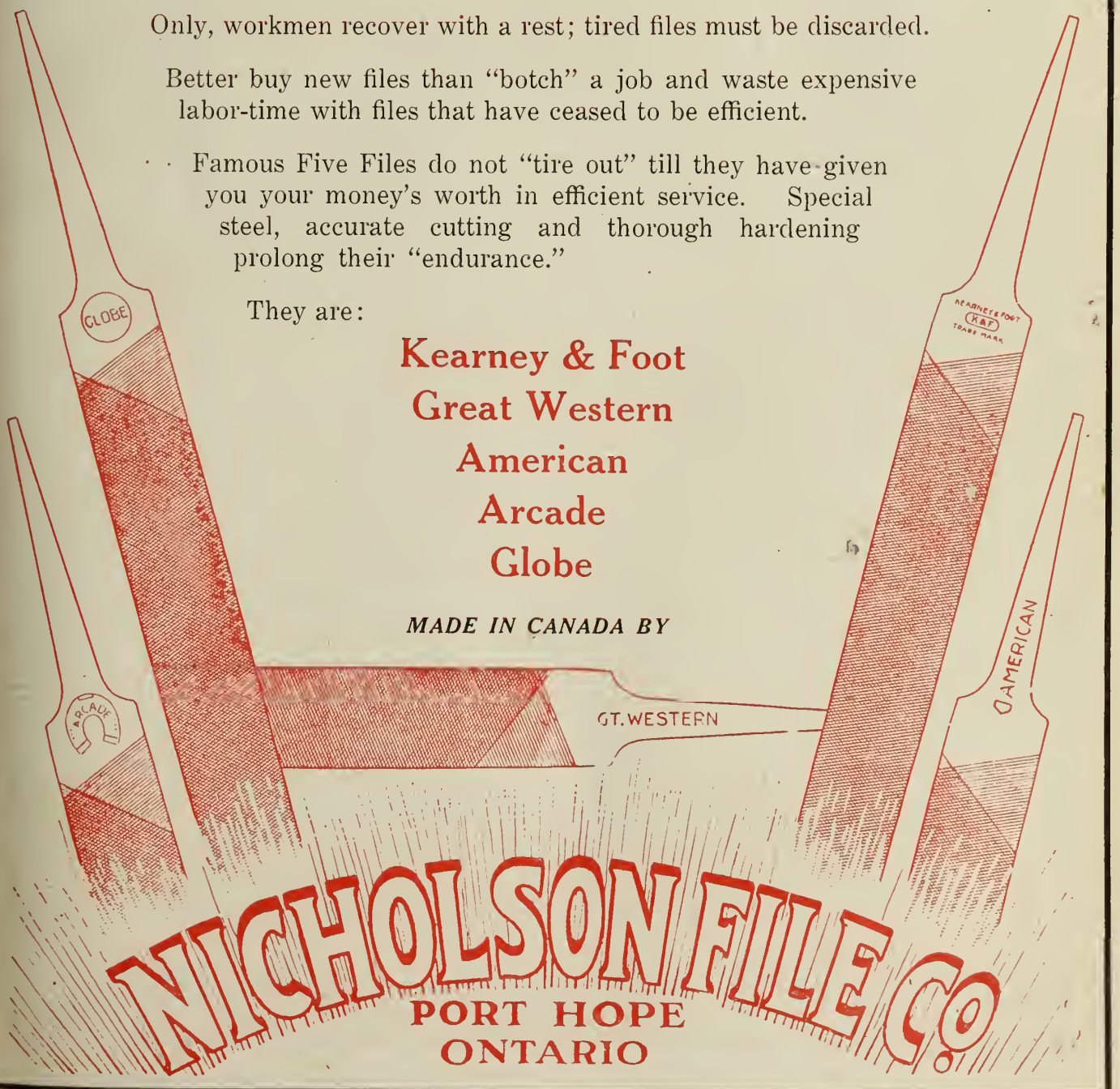

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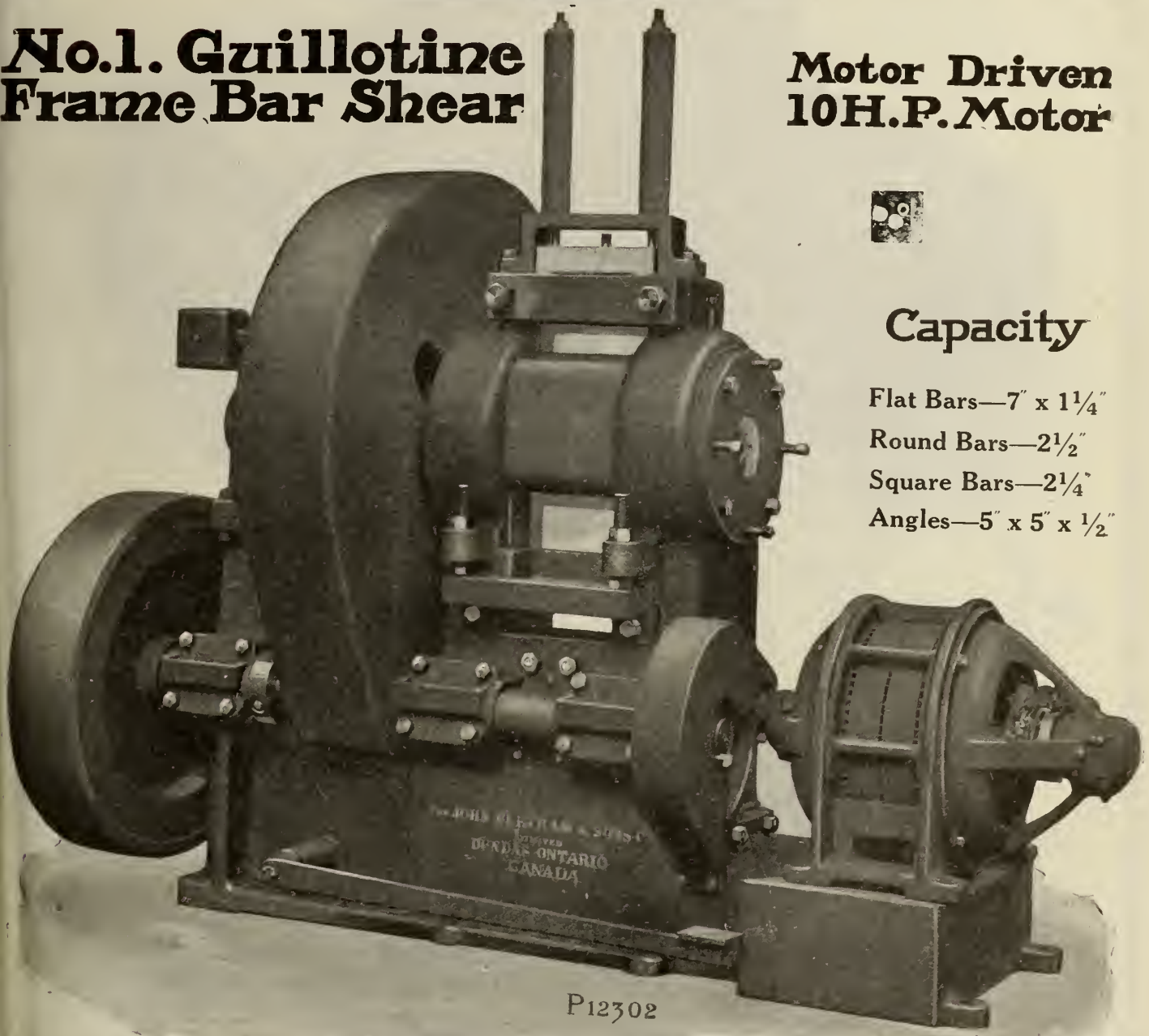

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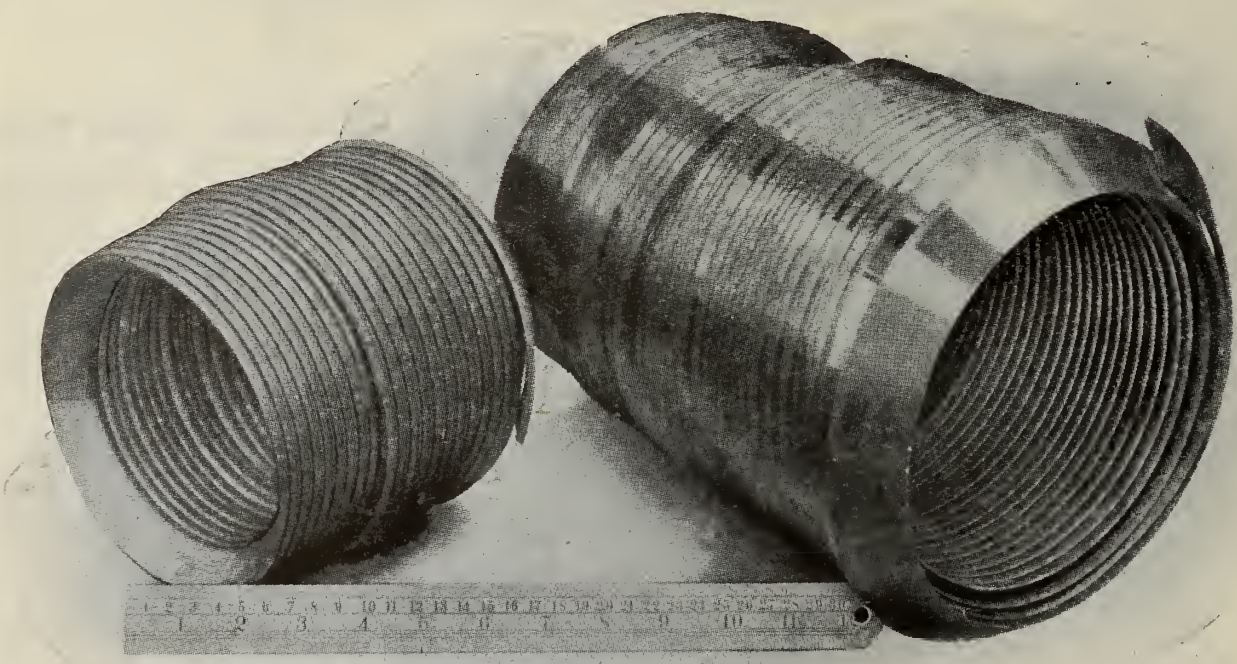

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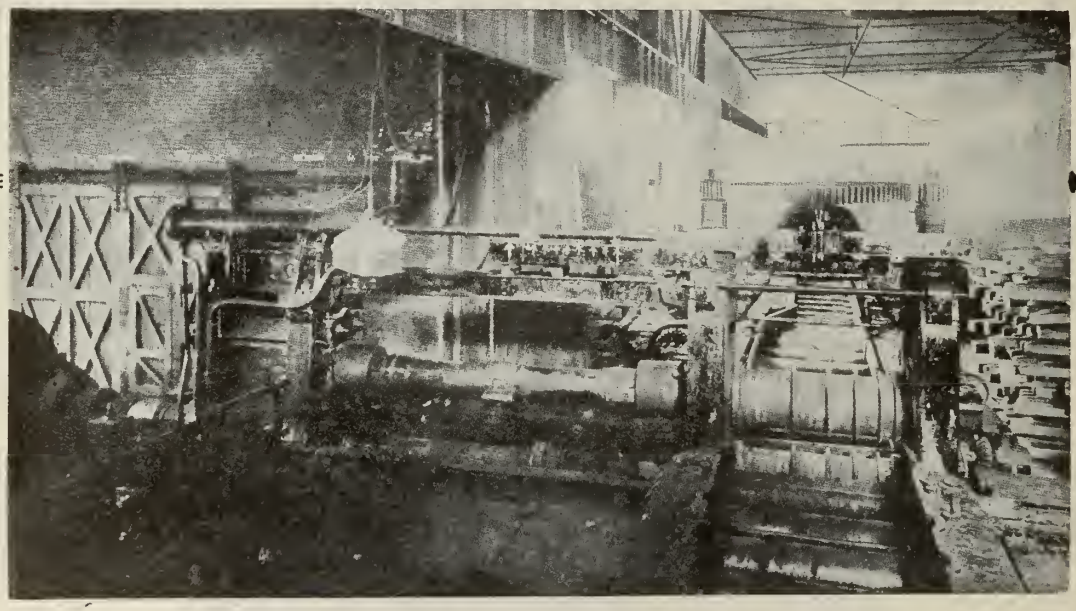

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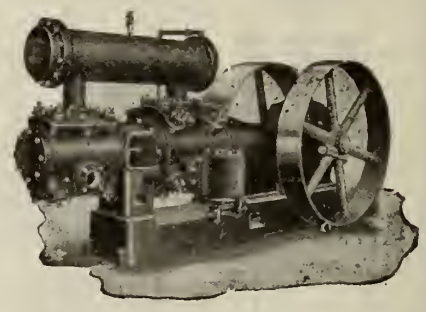

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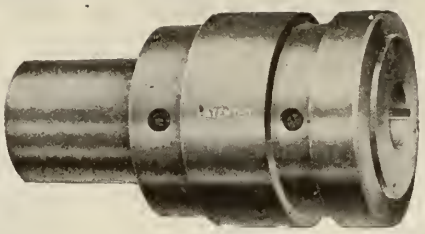

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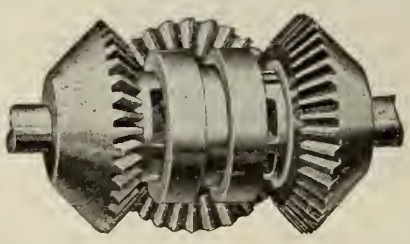

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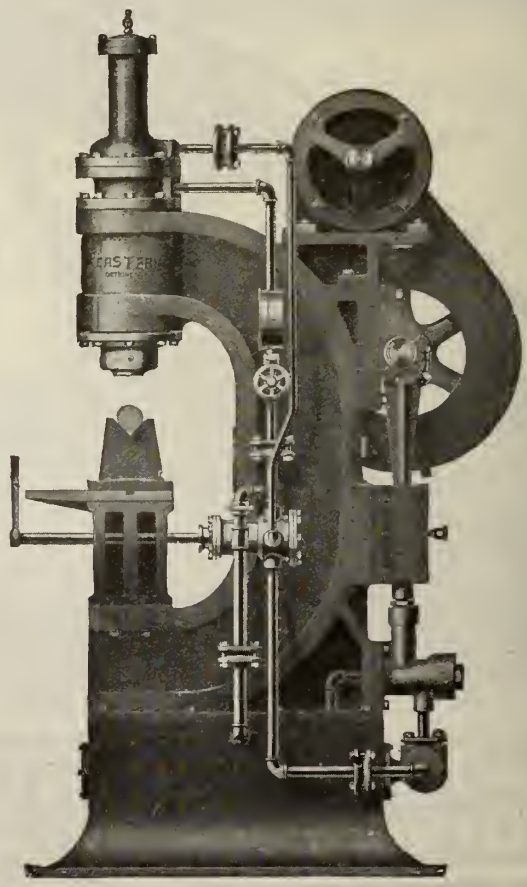

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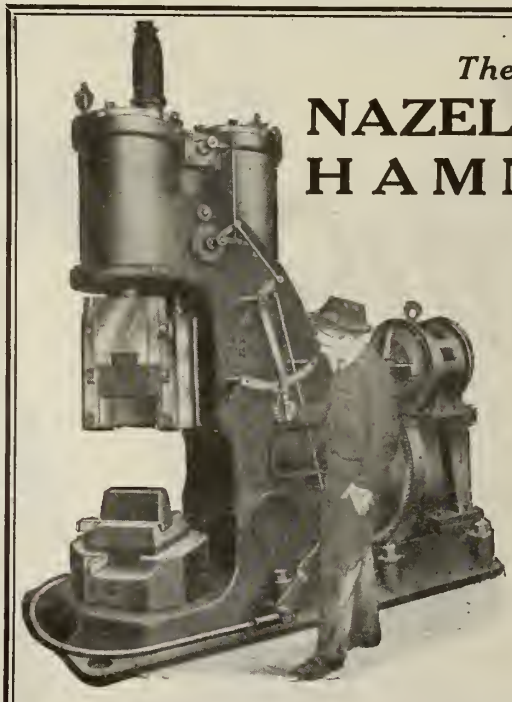

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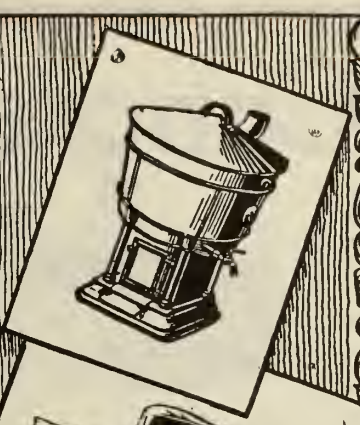
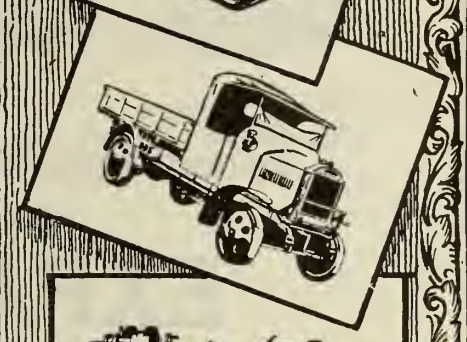
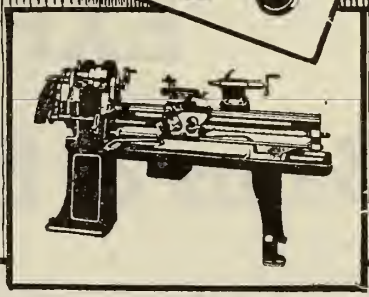
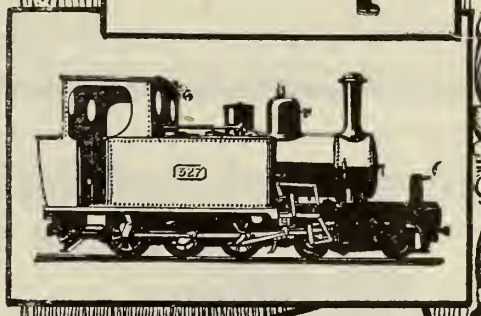
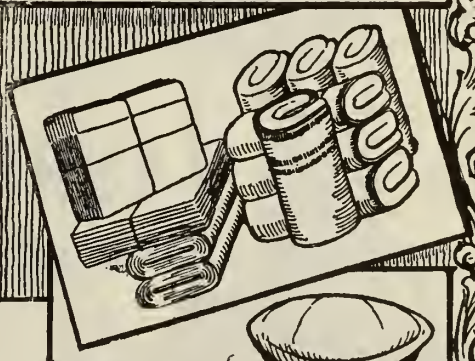

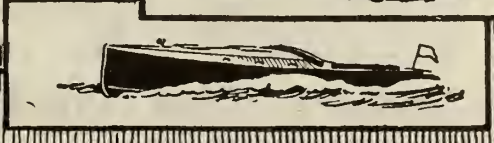
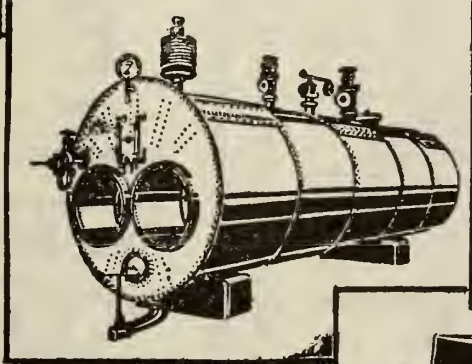
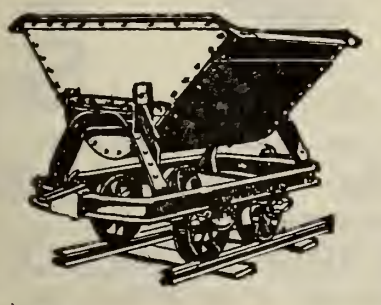

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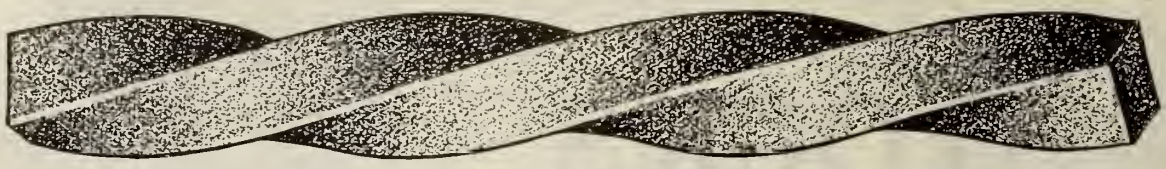
OF EVERY DESCRIPTION



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TRADE W.F. & J.B. MARK

Complete line. 8-inch to 50-inch swing

Gang Drills.—Horizontal Drills.

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1856
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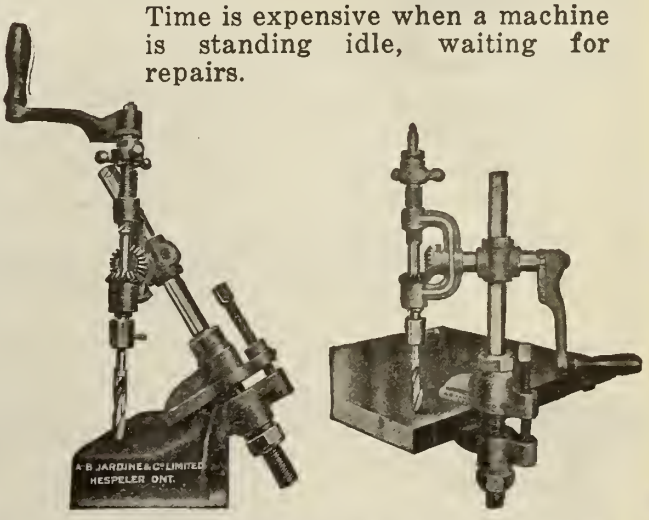
Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.



On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

Weight, 40 lbs. Price, $26.50 net.
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Canada's Dependable Machinery and Supply House

Your Problems!

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Just let us know your requirements and we will in turn let you know how we can serve you best.

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"Combination" Link-Belt for Elevators and Conveyors

Link-Belt Malleable Iron Buckets

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Chains—Wheels—Buckets

for elevating and conveying materials of every character have earned a reputation for durability and efficient service.

≻FLINT-RIM≺ wheels have hard, smooth bearing surfaces for contact with the chain links, thus insuring both wheels and chain from undue wear. They last twice as long as ordinary cast-iron wheels.

"C" Class Link-Belt is superior because of its joint construction which insures a long life of efficient service.

Link-Belt buckets are made by experienced molders who specialize on this work. They are remarkably free from blemishes and other casting deficiencies, have clean edges and sharp corners; gates are ground off and they are thoroughly oiled before shipment.

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WELLINGTON AND PETER STREETS
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Elevators and Conveyors

We Also Make

- ☐ Link-Belt and Sprockets
- ☐ Silent Chain Drives
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Write for Catalogs
Place X in Square

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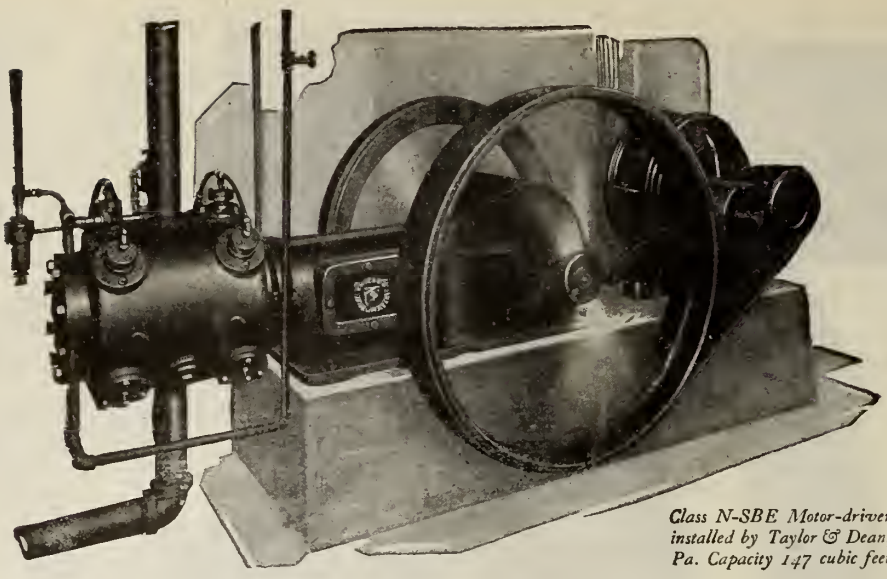

Class N-SBE Motor-driven Compressor installed by Taylor & Dean, Pittsburgh, Pa. Capacity 147 cubic feet per minute.

An ideal unit for moderate air power needs

CHICAGO Pneumatic Short-Belt Motor-Driven Air Compressors are ideal units for the small air power plant. Their compact construction economizes space. The short-belt drive with idler pulley prevents belt troubles

These units embody the same advanced principles of design and construction as the larger Chicago Pneumatics—Simplate Indestructible Flat Disc Valves, automatic regulation and lubrication, great rigidity, liberal bearing surfaces—all insuring more power with less waste; longer service with less upkeep.

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C-52-H

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Dependable Power at *Less Cost Per Hour*

Anything that requires machining, whether it's a dozen to the handful or large flywheels for gas engines, can be turned out at lower cost on the Manufacturing Automatics.

You may be manufacturing automobiles, or gas engines, or knitting machines, or grinders, or machine tools of any sort, in fact whatever your line, you probably come within the range of the machines.

Manufacturing Automatics

Call the stenographer and dictate a letter on the subject of cost cutting in your machining department.

Send your drawings or samples along and we will give you production figures, after which there will be no doubt as to the method you adopt.

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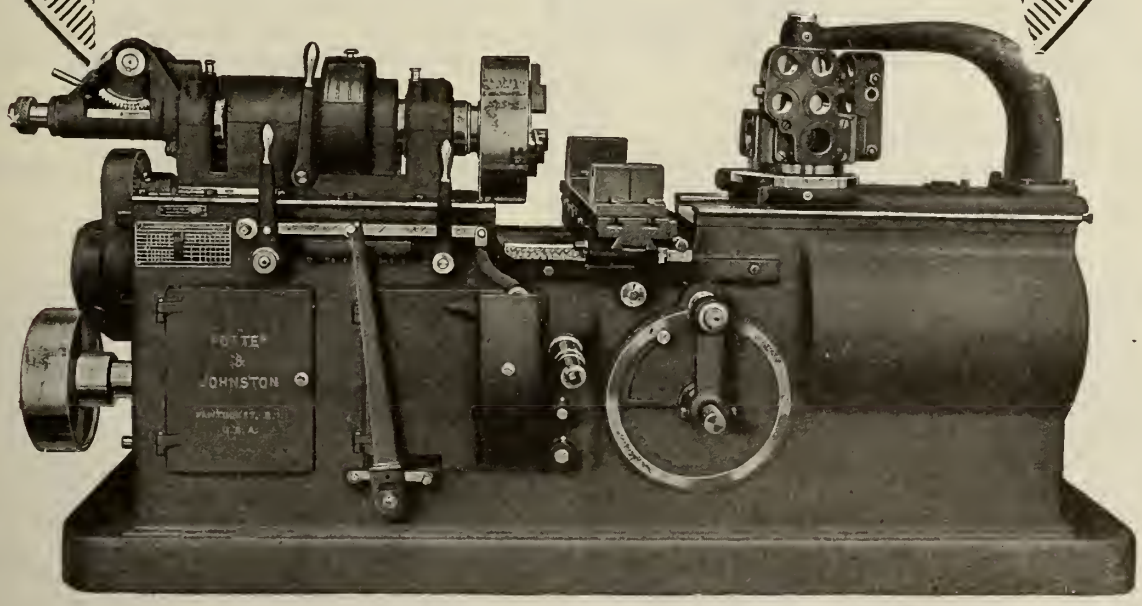

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ROELOFSON MACHINE & TOOL CO., LIMITED

Head Office: 1501 Royal Bank Building, Toronto, Canada
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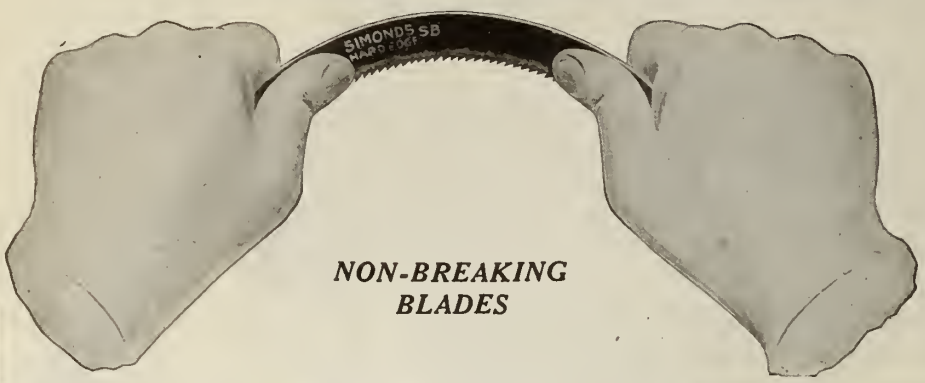

NON-BREAKING BLADES

CUT CUTTING COST

For Machine or Hand Use
Any Size or Length

Simonds Canada Saw Co.
LIMITED
MONTREAL
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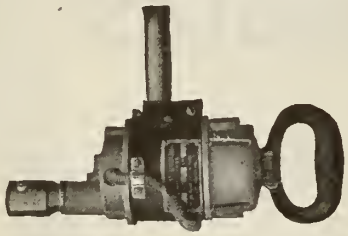
U. S. Electric Drills and Grinders

Save Time, Labor and Money



They can be attached to any lamp socket.

For drilling in metal they are superior to any other kind of portable drill. Cost 50% less to run than air drills.

3 SIZES
3-16 in., W.G.T., 6 lbs.
¼ in., W.G.T. 9 lbs.
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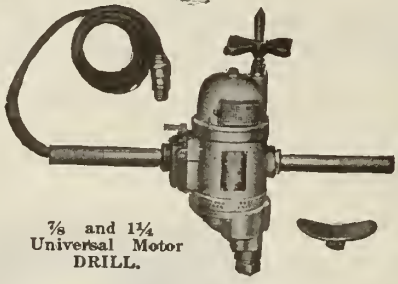
All motors wound for 110 or 220 volts.

Direct or alternating current.

Try a few of our Electric Drills and Grinders and you'll send us an order for more. Our guarantee protects you.



⅜ and 1¼ Universal Motor DRILL.

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QUICK DELIVERIES

High Carbon Steel
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QUALITY GUARANTEED

Sizes—½ lb. to 5,000 lbs. each

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ESTABLISHED 1860

HARDENED SCREW GAUGES

ALL SIZES—STANDARD AND MISCELLANEOUS

Made to a fine degree of accuracy

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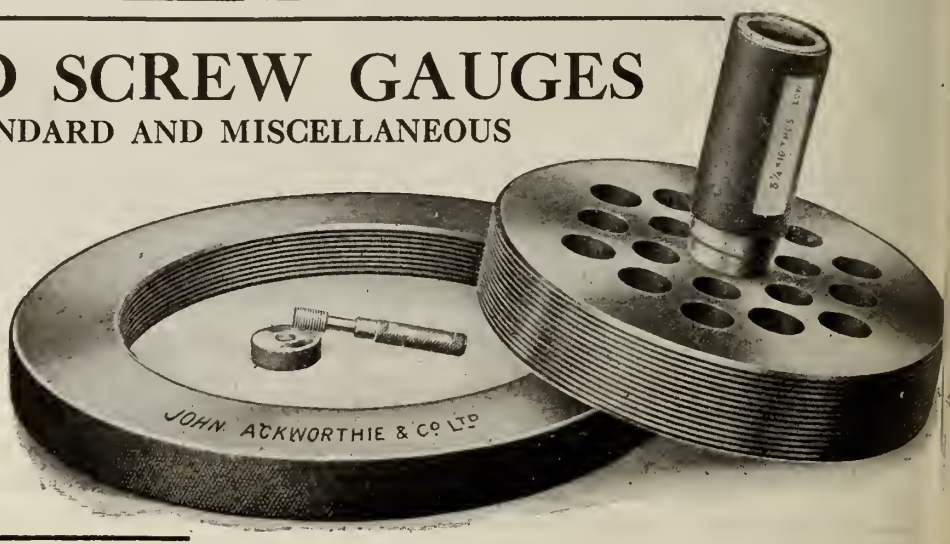

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Continues forge furnaces.

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Other furnaces for any industrial process of any description which requires heat—designed and built to operate with the same economy and reliability.
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Made in Canada

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Try Dominion Wheels on a Quality basis

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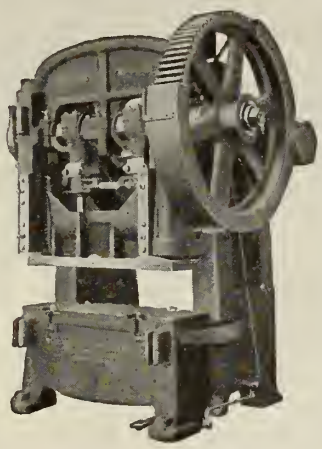
THE "TOLEDO"

DOUBLE CHUCK PRESSES



No. 206. For Multiple Punching, Shearing, Blanking, Forming, etc.

Really productive machines of rugged, sturdy construction embodying all the most advanced features in design.

Low maintenance cost and unusual capacity for heavy, continuous work have placed them beyond competition.

Widely used for cutting out and forming large articles of tin, brass, copper, sheet steel, cardboard, paper, cloth, etc.

We fit the press to the needs

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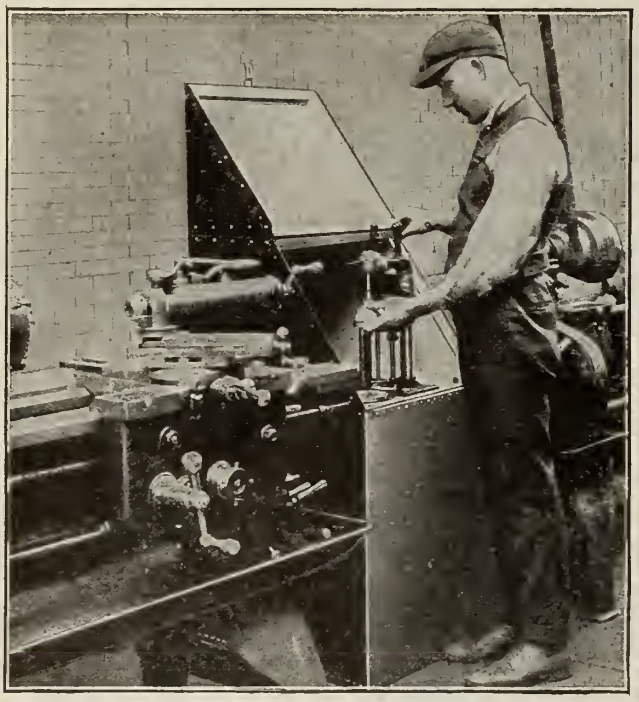
of Men and Machines



By placing Bowser Lubricating Oil Cabinets in departments where oil is used.

There is no going back and forth to the oil room, no spilling, no wasted oil, no fire risk from the oil storage.

Save the Oil

The oil supply can be stored and handled as systematically as raw materials or finished parts—income checked, distribution measured, charged and recorded.

Write for literature, explaining why and how Bowser Systems pay for themselves, many times over in saving of oils and labor.

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will withstand heavy pressure without increasing its temperature

For general machinery bearings it is without a peer.

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THE "SEMPLE" TAP

Patent Applied for.

A SCIENTIFICALLY CORRECT
CUTTING TOOL
makes tapping a pleasure

The Most MODERN,
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Send for a "SEMPLE" Sample Tap. Made in any thread
Special Taps for blind holes.

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Tell us the purpose for which the spring is intended, and our experts will gladly co-operate to see that you get the design best suited to the purpose.

Dunbar Springs are thoroughly tested for accuracy and quality. Send us specifications, for estimates.

THE DUNBAR BROS. CO.
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—for a large variety of grinding

if your variety of grinding is large invest in a Manhattan Universal Grinder. It is capable of handling cylindrical or internal grinding with the utmost in speed and accuracy.

Write for details.

Manhattan Machine & Tool Works

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Manhattan All-Around UNIVERSAL TOOL GRINDER

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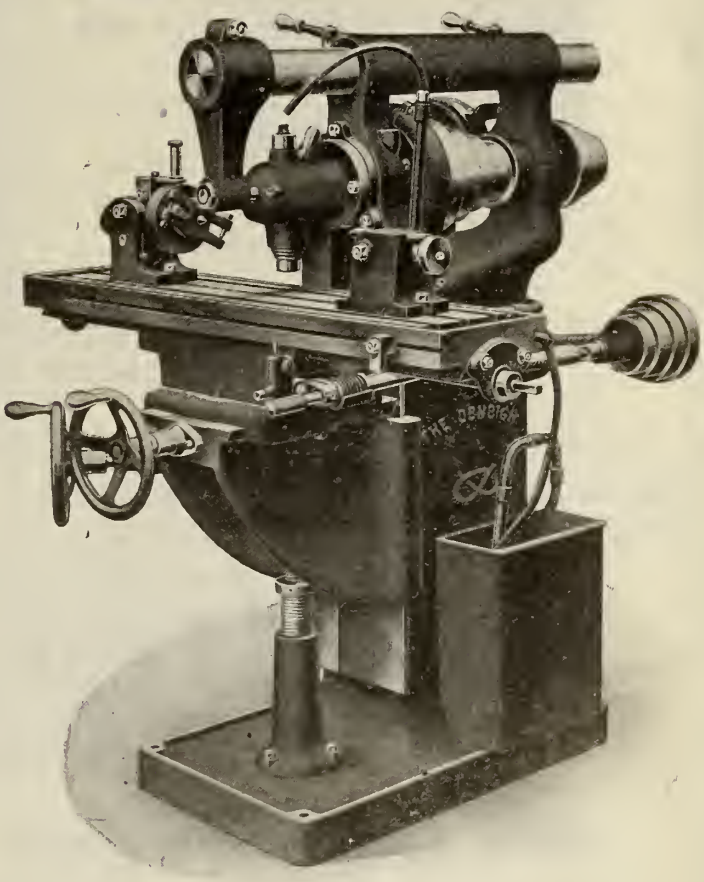
2

The DENBIGH Famous MANUFACTURING MILLERS



Enormous war demands enabled us to lay down a large and highly co-ordinated organization for the quantity production of Denbigh Manufacturing Millers.

This extensive experience has resulted in machines perfect in design and construction. We are now in a position to place them on the market at a very low price.

Nine types and sizes—to suit any miller requirement—**and the delivery is right.**

John M. Terry & Company

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Cables: Athenian, Cannon, London.

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Prompt shipments of all Standard Sizes in
Cap Screws, V or U.S.S.
Cap Screws, S.A.E.
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S.F. Hexagon Nuts, V or U.S.S.
S.A.E. Hexagon Nuts, Plain.
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Send us your rush orders.

THE
GALT MACHINE SCREW CO., LIMITED
GALT, ONTARIO

Eastern Representatives: The Canadian B. K. Morton Company Limited, 49 Common St., Montreal, Que.

We wanted something original—this is what we got

"BOTH of these operations and half another — I'll show you later—completed in the time our old taps took to do one; that, I guess, is why we continue to use your Victor Collapsible Taps."

It was the often-heard story of time saved, of costs lowered, of all threads clean and smooth. And it was pleasant to hear.

Victor Tool Company
Waynesboro, Pa.
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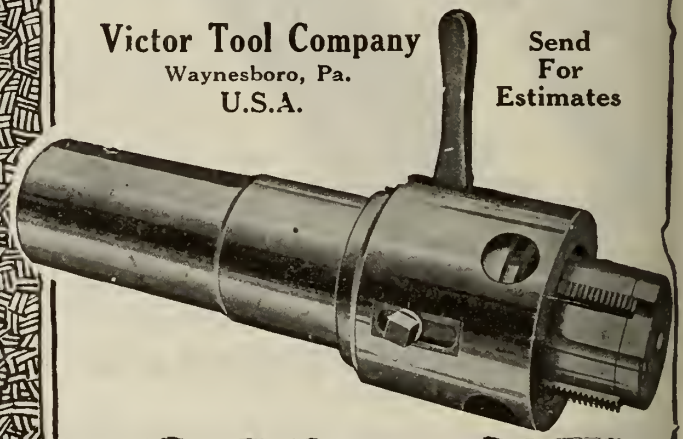

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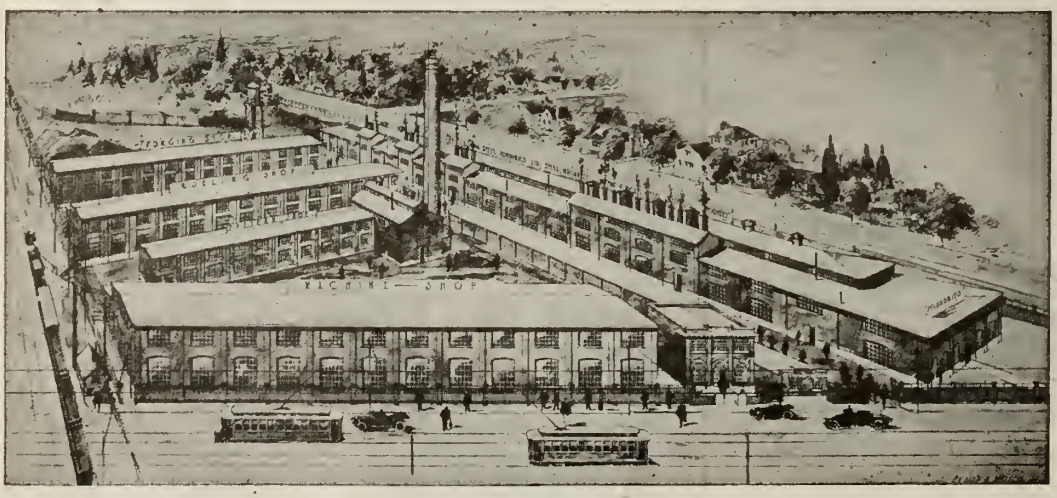
Steel, Chrome, Manganese and Nickel Steel Castings

Annealed and Unannealed

Cement Mill and Mining Machinery Castings, Stamp Mills, Crushing Plants, Excavating Outfits, Steel Car Wheels, Locomotive Driving Wheels and Frames, etc.



Machine-Moulded Gears

"HISCO" machine-moulded gears, while requiring no pattern, insure accuracy, dependability, quality, and the price is minus the cost of patterns—which in these days of high prices of lumber is something to be considered.

Specify "HISCO" Products

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FOUNDRIES & FORGINGS
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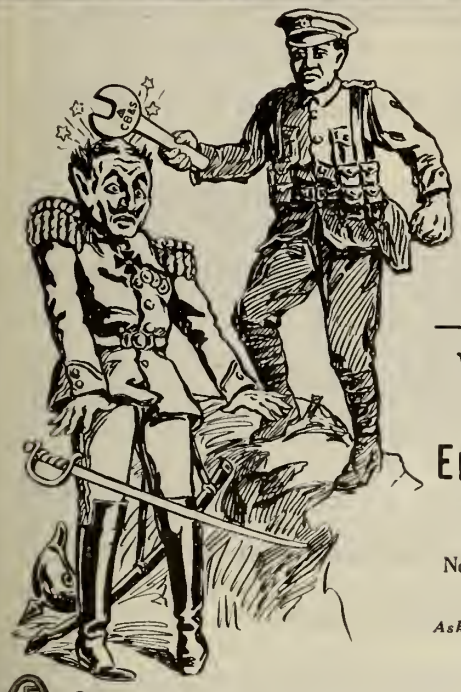

If a Bad "Nut" Gets Loose

—Use a Wrench

Endurance Brand

Never Wear Out

Ask Your Jobber

Canadian Billings & Spencer Plant
WELLAND, ONTARIO

Harris Heavy Pressure

The Babbitt Metal that's at the Front in Efficiency and Economy

Order a Box from our nearest Factory

Our Guarantee is Back of Every Pound of Babbitt Metal We Make

Manufactured by
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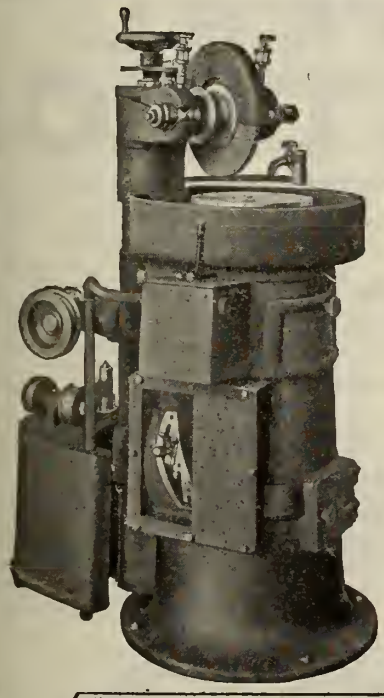

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Bristol 12-inch Rotary Precision Surface Grinder

Built for rapid production on grinding work.

It handles work either singly or in multiples within the capacity of the chuck and not thicker than 6-In., and grinds within quarter thousand in. of manufacturing accuracy.

And it is built to last.

It is provided with exceptionally long bearings throughout, especially in the back column. This prevents the wear, which is very slight, from affecting the accuracy of the grinder. The Back Column is made to swivel four degrees, which allows concave or convex grinding.

Bristol Rotary Surface Grinders are made in several types and sizes and are regularly equipped with 8-In., 12-in., and 16-in. magnetic chucks, either belt or motor driven and for dry or wet grinding.

Our Bulletin describes the many good points fully. Send us your name and address and we'll gladly mail you one.

Grinds within .0004 in. of absolute Accuracy

BRISTOL MACHINE TOOL CO.
SUCCESSORS TO C. G. GARRIGUS MACH. CO.
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CANADIAN MM CANADIAN MM

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Contractors For Complete Material Handling Plants

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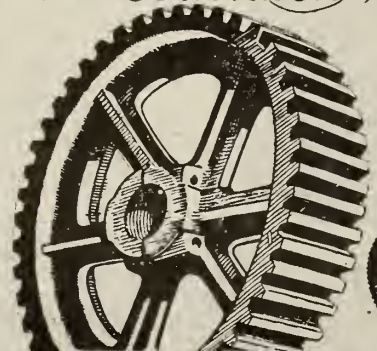

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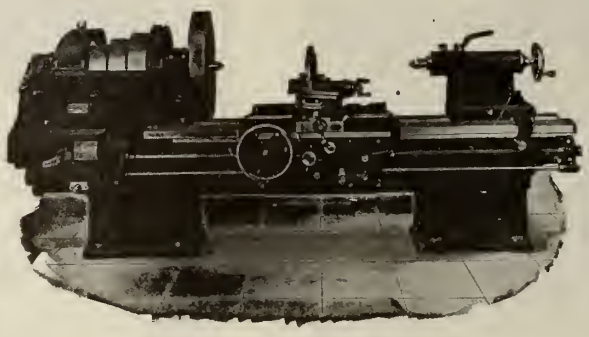

Specifications include 3-step cone, double brake gear, semi-quick change gear lathe, built on 10 ft. bed. This lathe also furnished with quick-change gears. Bed lengths available: 10, 12, 14, 16, 18 and 20 ft.

The Sydney Line comprises 15-inch, 17-inch, 19-inch, 25-inch, 27-inch, 30-inch and 36-inch lathes, which are adaptable to the finest tool room work or the heaviest duty shipyard or factory rapid production work.

Heavy Duty Engine Lathes

The Sidney Tool Company, Sidney, Ohio

Canadian Agents: Yeates Machinery & Supply Co., Montreal, Que.
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The Convenient Chuck

Your workmen know that Jacobs Chucks with the key and toothed sleeve give greater convenience and save time in changing drills, and that their grip is sure and saves in broken drills.

The sooner you use them the quicker they will commence to save your money.

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THE JACOBS MFG. CO. HARTFORD, CONNECTICUT, U.S.A.

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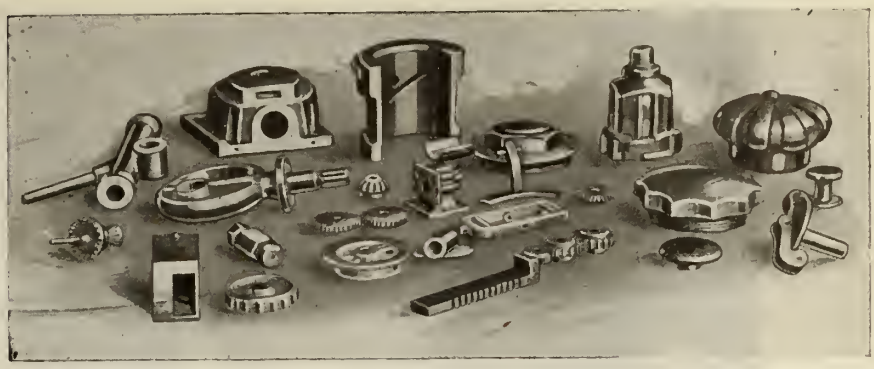

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Not only can we produce your small metal parts at a lower cost by the Die-Casting process, we can also assure you quick delivery of work. Remember Die-Cast parts require NO MACHINING. They come to you ready to assemble, and they are perfect in shape.

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Die-Casting Chat No. 7

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THE FISHER MOTOR CO., LIMITED
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McDougall Crank Shapers

16 and 20 inch

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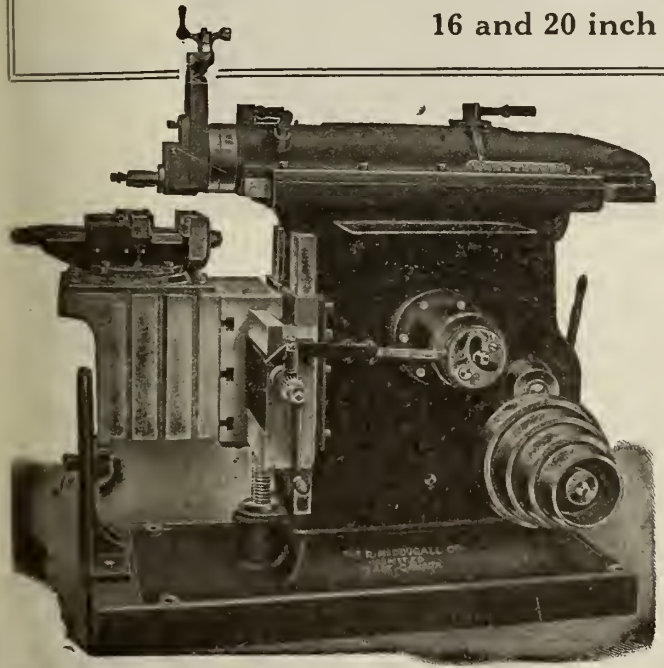

A Bigger Day's Work—

is made possible with McDougall Crank Shapers than with any ordinary Shaper because the McDougall is built on lines especially for this purpose. It embodies the most approved features of the most practical shapers on the market and care has been taken to exclude all non-essential parts.

The column is massive in construction, well braced and reinforced internally. Exceptional strength is also seen in the ram, which is semi-circular in form and of box type. It can be set forward by crank conveniently arranged.

Slides are square, accurately fitted and with broad bearing surfaces.

Have us explain the other salient points of this finely constructed machine. Full details on request.

THE R. McDOUGALL COMPANY, LIMITED, Galt, Ont., Can.

The Canadian Fairbanks-Morse Company, Limited
Sales Agents

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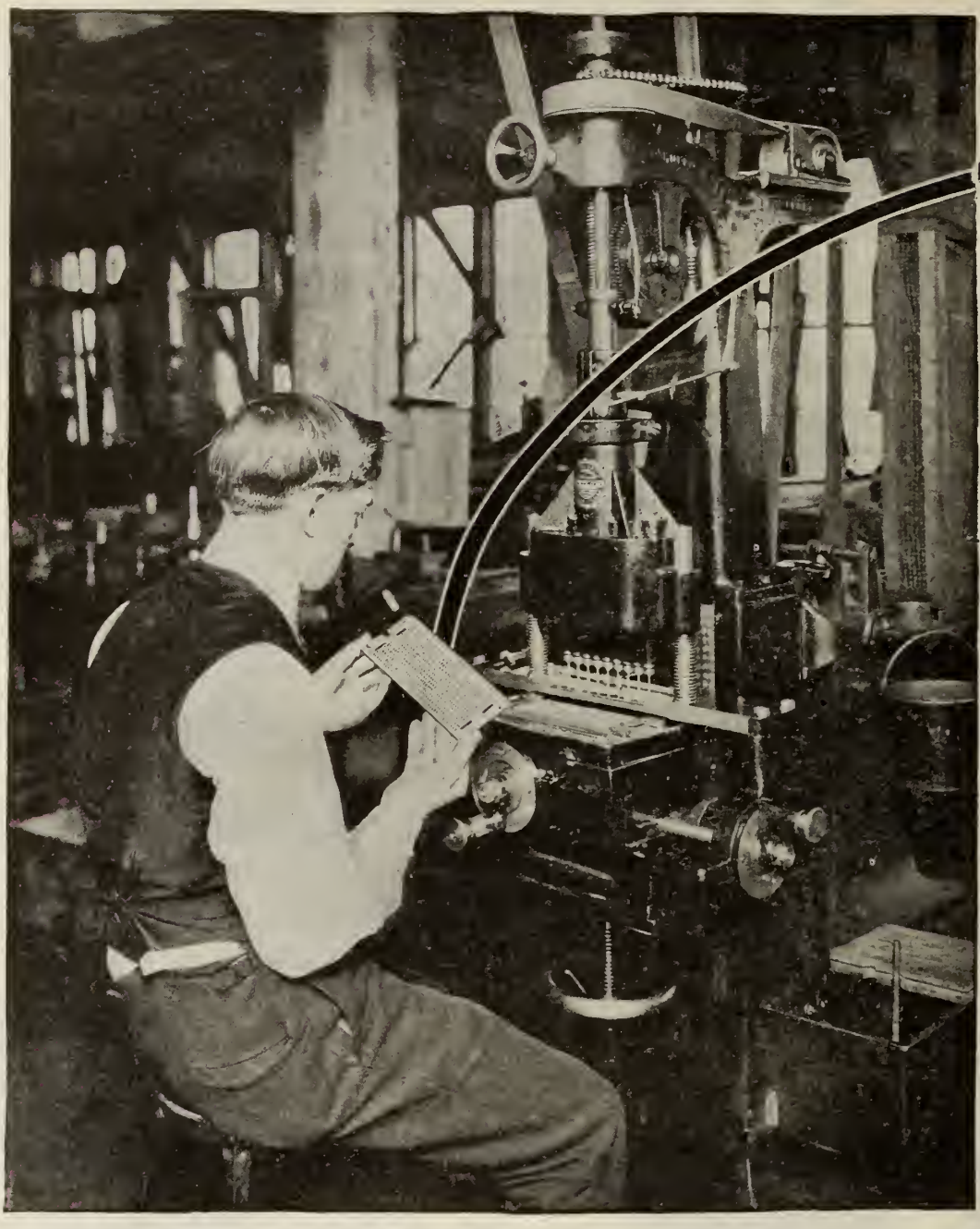

"I'll say that's going some!"

And it takes a Hoefer Driller to do it.

540 holes, 1/8 inch in diameter, through two steel plates, each 1/8 inch thick, in 21 minutes.

That 9-spindle Auxiliary Head does the trick.

No wonder the concern for which this record is made hands it to Hoefer for being one of the best machine tool investments that ever stepped in the plant.

They are proving it by purchasing a team-mate for the machine—one must like it.

Sales Engineers for Hoefer Heads: Chicago, 621 Washington Blvd.; New York, 30 Church St.; Philadelphia, Bourse Bldg.; Buffalo, Ellicott Square Bldg.; Cleveland, Citizens Bldg.; Pittsburgh, Empire Bldg.; Detroit, 602 Kerr Bldg.; Milwaukee, Majestic Bldg.; Dayton, John M. Howett, 12 W. Second St.; St. Louis, Colcord-Wright Machinery & Supply Co.; Minneapolis, F. E. Satterlee Co.; Montreal, Canadian Fairbanks-Morse Co. (head office).

HŒFER

Freeport,

Two of these plates while the clock ticks off 21 minutes—

and it used to take a day to drill four!

A specialty of Hoefer Drilling Equipment is turning the clock back—crowding more production into every day, hour, and minute.

Scores of manufacturers are scoring heavily on the right side of the ledger with Hoefer Tools.

How about you? Hoefer Service will help make every one of your working hours more productive.

Tell us what and how you are drilling. We'll figure what we can save by doing it the Hoefer way and present the facts without even the shred of a string attached to them.

M'F'G. Co.

Illinois

Sales Offices for Hoefer Drillers: Boston, Factory & Mill Supply Co.; Providence, Brownell Machinery Co.; New York, F. H. Niles & Co., Woolworth Bldg.: Philadelphia, Luster Machinery Co., 917 Arch Street; Syracuse, C. H. Wood Co.: Rochester and Buffalo, Ogden R. Adams; Pittsburgh, Motch & Merryweather Machinery Co.; Cleveland, Cleveland Tool & Supply Co.; Dayton, John M. Howett, 12 W. Second St.; Indianapolis, E. A. Kinsey Co.; Detroit, Cadillac Tool Co.; Chicago, Federal Machinery Sales Co., 12 N. Jefferson St.,; Milwaukee, Badger-Packard Machinery Co.; Minneapolis, F. E. Satterlee Co.; St. Louis, Colcord-Wright Machinery & Supply Co.; Atlanta, Walraven Co.; Birmingham, Young & Vann Co.; New Orleans, Oliver H. Van Horn Co.; Seattle, Portland, Ore., San Francisco, Los Angeles, Eccles & Smith Co.; Montreal, Canadian Fairbanks-Morse Company (head office), for all Canada.

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You will find NORTON wheels used for every conceivable purpose and service. Take, for example, this illustration—here NORTON wheels are used to finish grind the flange-ways in manganese steel tongue switches for railways.

It is necessary to use a special hand grinder and this is equipped with a 20 P ALUNDUM wheel, 10 x ¾ in., operated at 1800 r.p.m.

Whether you are grinding tongue switches or lathe tools—NORTON wheels will answer every requirement. Let NORTON wheels be specified on your next order—you will find they pay.

Norton Company

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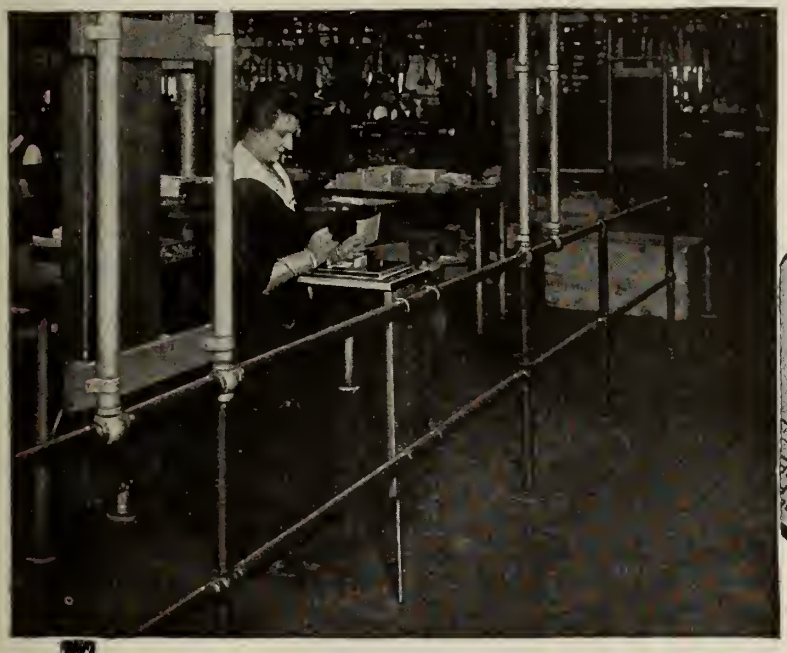

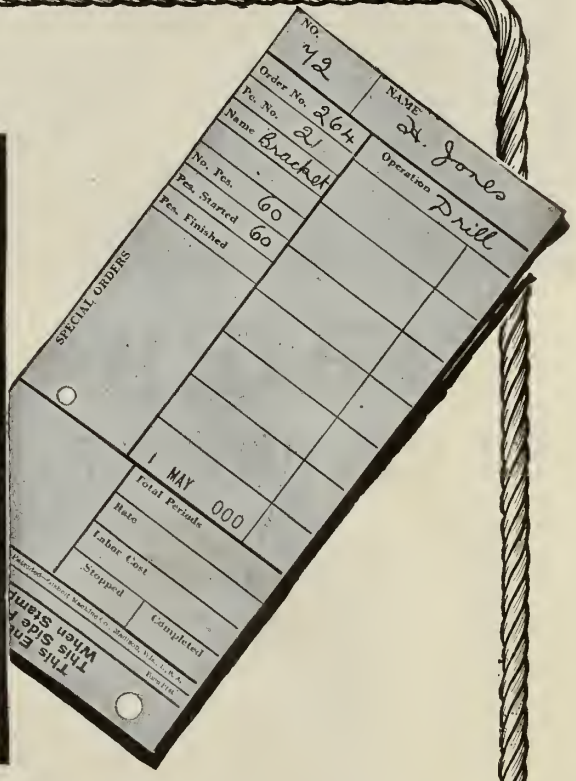

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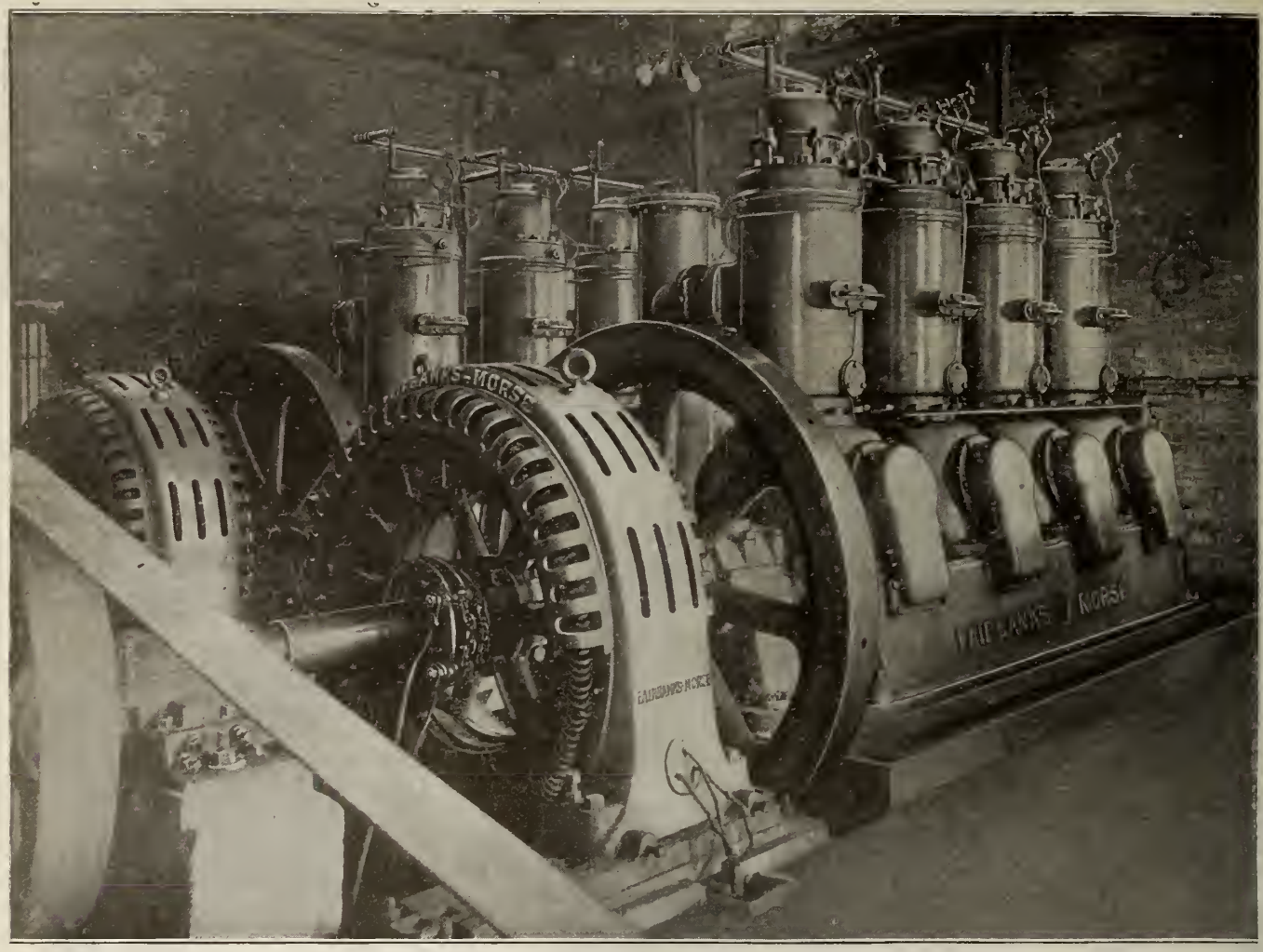

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Our smallest plant is a 1½ H.P. 9 K.W. Automatic Suburban Lighting Outfit.

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WINDSOR WINNIPEG SASKATOON CALGARY
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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

Vol. XIII, No. 20. May 13, 1920

Keeping Tab on Samples in Agricultural Plant

When You Have Some 20,000 Parts to Care for, System Becomes an Absolute Necessity—Here is How the International Harvester Company Handle Their Sample Room

By J. H. Moore

In previous article dealing with the routine adopted by the International Harvester Co., of Hamilton, Canada, we have quite frequently referred to the fact that this concern keep actual samples of every piece going through their plant.

These samples are really working templets, for in the event of any discussion arising, the sample is the proof as to who is correct. To facilitate the handling, the company has set aside a separate room for the storing of these samples. As there is in the neighborhood of 20,000 samples, some system of storing is essential.

These samples are called upon for reference purposes at all times, and are often scattered all over the plant instead of resting in their proper place in the sample room. From these few remarks readers can readily see that whatever system is adopted has to be accurate, yet easy to keep track of, for no system can be a success that does not immediately show where every sample is located.

The system as now arranged is a one-man proposition, with an assistant helping him a few hours every week. As we proceed into the plan we shall readily see why this assistant is required.

Entering the Sample

On a sample being issued, it first passes through the experimental and planning departments. The experimental department prints out a card as shown at Fig. 1. The price is next taken to the sample room where it is passed over to the attendant in charge, who signs the card. This frees the experimental department from further responsibility. The attendant makes out a similar card for his own file records, and places the same in its proper drawer. These drawers are arranged by symbol letters, certain letters meaning a mower, cultivator, or drill, as the case may be.

Having placed the card in its proper place, the sample is hung on its proper rack. The general appearance of a portion of one of these racks is shown at Fig. 2. The racks are also arranged according to symbol numbers, so that samples for each type of machine are placed together as much as possible. This is not always convenient, as some samples are used on various machines.

On the card shown at Fig. 1 is marked the rack on which the sample is placed, and in what location, so that all the attendant has to do, is look up his card, which perhaps says Rack 10, row 7, and on going to this location the sample is easily obtained.

Every sample has a tag attached to it stating its proper number, and whenever possible the number is also stamped directly on the sample for double protection. In the case of a spring it is impossible to stamp such an article, so they do the next best thing, namely to wind a piece of wire securely around the spring, attaching a washer to the other end of this wire. On the washer is stamped the symbol number of the spring, so that in this way they overcome the difficulty. The washer comes in handy for storing purposes, for it can be placed over a nail on the storage rack, in this way providing an easy method of hanging. In addition to these symbol tags, the rack itself has all the various symbol numbers painted in at the head of each nail or hook. Every sample has the word sample marked or stamped on it, as well as the number, so that there can be no possible mistake as to its being a bona fide sample.

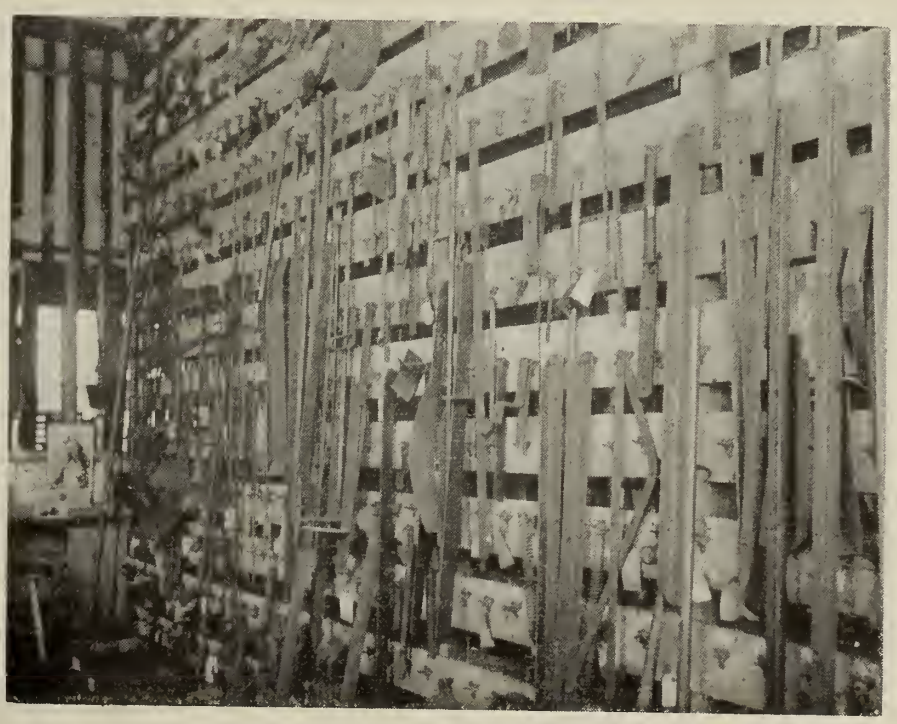


FIG. 2—A VIEW SHOWING PORTION OF ONE OF THE RACKS ON WHICH SAMPLES ARE HUNG.

An Actual Example

Now that we understand how the samples are stored, let us suppose that we are standing behind the attendant and watching his every movement. A bell rings and he goes forward to his wicket and receives from the party there a slip as shown at Fig. 3.

As can be noticed, this slip not only requests a certain sample, but gives the

date on which the request is made, the department to which the sample is going, and the foreman's name who authorized the getting of the sample.

In this way, the attendant has a definite record of the price he is about to hand out. He goes to his files, locates the position of sample, goes to the rack and secures it, all in about a minute. On handing out the sample, he takes this slip and places it in a special pigeon-holed shelf, which is arranged both alphabetically, and daily. That is, the racks are marked A, B, C, etc., also Monday, Tuesday, Wednesday and so on.

No sample is allowed to be out more than a week without a new slip being issued. This arrangement guards against careless workmen not returning samples promptly. On sample being returned, the worker receives his slip back, and promptly destroys it.

To make the system clearer, we will take our example over again from the point where the sample was requested. On going to the rack, the attendant finds that the sample is gone. On discovering this fact, he can, as a general rule, remember who receives it, and going to the proper pigeon hole produces the slip as proof. He instructs the workman where sample is located, and off he goes to find if he can have it.

Suppose it is in the tool room. On going there he requests the loan of the sample, but has first to give the workman who has the sample a slip to say he received it from him. Nothing is left to chance. A[illegible]sibility is placed where it belongs, and track is kept every moment on the movement of the sample.

Works Form 31

ORDER FOR SAMPLES

Date MAY 18th 1920 Deliver to bearer

FOR TOOL ROOM Sample for

Cat. No. FA10161

Name CAMPBELL

To be returned By May 25th 1920

Foden Masterson FOREMAN

Samples will be furnished to foremen or individuals authorized by superintendent to sign factory orders and must be returned on date shown on this order.

FIG. 3—SHOWING THE FORM OF ORDER SLIP USED AS REQUEST FOR SAMPLES.

Samples Overdue

Now comes the need of the assistant for a few hours. At the end of each week, there is usually an assortment of slips in the pigeon-holed shelf, of samples which have not been returned within the limit of time allowed. Leaving the assistant in charge of the store room, the attendant goes forth armed with these slips as evidence, and traces the overdue samples. If the samples are desired for a further length of time, a new slip is made out with the changed date. Should the owner of the slip admit that he has lost track of the sample, the experimental department is notified, when they send out a tracer to investigate the situation.

A sample is never considered lost before a three-month limit, but in extreme cases a sample does mysteriously disappear, which proves that no matter how well a system may be developed, certain allowances must be made for unforeseen circumstances. After three months, a new sample is issued if the search has proved to be unsuccessful.

We would not infer from the above that many samples are lost, for such would be a reflection on this splendid system, but we do want to be fair and point out that leaks will happen even in the best of conducted systems.

To any concern handling a large number of parts, we can safely recommend the adoption of this system, for the writer personally has seen this arrangement working very smoothly under the most adverse of conditions.

F14043 May 18th 1920

Name:- Hinge Brace Left-finished Sample

A

Rack 10

Row 7

See Memo # 4080

FIG. 1—A SAMPLE CARD AS KEPT IN THE ATTENDANT'S FILE.

The production of molybdenite in the Province of Quebec for 1918 amounted to 342,296 lbs., which was valued at 383,252 dollars. This output is an increase of 51 per cent. in quantity and 61 per cent. in value, as compared with the previous year.

COTTON ROPES FOR BELTS

According to Mr. J. Melville Allison, an English engineer, who spoke before the Montreal branch of the Canadian Engineering Institute, British manufacturers use cotton rope for belting purpose to a greater extent than we do on this side of the water.

His address was illustrated by special slides showing various types of cotton rope used for power transmission and the methods of using it.

Mr. Allison said that in England they had paid much more attention to rope draw for power transmission than on this continent. Cotton, he said, had superseded manila and any other material for rope drive in this connection. While some attention had been given to this method of power transmission on this side, manufacturers had not kept pace with the work in England, where cotton rope for drives was largely in use, some installations having been operated for twenty years. Manila rope, he said, was cheaper than cotton, but the latter would carry a third more power, with a lifetime in the ratio of five to one. while the cotton rope was much less affected by atmospheric conditions.

Splicing cotton ropes for power purposes, said Mr. Allison, was so important a feature of this work that English experts in splicing had been sent to all parts of the world. In textile plants the cotton rope drive had been found superior to the leather belting, as less cumbersome, cheaper, and that it let in much more light than the heavy leather belts.

DE-MAGNETIZING A WATCH

In working around an old-type bipolar generator having an extremely large magnetic leakage, a writer in an American contemporary states that his stop-watch become magnetized so that when he snapped the watch to start, the resetting lever dragged the cam to its point before releasing, thus moving the hand from 0 to 30 sec. in a small fraction of a second, before the wheel engaged with the watch mechanism. To de-magnetize it, he took a coil about 5 in. in diameter, consisting of 600 turns of No. 30 B. and S. gauge magnet wire, and connected it to 110-volt 60-cycle circuit. Then tying the watch to a piece of string and twisting it so that it would spin around, he passed it through the coil with the watch spinning rapidly. He adds that there was not a trace of permanent magnetism left in the watch after performing this operation once.

FRANCE

The Societe des Charbons L.T.H. is about to construct at Lariche, near Tours, factory for the production of coal from lignite and peat by the Teissier process. Touraine possesses a certain number of peat deposits, of which the most important is that of Saint-Paterns, on the line from Tours to Le Mans. This means that the new enterprise will consequently be able to obtain its raw material almost at the door of the factory.

Talk on Modern Methods of Heat-Treatment

This Paper, Which Was Presented Before the Philadelphia Chapter of the American Steel Treaters' Society, Describes in a Practical Manner Different Methods Adopted in the Art of Heat Treatment

By JOHN E. HALBING* and FRANK SHEPHERD†

IN the designing and manufacturing of machines and tools to-day, heat treatment has become such an important factor that without it engineers would be hopelessly lost, manufacturing or machine departments could not hope to meet the demands for production and the finished product in nine cases out of ten would be of very little commercial value.

The age demands that engineers design lighter and sometimes more complicated machines and tools which must perform more efficiently than former ones; manufacturing departments must be speeded up so as to increase production; it demands that the steel manufacturers experiment with and produce new steels that are capable of yielding the properties demanded by the engineers and manufacturing departments, and then, while we might go on indefinitely naming the demands made upon everybody, it is up to the heat treater to see to it that all the engineer's trouble in designing the new machine, all the efforts which the machine department had put forth in making new tools, fixtures, etc., and all the endless trials which everybody, including the steel maker, had to contend with up to the point where the machine parts were ready for heat-treating, not counting the costliness of all these things are not all wasted energy and money.

Without a doubt the national crisis through which we have just passed, with its demands for aeroplanes, trucks, better guns and shells and more of them, has been more instrumental in gaining for heat-treating the industrial prominence which it holds to-day than any other thing.

In the manufacture of mining machinery, as in the automobile or munition industries and countless others, where parts are made which later in service are subjected to severe stresses, the part which heat-treatment plays is an all important one.

Some hammer drills, for instance, weighing in all only 100 lbs., striking 1,500 blows per minute with a hammer weighing 8 lbs., upon a rock drill steel with a 1⅜ inch bit, which drills eleven inches per minute in hard granite, are subjected to very severe impact and vibratory as well as torsional stresses.

Anyone, even those not familiar with mining machinery, can readily imagine what would happen to such machine parts if they were not made from the correct material and properly heat-treated.

But all of us are familiar with the reasons why machine parts are heat-treated and it appeared to me that what we were more interested in is "How the heat-treatment is applied."

First of all, we must have the parts or the material from which they are made to heat treat. These may be in the form of forgings or castings, they may have been machined from bar stock, or the bars as received from the mill may be sent you for heat treatment, after which the parts may be finished from the heat-treated bar.

There should be some method of inspection employed whereby all the castings and bar stock received and the forgings made could be thoroughly inspected for physical properties, chemical composition, and defects. The labor wasted in finishing parts made from either the wrong or defective material, which would have been cast aside if it were inspected, usually more than pays for the cost of the inspection.

Then, too, there should be some method of marking the steel for discrimination between the various grades. For nearly all purposes stamping the bar with a steel number works out most effectively. This number can be transferred through the various stages of the machining on to the finished part, so that at any time without consulting job records one can readily see what material the part was made from. This also avoids controversies arising in the event of parts being returned after having seen service.

The selection of a material for a machine part should be governed by the size and shape of the pieces, the requirements to be met in service, whether the heat treatment necessary to produce the physical properties in the ultimate part with the steel selected could be practically applied on account of the shape and size of the part and whether the ultimate cost of the part would be prohibitive.

For certain parts there may be several different kinds of steel that would serve equally as well if given a suitable heat-treatment. For instance, a part fairly uniform and generous of cross-section which must have a hard wearing surface and which would meet with only slight stresses in service could be made from tool steel or any straight carbon or alloy case-hardening steel and in this case the question of the cost of the steel and the heat treatment could decide the selection.

There are other parts, however, which must resist severe shocks or strains in service and at the same time possess great resistance to abrasion for which, possibly, only one grade and analysis of steel would satisfactorily meet the requirements.

Once the steel has been selected from which certain machine parts are to be made it is then up to the manufacturing department to produce those parts on a commercial basis. Very often, particularly in broaching and threading operations, the steel will tear and mush up, due to being too soft, leaving a rough surface and in some cases breaking expensive broaches.

By proper heat-treatment such parts

FIG. 2.

*Asst. Supt. Heat Treating, Ingersoll-Rand Co.

†Asst. Metallurgist, Ingersoll-Rand Co.

FIG. 3.

can be rendered suitable for those operations.

A .10-20 carbon steel quenched in fresh water from 1625 degrees F. and a .12-.22 carbon chrome vanadium quenched in oil from the same temperature in our experience, possess the requisite threading and broaching properties. Through such heat treatment the brinell on .101.20 carbon is raised from 145 to 200 and on the low carbon chrome vanadium from 185 to 205.

A 1.0 per cent. carbon steel which tore badly in broaching and which brinelled 165, when heated to 1420 degrees F. and cooled in atmosphere of shop tested 200 and broached perfectly.

Some heat-treatment should be applied to all forgings, whether they are machined or not, such as an annealing above the critical or a quench from above the critical and a draw to somewhere under the critical (the exact method of heating and cooling, of course, would depend upon the grade of steel). In the case of forgings which, after machinery need no hardening treatment, a treatment necessary to bring out the requisite physical properties in the ultimate part could be applied to the rough forging unless it were of considerable size when it has been found good practice to thoroughly anneal in the rough and apply the finish or "full" heat treatment after the excess material has been machined off. In the case of those forgings which after machining require hardening, the heat treating of them refines them (or normalizes them as some like to call it) to the extent that the machining operations can be speeded up and the parts when they are hardened and less susceptible to distortion.

The distortion in hardening of parts machined from bar stock can be considerably lessened by heat-treatment after they have been partly machined.

Heat-treatment takes in numerous methods of hardening, annealing, tempering, toughening, normalizing, in fact, anything in the nature of an operation where temperature is relied upon to produce certain physical changes in the structure of steel.

Hardening, we know, consists of heating a piece of steel up to a point in or beyond its critical or transformation range and cooling it either slowly or rapidly as the case may require in oil, brine, or fresh water or as in the case of high speed steel, possibly in air. (The word "Hardening" when used throughout this paper is used in terms of shop language and means the rendering of steel in a condition, or with a hardness that resists the action of a file).

The manner in which a piece is heated, the temperature it is heated to, and the way in which it is quenched depend upon the kind of steel the piece is made from, the size and shape of the piece and the properties required in the finished article.

To the average heat-treater there are three distinct kinds of steels: Tool steels, case-hardening steels and the so-called oil-tempering steels.

The tool steels are those which, due to their chemical composition, possess the innate properties for hardening when simply heated to and quenched from in or above the critical range. In this class are those, such as the straight carbons, above .60% and those with the same or a little lower carbon content containing percentage of chromium, vanadium, tungsten or molybdenum.

The case hardening steels are those which, as their name implies, harden only to the depth of a case with which the exterior is carburized. These steels contain, initially, less than .30% carbon and for some purposes appreciable amounts of alloying elements, such as chromium, nickel, vanadium, tungsten and molybdenum.

The oil tempering class takes in the steels of medium carbon content (between .30% and .60%) with or without various proportions of alloys. They are used for purposes where great elasticity combined with ductility are essential.

The Methods of Application

There are many methods of applying heat-treatment. In the modern plant where "heat-treatment" is looked upon in the light of its present importance the methods of handling for heating, quenching, etc., are usually worked out to meet the particular plant conditions.

As the success of a heat-treating plant depends largely on the uniformity of its product and the obtaining of a uniformly heat-treated product is controlled largely by the tools with which the plant is equipped and the ability of those designated to use those tools, serious consideration should be given to the selection of equipment and the type

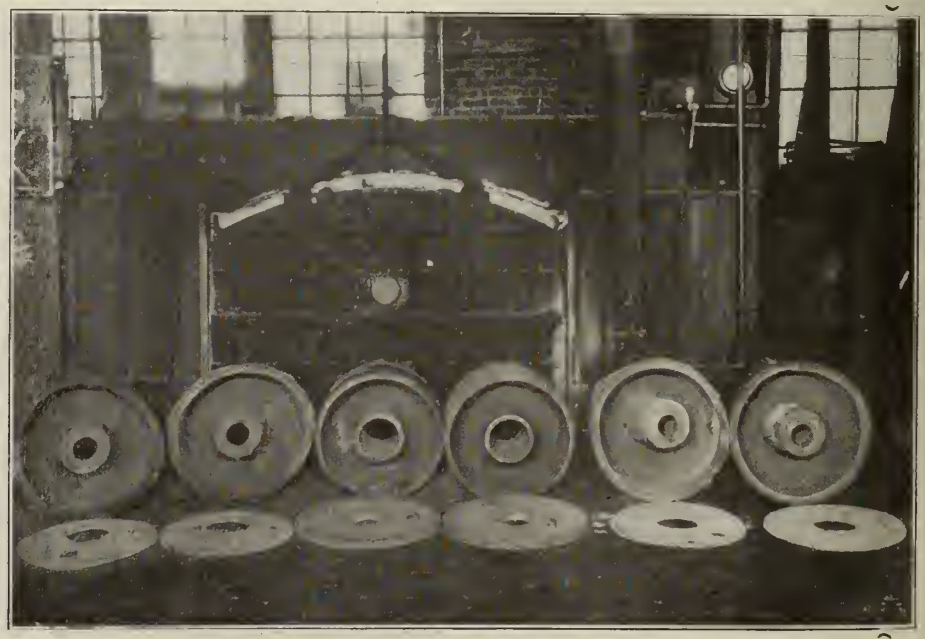


FIG. 4

of human element employed to operate it.

While the tools of a heat-treatment plant, such as furnaces, the quenching baths, the machinery necessary for the operation of each, the pyrometers, pots, boxes, etc., are of inestimable value, too much emphasis cannot be laid upon the factor of the human element in heat-treating operation, or the importance of the type and intelligence of the man on the job.

Even with the very latest improved systems of pyrometry and temperature control, automatic and continuous furnaces and quenching baths, the man on the job really decides the issue. He determines how the charge is to be placed in the furnace, regulates the flow of gases that make either for the neutral (or perfect) reducing or oxidizing atmosphere in the furnace, whether the work is heated at the temperature as indicated or recorded by the pyrometer, it rests with him to quench the work in the proper manner and then to see that the proper time and temperature are administered in tempering; in fact every heat-treated article has the ear-marks of the human element from every operation upon it. Further, while the articles may be tried for hardness with a file or tested with the Scleroscope, or possibly the Brinell, if the indentation is not objectionable, the damage done by improper heat-treating or the lack of proper heat treatment is not detected until after the piece has been placed in service. Failures in service are annoying to the customer as well as to the manufacturer and we are all looking forward to the apparatus to be designed which commercially will detect faulty heat-treatment as well as defects in the steel without destroying the part. The microscope will reveal these things to the experienced eye, but, as we all know, it invariably means cutting the part in many pieces, and at the best is a long-winded and tedious job.

The lack of means with which to test all parts for the purpose of detecting defects naturally compels those concerned to equip the heat-treating department with those tools which eliminate the personal equation as much as possible and then furnish those supervising the work with a type of human element intelligent enough to operate those tools.

In the hardening of tools the principle applied is the same, no matter where or under what conditions. They must be heated and they must be quenched. In many cases the way in which the work is to be heated is somewhat an optional one. At one place the heat-treater may prefer the use of a semi-muffle furnace of a lead bath, while another may prefer a salt bath or a electric furnace. Excepting a certain method for hardening very particular parts, which we will discuss later on, in my opinion the lead or slightly case-hardening solution bath is to be preferred for heating for quenching. By its use the human element is practically eliminated from the time the work is placed in until it is taken from the bath for quenching, providing some reliable means of determining the temperature is employed. With the use of the open fired or semi-muffle furnace the work is at the mercy of the "man on the job," from the time it is placed in until it is taken out, even though the most accurate temperature indicating devices are employed.

We will suppose that the time temperature curve as shown on a recorder connected to an open fired furnace during a heat was perfect. It is no indication that all conditions in the furnace were perfect. The operator could at any time during the heat use more air blast than is necessary to perfect combustion, producing what we know as an oxidizing atmosphere in the furnace and by so doing oxidize the surface of the work being heated to the extent that the pieces were finished they would be practically worthless when taken from the quench.

On the other hand, taking an extreme case, more oil than is necessary to perfect combustion could be used, producing what is termed a reducing atmosphere to the extent that carbon would be deposited in spots upon the surface of work, rendering those spots hard and brittle when quenched and if the work were of a character having very sharp teeth, corners or projections it could lead to the breaking or flaking off of those sections when quenched. This condition, however, is not as frequently met with as the former, for when the atmosphere is reducing, a black smoke is seen and usually would be corrected by the operator, if he were at all on the job.

The neutral atmosphere, the ideal condition, is obtained when the combustion is perfect. To the experienced heat-treater this is characterized by a clean and soft heat. (By "The Neutral Atmosphere" I mean the one so called by the practical man, but which really is slightly reducing.)

Looking at is from another angle, it is entirely up to the man who observes each individual heat, or should be, to determine the speed with which the work should be heated to the quenching temperature, as he only is in a position to determine whether the work is lagging too far behind the furnace. If the furnace is driven too fast, uneven heating is the result, with the tendency to buckle any long pieces even though the pieces are turned over frequently. Unless governed by thermo-static control (and this is not practical as yet with oil fired furnaces) it is practically impossible for the average heat-treater to operate his furnace so as to produce the same heating curve on every heat.

Then, too, there are other factors over which the operator has no control such as burner trouble, motor breakdowns, pump trouble or the quality of fuel oil used which cause any amount of trouble on open furnace work. For instance: If a heat had been brought up to the required temperature or very near it and to all appearances was perfect in every respect, and the oil became sluggish or a piece of dirt clogged the burner or the fan or possibly the pump stopped, the heat would immediately drop and the tendency on the part of the average man after the trouble was adjusted, on account of having lost time in bringing the work up to the required temperature, would be to bring the heat back to the temperature attained before the trouble arose in the shortest possible time, and would invariably oxidize or distort the work beyond hope of restoration.

These conditions have no effect upon the work heated in a good lead or molten solution as the products of combustion do not come in contact with the work, changes in temperature of work are affected very slowly through the pot and bath, and unless too many pieces are

FIG. 5A.

placed in the bath at one time for heating there is little chance for non-uniform results arising from the heating operation.

Care should be taken, though, to prevent baths from oxidizing the work. In the case of cyanide solution enough pure sodium cyanide should be added from time to time to keep the properties of the bath up to slightly case-hardening and in the case of a lead bath either a coating of wood charcoal or about ½ in. of cyanide solution or potassium chloride and sodium chloride should be kept on surface to prevent oxidation of the lead which would in turn oxidize the work being heated. A coating of cyanide or potassium chloride and sodium chloride solution over surface of lead bath renders work very clean when quenched in water or brine. When quenching in oil it has been found best practice to use the coating of charcoal.

In the hardening of tools such as drills, taps, reamers, broaches, threading dies, etc., from a lead or solution bath or a muffle-furnace it is good practice to obtain a small disc from the bar from which the tools were made, and before proceeding with the hardening of the finished tools, harden the disc in the same manner in which it has been decided to harden the tool. By examining the fracture of the disc a good idea can be obtained as to what the hardening temperatures for the tools should be.

Advice on Production Work

On production work when the machine parts are put through in lots it is always advisable to first harden and break one part and by its appearance regulate the hardening of the balance of the lot.

I know that some of you are thinking right now; what's the use of holding up the job and going to the expense of breaking a machine part in checking up the hardening in such a manner when it should not be necessary if the pyrometers are checked in the right manner and the bath is held constant and the steel is of a definite character, it having been thoroughly inspected, etc. But to this I would answer that even though steel is inspected thoroughly and the quality and temperature of the quenching medium and the accuracy of the pyrometer system is checked systematically, there are variables in the hardening operation which must be allowed for and there is no better way that we know of to ascertain the exact results to be expected in the lot than by first treating and breaking one part. We usually call this piece our dummy.

FIG. 5B.

Very good results have been obtained with tools made from a 1.0% straight carbon steel when heat-treated as follows:

For taps and reamers.

Operation 1. Rough machine from bar stock.

Operation 2. Heat thoroughly, preferably in a semi-muffle furnace to 1425 deg. F. and leave cool in furnace.

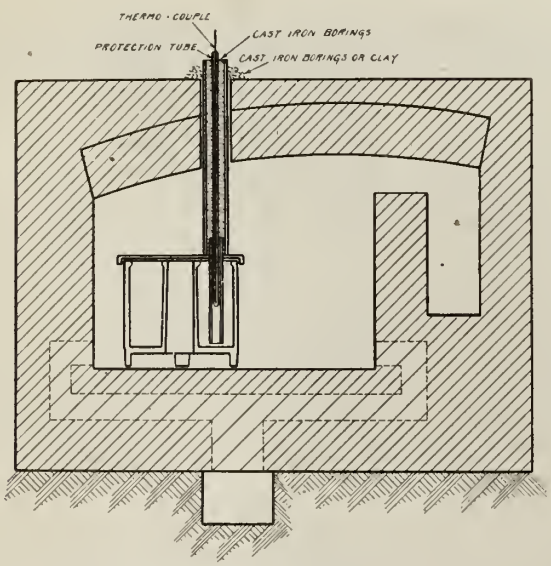
Operation 3. Finish machine.

Operation 4. Preheat in a lead bath to between 1150 and 1200 deg. F.

Operation 5. Transfer to another lead bath heated to around 1400 to 1420 deg. F. and heat thoroughly to 1400 to 1420 deg. F., then quench vertically, tang downward, partly in salt brine at about 70 deg. F., finishing the cooling in oil.

Operation 6. Temper in oil to 425 deg. F.

The second operation, namely, the annealing after rough machining has been found of great benefit in lessening the



METHOD OF PLACING THERMO-COUPLE IN LARGE CARBURIZING POTS.

FIG. 6

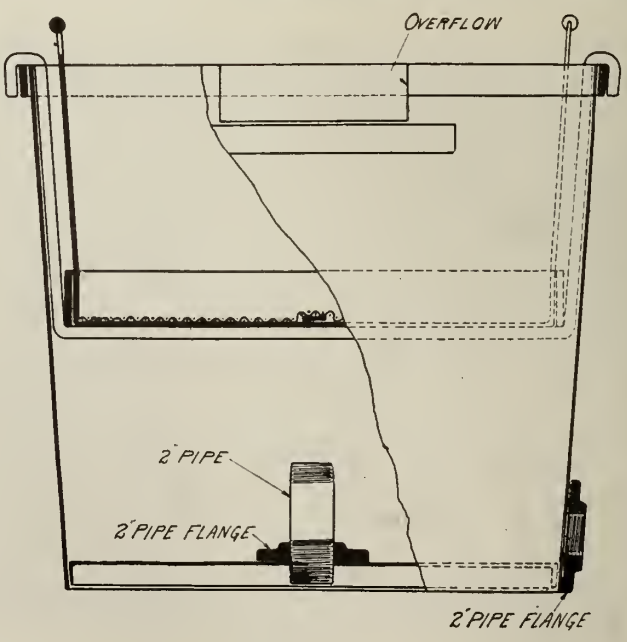


FIG. 7.

distortion in hardening For many tools this way of annealing has proven, in our experience, to be superior to pack-annealing. Operation 4 could be performed in a semi-muffle if care is taken to see that furnace has been treated thoroughly to the specified temperature before the tools are placed in for preheating and that the tools are not laid too near the edge of the tile or over a joint or crack in furnace where parts of tools perchance might be subjected to a flame or intense heat. The latter precaution cannot be over-emphasized, for it has been found that a large proportion of the "running off" of the corners of tools in hardening were the results of "fire cracks."

Good results have been obtained with broaches up to 48 in. long made from 10% straight carbon steel by first machining them from bar stock and hardening as follows:

Preheat in a semi-muffle furnace at 1200 deg. F. turning broaches over in furnace frequently to insure uniform heating. When thoroughly heated transfer to a lead bath covered with cyanide of salt solution and heat to 1400 to 1420 deg. F. and quench, vertically, almost entirely in salt brine finishing the cooling in oil. These are not tempered. By wrapping the undercut sections between the teeth of broaches with asbestos cord the effect of quenching is retarded to the extent that they are left somewhat soft in those sections, thereby facilitating the straightening of them without much fear of breaking in the event of their distorting in the hardening operation.

Gauges made from tool steel are hardened by several methods. Those with plain surfaces, where it is possible to grind after hardening are usually finish machined, less grinding, from the bar, then hardened by heating slowly to 1400 to 1440 deg. F. (the temperature depending upon the size of gauge), quenching entirely in salt brine and drawing in oil to 400 deg. F.

The hardening of thread gauges is a somewhat different problem. Because of the inability to grind them they are finished to size before hardening and must be held to shape in hardening Many of these gauges are finished to as close as .0025 in. and must hold those sizes through the hardening. If they shrink in hardening they are doomed for the scrap pile. If they expand there is a chance of using them by lapping; but as lapping at best is a long drawn out, tiresome and expensive operation, the hardener is given no room for excuses.

A practice followed for a long time with good results consists in:

First. Rough machining from bar stock.

Second. Heating thoroughly in semi-muffle furnace to 1425 deg. F., leaving cool in furnace.

Third. Finish machine.

Fourth. Packing all over in carburizing compound and heating at 1425 deg. F. for 3 to 4 hours after heated through, leaving cool in pot.

Fifth. Unpacking then repacking (with the gauge in a position opposite to the position it was packed in for the previous operation), heating at 1425 degrees F., for 3 or 4 hours after heated through and cooling directly from pot entirely in a good mineral oil.

Reference will be made later on to another method of hardening whereby the distortion of parts is minimized.

The case-hardening of steel is, as mentioned previously, a process of hardening whereby articles of low carbon steel are given a hardness in the form of a case on the surface. This process should not be confused with the hardness often obtained on articles of tool steel which very closely resemble case-hardened alloy steel.

A case hardening steel, being of low carbon content is devoid of the qualities possessed by a tool steel, of hardening when simply heated and quenched, and must necessarily have those properties added to it. These properties are added in the form of carbon to the exterior and the particular operation is called "carburizing."

There are three distinct methods of carburizing, namely, the "dry" or "pack-carburizing," "gas-carburizing," and the "liquid-bath" methods, each of which has its own particular advantages.

The first step to take in case-hardening is to determine the depth of case with which the article must be carburized and hardened to function properly in service. This should be decided jointly by the engineers who were responsible for the designing of the piece and those responsible for the selection of the steel from which the part was made. This done, the method whereby the best results are obtained, together with the least cost, should decide which of the three methods of carburizing is to be employed.

The "dry" or "pack-carburizing" method consists of packing the articles to be carburized in pots or boxes with a solid carbonaceous compound and heating to a temperature above the upper critical long enough to obtain the depth of case desired, after which the articles are either left cool in the boxes or quenched directly from the boxes in oil or water. The carburizer, the pots or boxes and the furnaces used in the application of this method are of equal importance and serious consideration should be given to each. Of all heat treating operations, the carburizing surely is the one where "uniformity" should be the slogan, and, while the other factors making for the complete operation are important, the carburizing compound and its selection is of paramount importance.

The selection of a carburizer should be made after first conducting a thorough test on various brands. Tests on carburizers if conducted in the proper manner are somewhat elaborate, they need the very closest supervision, and are expensive to say the least, and once having made a selection, with which the satisfactory results were obtained, the heat treater should not be bothered about conducting tests annually to prove that the fellow who offers a carburizer for less monely, with the story that it is more efficient than all others, is a frost, but should be concerned only about obtaining the same material from time to time that was selected. What is needed most is a uniform carburizer. There are good commercial compounds on the market to-day from which the heat treater should have no trouble making a selection. In my opinion it is to be expected that the carburizer purchased from a reliable manufacturer handling thousands of tons yearly would be of a more uniform character than one's own make. The manufacturer is fully equipped for the preparation of it and handles the raw material in a much larger bulk than the average individual could afford to. Some men making up their own compound say, yes, but look what I'm saving. That's a question everyone must answer for himself.

The most expensive compound is not always the best and I know that we are all after economy of operation, but a cheap carburizer is often false economy.

(To be Continued in Our Next Issue.)

AN OPPORTUNITY WORTH WHILE

In this week's issue of CANADIAN MACHINERY is an article on "Some of the Methods of Heat Treatment." This article is one of many that we hope to present on this important subject, for as time goes on the value of proper heat treatment is becoming more and more recognized.

We suggest that readers desiring to follow up all important developments in the heat treatment field get acquainted with Toronto Chapter of the American Steel Treaters' Society.

This body of men meets once a month and prominent speakers will present papers and lectures from time to time. Experience meetings will also be held; in fact it will be a real get-together club. You need not reside in Toronto to become a member, for if you so desire reports of all meetings will be forwarded you should you be unable to attend personally.

Investigate this for it will more than repay you, the price of membership being far from prohibitive. Write Mr. Lowry, chemist of the Massey-Harris Co., Toronto, if interested.

According to statistics published by the Association pour les Interets Miniers d'Alsace et de Lorraine, and quoted by the Iron and Coal Trades Review, the output of iron ore in Alsace Lorraine was as follows in metric tons:—10,000 000 in 1918; 13,000,000 in 1917; 13,000,-000 in 1916; 10,000,000 in 1915; 14,000,-000 in 1914; and 21,000,000 in 1913. The coal output during the same period was 2,600,000 tons in 1918 and 1917, 2,020,000 in 1916, 1,900,000 in 1915, 2,-800,000 in 1914, and 3,700,000 in 1913.

Handy Chart for Design and Pin Connections

By JOHN S. WATTS

THE accompanying chart gives the dimensions of double eye pin connections for transmitting motion by connecting rods through levers, bell cranks, etc., for all loads in tension or compression up to 30,000 pounds.

Knowing the load, to use the chart, follow along the horizontal line for that load and read off the dimensions for each part at the nearest higher size in each column.

For example, to determine the dimensions for a double eye connecting rod, to transmit a load, both in tension and compression of fifteen thousand pounds.

Following along the fifteen thousand pound horizontal line we find that the diameter of the body should be 1¾ in. if the length centre to centre of pin holes does not exceed 52½ in. The diameter of the pin and the width between the jaws should be 2¼ in., and the outside diameter of the eye 3⅝ in. Pin will be 5 in. long between centres of cotter pin holes, and 6 in. long overall. The cotter pins will be 5-16 in. diameter by 3¼ in. long, and the metal in the sides or jaws of the double eye will be 11-16 in. thick.

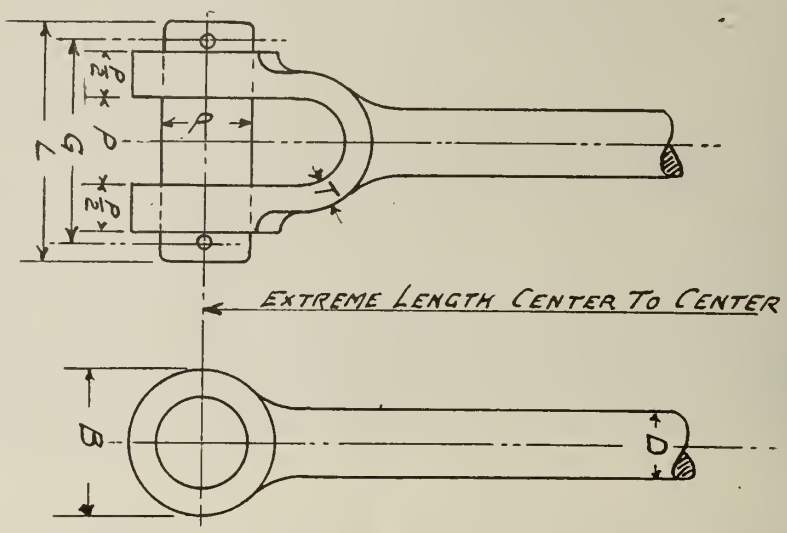
The limit in length, as given under the column marked extreme length, is to take care of the fact that the connecting rod acts as a column when under compression, and if the length must be greater than that given the diameter must be increased to keep the ratio of length divided by radius of gyration not over 120. In very long rods this can be done very nicely by making the rod from a piece of pipe, welded to the double eyes at each end. This increase in the diameter D does not affect the other dimensions. If the connecting rod is only subject to tension the extreme length limit may be ignored.

When designing connecting rods for use with hand or foot levers, it is better to disregard the calculated pull required to operate the mechanism, and, indeed, use the maximum pull that can be exerted on the hand or foot lever by the operator, as it is more than probable that this maximum pull will be exerted on the lever some time or other, either by ignorance or because of some stiffness in the mechanism. This maximum pull may be safely assumed at 120 pounds on a hand lever, and 200 pounds on a foot lever.

The basis upon which the chart is constructed is as follows: The diameter of the bar is that diameter at which the load will give a stress of 6,600 pounds per square inch, and this is the stress that is used throughout on account of the load being intermittent and reversing.

The extreme length is that at which

$$\text{the ratio } \frac{\text{length}}{\text{radius of gyration}} \text{ equals 120,}$$



LOAD IN POUNDS	DIAM OF BAR D	EXTREME LENGTH	DIAM OF PIN & WIDTH P	B	G	L	COTTER PIN DIA	COTTER PIN LENGTH	T
30,000	2 3/8"	71¼"	3⅛"	4⅞"	6¾"	7¾"	5/16"	5"	15/16
28,000			3"	4⅝	6½	7½"			
26,000	2¼"	67½							
24,000			2⅞	4½	6¼	7¼			
22,000	2⅛"	63¾							7/8
			2¾	4⅜	6	7		4"	
20,000	2"	60	2⅝	4⅛	5¾	6¾			13/16
18,000	1⅞	56¼	2½	4	5½	6½		3¾	3/4
			2⅜	3¾	5¼	6¼			
16,000	1¾	52½							11/16
			2¼	3⅝	5	6"		3½	
14,000	1⅝	48¾	2⅛	3⅜	4¾	5¾			
12,000	1½	45	2	3¼	4½	5½		3	5/8
			1⅞	3	4¼	5¼			
10,000	1⅜	41¼							9/16
			1¾	2⅞	3⅞	4⅝	¼	2¾	
8,000	1¼	37½	1⅝	2⅝	3⅝	4⅜			½
6,000	1⅛	33¾	1½	2½	3⅜	4⅛		2½	
	1	30	1⅜	2¼	3⅛	3⅞			7/16
			1¼	2⅛	2⅞	3⅝		2"	
4000	⅞"	26¼	1⅛	2"	2½	3⅜	5/16"		3/8
	¾"	22½	1"	1¾	2¼	3	5/32"	1½	5/16
2,000	5/8"	18¾	7/8	1½	2	2¾			
	½"	15"	3/4	1⅜	1¾	2¼		1¼	1/4
	3/8"	11¼"	½"	1"	1½	2⅛	⅛"	¾"	5/16

THE TABLE AND DIAGRAM WILL NO DOUBT BE EASILY UNDERSTOOD.

which, as the radius of gyration of a circular bar, is the diameter divided by 4, is equal to thirty times the diameter of the bar.

The diameter of the pin and the width of the bearing between the jaws, is such that the load will impose a pressure on the bearing surface (diameter of pin multiplied by width of bearing) of 3,000 pounds per square inch. It may be admitted that this gives a larger bearing surface than is generally used, but a long experience in repair work has proved to me that this bearing pressure should not be exceeded. The higher bearing pressures sometimes used to cause the pins and pinholes to wear out very rapidly and shorten the life of the machine considerably.

Making the width of the bearing surface equal to the diameter of the pin gives us better proportions than a smaller pin with a wider bearing or a larger pin with narrower bearing.

The diameter of the eye B is calculated to give a net area of metal to resist tearing across the eye, such that the stress, due to the load, will not exceed 6,600 pounds per square inch after the hole has been worn and reamed out for a new pin one-quarter of an inch larger in diameter than the original pin.

The thickness of metal in the jaws is that which will give an area of section $D \times 2 \times T$ equal to the area of the body,

i.e., $\frac{\pi}{4} \times D^2$.

It will be seen that the sizes given in the chart can be used with all confidence as being of ample strength to withstand continually reversing stresses and rough treatment.

RULES FOR WELDING OF INSURED BOILERS

BY "autogenous welding" is meant any form of welding by fusion, that is, where the metal of the parts to be joined or added metal used for the purpose is melted and flowed together to form the weld. Such welding is accomplished by the oxy-acetylene, hydrogen or other flame processes, or by the electric arc; no distinction is made between any of these processes. The general rule to govern the acceptance of such welds in insured vessels is that prescribed by the Boiler Code of the American Society of Mechanical Engineers, Par. 186, as follows:

> "Autogenous welding may be used in boilers in cases where the strain is carried by other construction which conforms to the requirements of the code, and where the safety of the structure is not dependent upon the strength of the welds."

The following illustrations will serve to point out where such work should be accepted or rejected:

1. Any autogenous weld of reasonable length will be permitted in a staybolted surface, or one adequately stayed by other means so that should the weld fail, the parts would be held together by the stays. It is necessary for the inspector to use judgment in interpreting the meaning of "reasonable length" as given above, since it may vary in different cases. In the average case it should be not more than 3 ft. Autogenous welding will not be accepted in unsupported surface.

2. The edges of the inner and outer sheets of vertical firebox boilers or boilers of the locomotive type may be joined by autogenous welding to form the door openings, if the surrounding surfaces are thoroughly stayed. This would also apply to other openings of a similar character in such surfaces.

3. For low pressure plate steel boilers operated at a pressure not exceeding 15 lbs. to the square inch, or for higher pressures in unfired vessels subjected to water pressure only, rectangular headers may be autogenously welded at the edges if the sheets are properly held together by stays. Autogenous welding of cracks and fractures in cast iron boilers will not be permitted.

4. Fire cracks in girth seams extending from the edge of the plate to the rivet hole may be autogenously welded, provided the cracks are properly prepared by cutting out the metal at the crack in the form of a letter "V" to permit fusion through the entire thickness of the plates.

Similar cracks in girth seams located between the rivet holes may also be autogenously welded, provided the cracks do not extend beyond the edge of the lap of the inner plate. In the latter class of cracks it is advisable to drill a hole not exceeding 3-8 in. in diameter at the end of the crack before the weld is made. Cracks extending from rivet hole to rivet hole on girth seams cannot be welded. Calking edges of girth seams may be built up by autogenous welding under the following conditions: The original section of the metal between rivet holes and calking edge to be built up must average equivalent to ¼ of the diameter of the rivet hole and the portion of calking edge to be replaced must not exceed 30 in. in length in a girthwise direction. In all repairs to girth seams by autogenous welding the rivets must be removed over the portions to be welded and for a distance of at least 6 in. at each and beyond such portions. After repairs are made the rivet holes should be seamed before the rivets are redriven.

5. Stayed sheets which have corroded to a depth of not more than 40 per cent. of their original thickness, may be reinforced or built up by autogenous welding. In such cases the stays shall come completely through the reinforcing metal so as to be plainly visible to the inspector.

6. Where tubes enter flat surfaces and the tube sheets have been corroded the ends of such tubes may be autogenously welded to the tube sheets. The above-mentioned repairs for tube sheets and the welding in of tubes in the sheets are not to be permitted where such sheets form the shell of a drum or boiler, such as in the case of Stirling type of boiler.

7. When external corrosion has reduced the thickness of plate around handholes to not more than 50 per cent. of the original thickness and for a distance not exceeding 2 inches from the edge of the hole, the plate may be built or where cracks exist between the tube ligaments, autogenous welding may be used to reinforce or repair such defects.

8. Pipe lines will be accepted where the flanges or other connections have been welded autogenously, provided the work has been performed by a reputable manufacturer and the parts properly annealed before being placed in position. Such welding when made with the part in place and unannealed will not be acceptable.

9. Autogenous welding in patches in the shell of a boiler will not be acceptable regardless of the size of such patches. Autogenous welding of cracks in the shell of a boiler—except those specified in Par. 4—regardless of the direction in which they may lie, will not be permitted, unless such welding is only for the purpose of securing tightness and the stresses on the parts is fully cared for by properly riveted-on patches or straps placed over the weld. The plates at the ends of joints may be welded together for tightness, provided the straps or other construction is ample to care for the stresses on the parts so welded.

10. Re-ending or piecing of tubes for either fire tube or water tube boilers by the autogenous process will not be permitted.

The production of pig iron in the United Kingdom in February amounted to 645,000 tons, or 20,000 tons less than in January. When allowance is made for the shorter month, however, the rate in February was rather higher than in January, the daily rate being 22,300 tons, against 21,500 tons. The production of steel ingots and castings amounted to 798,000 tons, or 44,000 tons more than in January, and was higher by 40,000 tons than the best month in 1919—viz., March, when the production was 758,000 tons. The 645,000 tons of pig iron included 234,000 tons of hematite, 223,000 tons of basic, 170,000 tons of forge, foundry, and other qualities, and 18,000 tons of alloys.

Discussion of Strains in Rolling of Metal

This Abstract Touches on a Most Vital Subject to Those Interested in Rolling of Metals—The Original Paper Was Presented Before the American Society of Mechanical Engineers at Their Annual Meeting

By ALFRED MUSSO, General Manager of the Coast Coaling & Eng. Co.

WHEN a piece of metal is put through the rolls in a rolling mill, its linear dimensions are strained and the whole piece itself is deformed; in other words, the thickness of the piece becomes smaller while its length and width are increased. These strains are the effect of the pressure which the rolls exert on the piece, and as introductory to our specific subject we will first consider the behavior of a piece of metal under compression.

Let ABCD (Fig. 1) be the cross-section of a piece of metal as subjected to the pressures P and P_1 normal to the faces shown in cross-section as AB and CD. When the compression is carried beyond the elastic limit of the material, the two faces AB and CD will come closer together as shown by the dotted lines A_1B_1 and C_1D_1, while the two sides faces AC and BD will bulge outward as shown by the dotted curved lines A_1C and B_1D_1, and if the forces P and P_1 are still increased the piece will ultimately fail by shearing along its diagonals.

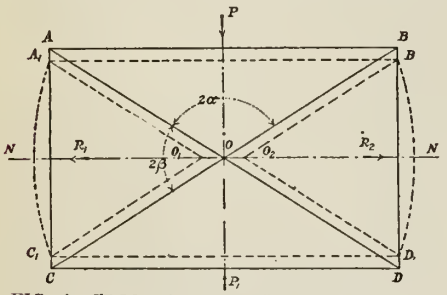


FIG. 1—CROSS SECTION OF A PIECE OF METAL SUBJECTED TO PRESSURES P. & P.

The ultimate behavior of the failing piece is influenced by the structure of the metal itself. In fact, experience shows that ductile metals possessing a homogeneous structure, such as copper, aluminum, etc., will become plastic and flatten down to a disk, while fibrous metals, such as steel, wrought iron, etc., where strength across the grain is much lower than with the grain, are not susceptible of any plastic state at all and will ultimately fail by splitting sideways. As it is beyond our present scope, however, to discuss this subject of the failure of metals under compression, it is sufficient for our purpose to regard the piece as shown by Fig. 1 as divided into six pyramids having as a common vertex its pressure centre O, and as bases its six faces.

It is obvious that while the compressive forces P and P_1 are tending to telescope into each other along the pressure line PP_1 of the upper and lower pyramids, the other four pyramids will be pushed outside by the expulsive forces R_1 and R_2 consequently set up by the aforesaid pressures P and P_1. The value of the expulsive forces evidently depends on the two angles AOB and AOC, ordinarily known as pressure angle and expulsion angle, respectively. We will now apply the foregoing considerations to the rolling-mill process, and begin our investigation of the effects of the roll pressure at any point of the surface of the piece being rolled.

Let Fig. 2 represent a cross section of a rolling-mill through the rolls. NN_1 is the piece of metal going through the rolls C and C_1. Inasmuch as the pressure is exerted radially we may consider it at any point, say at A, which is the initial point of the contact arc AMB. The pressure P may be resolved into two components, one normal to the piece and the other parallel to its surface, as follows:

n=P cos b, normal component

m=P sin b, parallel component

where b=angle ACB, known as the approach angle. The directions of the components clearly show that while n is the force which actually compresses the piece, m is the component of the pressure which hinders the piece from entering the rolls, and unless n is larger than m, the rolls will not grip the piece.

The useful limit of b is easily found from the relation $n > m$, from which $b < 45$ deg. The actual value of b for metals is given by tan b=c, the coefficient of friction between roll and piece, but for metals c=0.577 (approx.), therefore b=tan^{-1} 0.577=30 deg., which, according to actual practice, is the maximum value of the approach angle for which the rolls will grip the piece.

Let us now deal with the effect of the pressure on the whole arc of contact A B. We may consider the pressure as applied to the middle point M and the whole piece represented in cross-section by ABB_1A_1 will be divided into pressure pyramids with a common vertex at O. In accordance with previous remarks concerning the behavior of a piece under compression, we deduce that part of the piece bounded by the contact arcs and shown shaded in the figure is pushed outward by the rolls in the direction of the pass, consequently it is the one we must consider in looking for the elongation of the piece. Obviously, when the piece has gone through the rolls, the shade area OMB_1M_1 will have been transformed into a rectangle, its height being equal to the pass and its base longer than the average base of the original expelled part.

Determination of Elongation. In the complete paper an expression is derived for the shaded area $OMBB_1M_1$, which, as previously noted, must be equal to the area of a rectangle of height b and base of length l, where p=pass (BB_1). The value of l is given by the equation:

$$l=\frac{1}{p}\left(\frac{(2r+p)^2(t-p)}{8r\sin b}-\frac{3.14r^2}{360}b\right) \quad [1]$$

and the value of the average base l_0 of the shaded area by

$$l_0=\tfrac{1}{2}\left(\frac{(2r+p)\ (t-p)}{4\ r\sin b}+r\sin\frac{b}{2}\right) \quad [2]$$

in which r is the radius of the roll and t the original thickness of the piece (AA_1).

The elongation e of the piece will evidently be $l-l_1$, and referring e thus found to the total length of the piece gripped by the rolls, we will have the elongation per unit e_1. Also the total length of the piece gripped by the rolls is (Fig. 2) AF =r sin b, whence the percentage elongation e_2 will be

$$e_2=\frac{100\ e}{r\sin b} \quad [3]$$

Equation [3], besides showing the elongation obtained by rolling a piece of metal, furnishes also other valuable information, namely, a check on the safety of the rolling operation, by comparing the e with the tensile-strength test of the material in question. In the event that the value of e is too large for safely straining the piece, or should it happen to be too conservative, it will always be possible to readjust the pass of the roll-

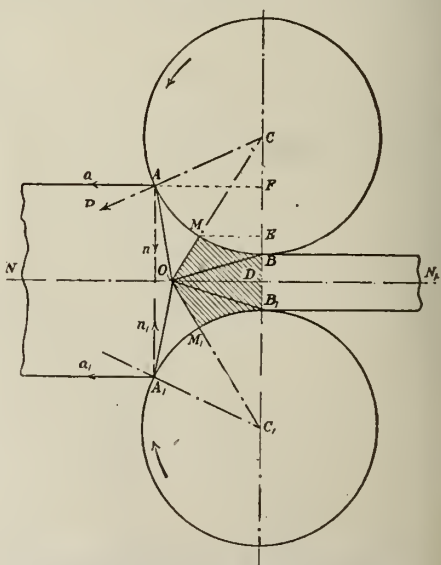


FIG. 2—CROSS SECTION OF A ROLLING MILL THROUGH THE ROLLS AND THE PIECES OF METAL BEING ROLLED.

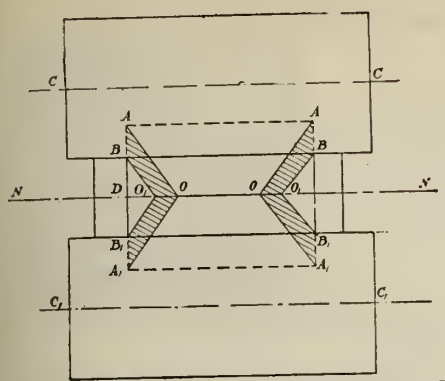


FIG. 3—LONGITUDINAL CROSS SECTION OF A ROLLING MILL THROUGH THE ROLLS.

ing mill to suit, because e is a function of b.

In order to find the side spread (s) of the piece caused by the roll pressure, will refer to Fig. 3, which is a longitudinal cross-section through the rolls. Let CC and C_1C_1 be the axes of the rolls, AA_1=t the original thickness of the piece and BB_1=p the pass. In this case, since the expulsion angles AOA_1 are equal for both sides of the piece, the total spread will be twice the spread of one side.

By reasoning the same as in the case of Fig. 1, we can easily see the amount of side spread is given by the shaded areas, namely, AOA_1 and B_1O_1B. In the case the shaded area is given by the difference of the areas of the triangles AOA_1 and BO_1B_1, which depend upon the value of the pressure angle a because angle DAO=a/2. In the complete paper it is shown that

$$\frac{a}{2} = \tan^{-1}\left[\frac{(r+\frac{p}{2})\tan\frac{b}{2}}{\frac{p}{2}} - \frac{b}{2}\right] \quad \ldots\ldots[4]$$

It should be noted that the pressure angle is also a function of the approach angle b, and once the value of the pressure angle has been calculated it is easy to find (Fig. 3) the area of the shaded portion, which divided by the pass will give the amount of the side spread at each side of the piece, namely,

$$s = \frac{(t^2 - t^2)}{p} \tan\frac{a}{2} \quad \ldots\ldots[5]$$

If w is the width of the piece, the total spread per unit of width will be $2s_1 = 2s/w$, and the percentage spread

$$2s_2 = \frac{200\,s}{w} \quad \ldots\ldots[6]$$

Equation [6] shows that the side spread is independent of the width of the piece, but it depends entirely on the values of the original thickness t and the pass p.

In conclusion the author wishes to present a practical application of the foregoing formulae by solving the following problem: In the cold-rolling operation a strip 0.20 per cent. carbon steel is put through a 10-in. mill. The strip before rolling is 2 in. wide and 0.065 in. thick. The pass is 0.050 in. Find the percentage elongation and side spread.

The first step is to find the approach angle. The fundamental equation of a rolling mill is

$$t = p + 2r\,(1 - \cos be)$$

Substituting and solving, it is found that b=3 deg. 8 min. Also from the above data and Equation [4], a/2=78 deg. 7 min.

We can now dispose our data as follows:

Roll radius, r=5 in.
Original thickness, t=0.065 in.
Pass, p =0.050 in.
Width of strip, w=2 in.
Approach, b=3 deg. 8 min.= 3.133 deg.
$\sin b = 0.05466$
$\cos b = 0.9985$
$\sin \frac{b}{2} = 0.02734$
$\tan \frac{a}{2} = 4.75219$

The elongation, using Equations [1], [2] and [3] is found to be 0.06275 in., or in percentage, $e_2 = \frac{6.275}{5 \times 0.05466} = 24.6$ per cent. of the original length of the piece gripped by the rolls.

Interesting Facts to be Found in This Week's Advertising Section

How to prevent idle time of men and machines.
How to save oil.
What to do if a nut gets loose.
Why a bench lathe is sometimes best.
How to procure a healthful drink.
A blast gate that has given entire satisfaction.
The method of milling chilled rolls.
How to record time spent in operations.
A shear that can cut 7"x1¼" flat bars, round bars of 2½", and other large work.
Where to secure steel for every commercial purpose.
A tool holder that won a grand prize.
How to secure steel castings of all sizes from 5 to 5.000 pounds.
How to reduce cutting-off costs.
How to save time in changing drills.
How to take deep cuts without pause or chatter.
How to eliminate spoiled work.
A fine piece of history about Major Anderson, the defender of Fort Sumter.
A chuck which has reversible screws.

The side spread on either side, from Equation [5] is s = 0.164 in., and the percentage spread from Equation [6] is 16.4 per cent.

The result thus obtained evidently shows that the percentage spread is inversely proportional to w, the width of the piece. Now, because of the fact that in rolling-mill practice we are interested only in obtaining the highest possible value of the elongation e, the best economic operative conditions will be furthered by using a strip as wide as possible consistent with the dimensions of the rolls, the power of the mill and above all the degree of uniformity desired in the thickness of the finished strip.

The output of tungsten ores in the Malay States has increased during recent years owing to the high prices they fetch. In 1914 the output was 261 tons; 1915, 292 tons; 1916, 518 tons; 1917, 761 tons; and 1918, 370 tons. Tungsten ores are usually found mixed with tin ores.

According to a statement in a New York newspaper, the vice-president of the Pennsylvania Railroad said that, as compared with two years ago, the company had 14 per cent. more men to do 11 per cent. less work; or, put another way, it took 127 men in 1919 to do the work of 100 men in 1917. In 1917 the day was one of ten hours; now it was eight hours. In 1917 the average number of traffic units per man was 113,932. With the shorter day this would have worked out at 91,145; actually it was 89,308. In the shops there was an eight-hour instead of a ten-hour day, but piecework had been abolished, and the output per man had fallen from 100 per cent. to 75 per cent. With the eight-hour day the output per day was but 60 per cent. In other words, it takes ten men to-day to do the work of six men two years ago.

According to "Engineer" a series of motor tractors burning palm oil or other vegetable oils grown in Africa is to be organized in Belgium by the Colonial-office, Department of Agriculture. Foreign tractors will be eligible for the trials. Two awards of 15,000f. and 10,000f. respectively will be made to the two best tractors burning fuel oil or some similar grade of heavy petroleum residue. The tractors must be able to give a total pull of 1,000 kilos. on the draw-bar at a speed of 2 miles per hour. Preference will be given to tractors weighing not more than 3,500 kilos., suitable for the rough roads of Central Africa. The trials will be held near Brussells, probably next April, and will last six to ten days. The tractors will be tried on ploughing, belt driving, and hauling of transport wagons—up to about 30 miles a day. Particulars of these trials can be obtained at the Agricultural Department of the Ministry of Colonies, 7, Rue Theresienne, Brussels, Belgium.

WHAT OUR READERS THINK AND DO

TEST GAUGE FOR LOCKING LEVER

By Robert Mawson

ON SOME parts where various machining operations are performed it is essential that certain finished surfaces are produced in the correct relative positions.

If these surfaces vary their proper function is uncertain, and the effectiveness of the finished machine is impaired.

In Figure 1 is shown the detail of a locking pin lever, the first machining operation on which is drilling and reaming the 3-8 inch hole at a distance of 4 1-16 from the left hand end.

The lever is then held in vise jaws located by a 3-8 inch pin, and the end marked 1st cut Fig. 2—machined using two formed cutters as illustrated.

The lever is then reversed, placed in a locating pin and also located on the vise jaws, which are machined with a similar contour to that produced on the lever.

The second cut—marked 2nd cut—is then made on the piece, using a formed cutter as shown.

The lever is again reversed, located on a pin and with the vise jaws also locating the piece by means of surfaces which have been machined with similar contours to that produced on the lever at the second cut. The third milling operation—marked 3rd cut—is then made using the same formed cutter as that employed on the second cut.

It is obvious that providing the various formed cutters have been made with the correct outline and the several vise jaws correctly made by the tool maker, and further that these various tools have been properly used by the machinist all the levers should be exactly alike in outline and the machined surfaces in their correct relative positions.

This, however, is taking too much for granted, too many factors, human and mechanical, enter into the question.

A testing fixture was therefore designed and made as shown in Fig. 3, so that a check can be made on the finished machined parts.

The body of the testing fixture is made of cast iron, which is machined all over. A pin, made of tool steel, hardened, is driven into the body, the projecting portion being a good sliding fit for the 3-8 inch reamed hole in the lever.

At the right hand end is fastened a tool steel block set at the correct angle and distance from the locating pin.

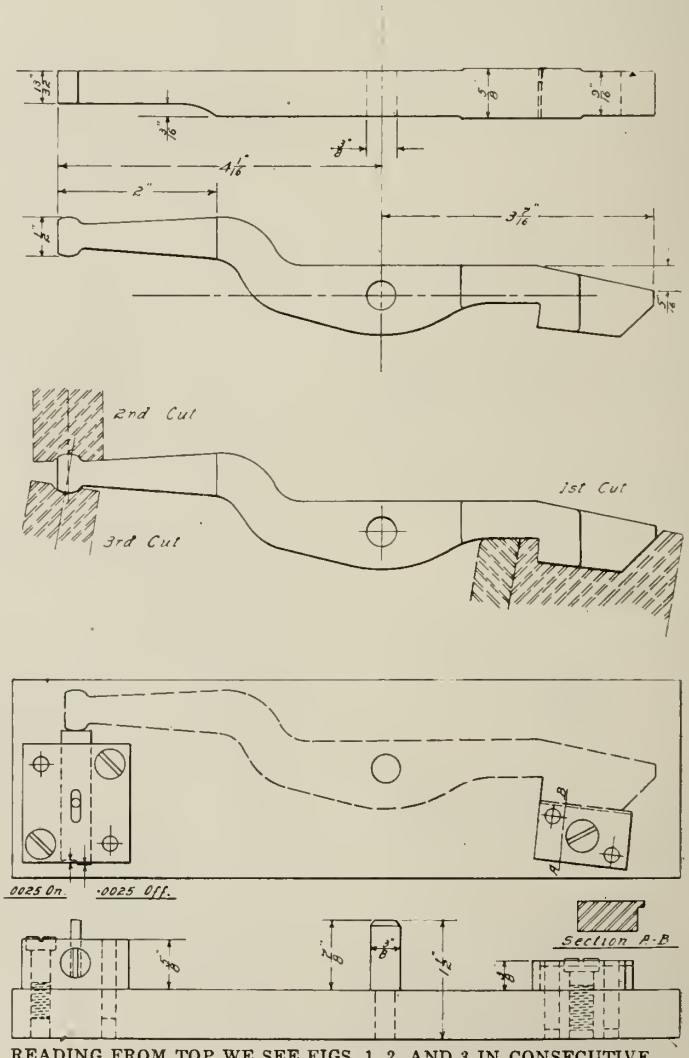
By referring to the section A-B it will be noticed that the block is cut away except for a width of 1-16 inch at the upper edge. This is done so that a feeler may be used to determine whether the lever surface being tested fits properly against the surface of the block. At the left hand end another block is fastened, in the centre of which is a limit gauge which may be slided against the lower end surface of the lever.

To test the lever it is placed on the locating pin and pushed against the right hand block, the contact being tested by means of a feeler gauge as previously stated. The sliding pin in the left hand block is then pushed against the lever as shown.

The gauge pin is made with limits of .0025 inch plus and minus and the inspector can easily determine by touch whether the machined lever meets these requirements.

If it be found that the gauge pin either projects or can be pushed in beyond the limits it will prove that the cutter set up for either the second or third cuts were wrong, in one case too low and in the other too high in relation to the vise jaws.

The positions must therefore be changed so that the lever will meet the demands of the testing fixture and yet remain the 1-2 inch width called for on the lever detail.



READING FROM TOP WE SEE FIGS. 1, 2, AND 3 IN CONSECUTIVE ORDER.

OXY-ACETYLENE AND THE SCRAP HEAP

By F. A. McLean

IT is not so many years ago that plant owners, managers, superintendents, and other officials were prone to regard their scrap heaps as necessary evils, unredeemable, and all attempts at reclamation as more or less worthless, or a foolish waste of time.

How different is the state of affairs that exists in this regard to-day and the two things which have perhaps been more instrumental in bringing this condition about than all others put together, are the late war and the modern oxy-acetylene welding outfit.

In the old days, all too many scrap heaps used to be the broad highway for escaped profits and huge financial losses. Go anywhere in the neighborhood of large mines, steel mills, shops, foundries, or other industrial plants and what motley collections of blasted hopes were to be found.

During the war, with the prices of raw materials soaring to dizzy heights, plant managers and factory men began to cast reflective glances at their scrap heaps and usually found large aggregations of broken or partially worn-out machinery, machine tools, pieces of tool or alloy steel, tubes, plates and other odds and ends that naturally represented considerable profit thrown away, but, which from the lack of necessity, of knowledge, or of ways and means, would, in normal times, have graced the landscape or the vista of some out-of-the-way corner of the plant until its huge proportions required the attention or excited the avarice of some wandering junkman, in which case some use was made of the material—it found its way after careful sorting at the hands of some Jacob or Isaac and his tribe into the voracious maw of an open hearth furnace, brass foundry or lowly cupola.

In the case of isolated plants, remote mines, etc., such apparatus as found its way to the scrap pile usually finished its career through the action of the snow and rain, as rotting rust in the ground from whence it came.

Confronted with the problems of labor shortage, raw material shortage and long-time deliveries of machine tools and other equipment, many of the more resourceful plant executives enlisted the services of a modern acetylene welding outfit and put much of their old equipment into service once more with much profit, as in most cases the equipment had long since been written off their books.

A large Western mine recovered from their junk piles broken dollies and dies for their drill sharpening machines, which, through the medium of the ever-ready acetylene torch, were soon rendered fit for further service at about one-tenth of their original cost.

A Pacific Coast mine saved several hundred dollars by welding a large crusher frame, or rather several thousand dollars, if one takes into consideration the length of time that the mill would have been running under a handicap during the weeks or months that would have elapsed before a new frame could be cast, machined and shipped from the East.

Another mine, at trifling cost, put back into service a year's supply of broken-bottomed tram buckets, several months' supply of broken stamp mill stems and odd lengths of tungsten steel, as well as a number of manganese steel crusher plates or checks which were too large for their machines.

A great steel mill reduced a shut-down which might have run into many weeks to a matter of 48 hours or so by welding a giant spur gear and thus saved many thousands of dollars.

One of the shipyards on the Pacific Coast had the misfortune to fracture the frame of one of their hydraulic presses and through the good offices of a local garage man and a portable welding outfit the press was soon back at work again, notwithstanding the fact that this was the first job of the kind the garage man had ever tackled. This yard now has a first-class welding equipment of its own.

Into one of the dockyards on the Atlantic seaboard floundered and limped an ocean-going freighter with a broken rudder post, and here again acetylene welding saved time and money for the owners.

In one of Canada's largest textile mills, running twenty-four hours a day, the breakage of some small parts of their complicated machinery is an almost daily occurrence, usually tying up the machine for a matter of a few minutes or hours at the most, since an acetylene welding outfit is an outstanding feature of their up-to-date repair shop.

Midst all of the smooth-running hurly-burly of a mammoth daily newspaper plant, a press suddenly breaks down through the failure of some minor, but none the less important part, while there are yet several thousand copies to be run, and again acetylene saves the day and incidentally the publishers' reputation for having "Never missed an issue in two or three decades."

During the war many railroads were hard pressed for rolling stock, and many a cracked locomotive frame and driving wheel owe their resurrection to the oxy-acetylene process with thousands of dollars in savings to their owners through the reclamation of discarded equipment.

Cast gears are likely to have a nasty habit of shedding their teeth, often when least expected, and one milling concern whose junk heap was swollen by these toothless wrecks, cast about for ways and means to use them again. On examination it was decided that many of the gears could be repaired and an acetylene welder was called in and proved himself a skilful dentist by fusing new teeth into the castings, which were thus made as good as new and kept many dollars in the company's coffers for the shareholders.

In the ordinary machine shop, lathes, planers, millers and other machine tools which are sometimes broken, are often easily repaired by welding the broken parts. Small pieces of high speed steel are welded to cheaper shanks or bodies to form lathe, planer, or slotter tools, milling cutters, etc., and many pieces of tool steel which were once regarded as waste are now used up to the last fraction of an inch.

What the oxy-acetylene torch has done for the automobile owner and the garage man is too well known to need comment. Now-a-days any piece of metal, be it steel or iron, cast, wrought, or malleable, sheet, tube, or bar, brass, bronze, aluminum, aluminum alloys or the precious metals, such as platinum, gold and silver, may be easily welded and made new again by the intense heat of 6,300 degrees Fahrenheit produced by the burning of acetylene in oxygen which fuses these metals so that they run like wax and which might virtually be said to weld the broken parts by remoulding them.

Some of the first attempts at organized espionage and war on the waste pile seem to have originated in England before the war. In a popular magazine published in 1913 there appeared an article on the career of a young Englishman who was said to have been paid a percentage on the money which he recovered from his employers' scrap heaps which brought him in an income of about $20,000 a year.

It used to be said that the United States had the biggest scrap heap in the world, and perhaps Canada was not far behind, but with the well-organized campaigns against waste now carried on by most of the big railroads, mines and industrial plants, this would be a hard statement to prove at the present time.

The war in itself was a great creator of waste, yet in view of the resourceful and efficient methods adopted to realize as much as possible from worn-out or discarded material, no one can fail to have other than ardent admiration for the skill and foresightedness of the men in charge of this department of the work.

In the midst of the great cry for the conservation of natural resources, of raw materials, of man power, of time and of money, that goes forth to-day, two of the most conspicuous causes of the newer and more intensive economy, are the war and the oxy-acetylene welding outfit. The former, because it taught plant executives to regard their scrap heaps in a new light and the latter, because it has enabled them to reduce their size to reasonable proportions.

DEVELOPMENTS IN SHOP EQUIPMENT

A NEW COMPENSATED HEATMETER

Until comparatively recently, the determination of furnace and kiln temperatures by means of thermocouples was attended with complications and difficulties which made practical men impatient, and in some instances doubtful in regard to the intrinsic value and reliability of the method.

Technical men, however, have realized from the beginning that, within certain temperature limitations, the results obtained by the use of thermocouples were not only accurate, but could be made "direct reading," provided that the thermocouple be connected with a galvanometer which would indicate the actual value of the e.m.f. obtained by heating.

On first consideration, this problem did not seem difficult of solution, since it is an established fact that the e.m.f. or voltage of a thermocouple bears a direct relation to the difference in temperature between its hot and cold ends. It is also true that the movable coil of a millivoltmeter will be deflected to an extent which is directly proportional to the e.m.f. of the thermocouple. Therefore it would seem the simplest operation imaginable to connect the thermocouple and the instrument together by means of insulated conductors, figure the scale in temperature values and regard the problem as solved.

Unfortunately, however, we have also to contend with factors which cannot be ignored if accurate results are required; namely, line resistance, thermocouple resistance, and the resistance of the indicator itself, because, to be precise, a direct current millivoltmeter actually is not a millivoltmeter at all, except in name, but is a milliameter or current indicator. All instruments of the d'Arsonval type depend primarily upon current for their operation and the extent of the deflection obtained with any given current is established by the intensity of the magnetic field, the controlling force of the springs, and the number of convolutions or ampere turns in the movable coil, and not by a remote e.m.f. Therefore, if the conductors which carry the current from the source of e.m.f. to the terminals of the instrument do not have a negligible resistance, then, in accordance with Ohms' law there will be an appreciable fall of potential along the line, with the result that the movable system will receive a diminished current and therefore be low in its readings. To reduce such errors to a minimum, it is desirable that the instrument resistance be as high as possible, so that the line and thermocouple resistant may be proportionately insignificant. For instance, if the resistance of the millivoltmeter is 300 ohms, and the resistance of the line (A) and thermocouple (C) is 3 ohms, the current through the circuit will be reduced ½ of 1 per cent. instead of 1 per cent., and the instrument indications will be 1 per cent. low. Figured in degrees Fahrenheit, this would mean an error of approximately 14 deg. in 1400 degs. Fahr. if a thermocouple were used.

The advantage of high-resistance instruments, therefore, becomes evident. For instance, if the pyrometer has a resistance of 600 instead of 300 ohms, and the line resistance remains the same, an error of 3 parts in 600 will result or only ½ of 1 per sent. instead of 1 per cent., or about 7 deg. Fahr. in 1400 deg. Fahr.

Until within the last five years it was customary to use a so-called low resistance pyrometer to measure the current from the thermocouple. These instruments had from 2 to 5 ohms internal resistance and were naturally materially affected by the external resistance of the thermocouple and leads. In the past few years high-resistance pyrometers have been almost universally adopted. These instruments have an internal resistance of usually from 300 to 1200 ohms. The higher the resistance naturally the less effect on the readings due to variations in line resistance, but will increase in internal resistance; something has to be sacrificed, and usually control or torque is weakened. In consequence, the instrument is not as substantial or dead-beat, and, due to the use of lighter springs is more apt to be affected by spring fatigue.

It has been found by trial that an instrument of medium resistance (about 500 ohms) can be produced in a satisfactory and substantial form, but an instrument of this class is necessarily affected in its indications when leads of considerable length are employed. Material variations in the length of thermocouples are also a source of error, as well as the introduction of compensating leads. When compensating leads are employed, as well as long wires, in connecting the thermocouple with the instrument, it is a common practice to reduce the resistance of the instrument in order to offset the effect of line resistance. This is at best a method of doubt-

GENERAL VIEW OF THE HEATMETER.

ful value, since it interferes with checking the scale by comparison with a standard, and does not compensate for changes in the resistance of the line or thermocouple, due to variations in temperature.

Various devices and attachments have been made for use in connection with indicating and recording millivoltmeters and pyrometers, by means of which the instruments will remain direct reading, and at the same time be compensated for external or line resistance. Inventions of this class range all the way from a simple step rheostat connected in series with the "dead" resistor of the instrument, to the elaborate and complicated apparatus employing the substitution and deflection methods, the potential of the thermocouple being first balanced against another potential derived from a dry cell, and after an intermediate operation and on intercomparison of deflections, the effect of line resistance is finally balanced out by means of a rheostat, and direct deflections are obtained from the thermocouple current.

It remained for two physicians, Paul D. Foote and T. R. Harrison, of the Bureau of Standards, Washington, to offer an invention of theirs, which, incorporated in a Brown pyrometer, eliminates the effect of line and thermocouple resistance by means of an operation which is so simple that anybody can use the instrument and obtain accurate results.

This improved heatmeter will unquestionably appeal to the practical man who wants results and does not care especially how the instrument functions provided its indications can be relied upon.

In testing with this apparatus all that is necessary is to connect the thermocouple with the instrument binding posts in the usual manner, press a button, turn a knob, and take a reading, which will be the correct e.m.f. of the thermocouple at its hot end, even if the line is miles in length. In fact the line may have as much as 15 ohms resistance. The Brown Instrument Company, Philadelphia, are the manufacturers of this equipment, and the accompanying illustration shows one form of the complete instrument. As will be seen, the accessory details incorporated into the instrument do not decrease its portability and convenience nor increase its size.

LET'S USE THE RIGHT NAME

Under this peculiar, yet reasonable heading, the Warner & Swasey Co., Cleveland, Ohio, comments as follows:

The name "screw machine" is no longer appropriate when applied to the modern turret lathe. This type of machine is seldom used for the making of screws, as automatic screw machines of various types serve this purpose better when large quantities are involved. The field of the modern turret lathe is as universal at the present time as is that of the engine lathe. Ten years ago bar work was the main product handled on what was then known as a hand-screw machine; but to-day there is more chucking work performed on the turret lathe than bar work. Furthermore, the modern turret lathe is designed and constructed to handle heavy castings and forgings and is provided with sufficient power for machining tough forgings and alloy steel parts. For merely making screws, the present power provided in turret lathes would be entirely superfluous.

While there is a natural reluctance to change a trade name so long used, we have started a campaign for discontinuing the name "screw machine" when applied to the modern turret lathe. We believe that the mechanical world prefers to call a machine by a name which describes the field for which it is intended —a name that it has acquired by evolution into a larger field, rather than a name designating the field occupied years ago. The screw machine of yesterday is the turret lathe of to-day, and we take this opportunity of urging all users and manufacturers to aid in the campaign for dropping the old term "screw machine" when applied to turret lathes.

NEW THINGS IN MACHINE TOOLS

The Sibley Machine Company of South Bend, Ind., are now manufacturing two new sizes of drill presses, similar in design to their 24-inch sliding head machine.

* * *

The Grand Rapids Grinding Machine Company has designed a grinding machine for grinding the tapers on the ends of taps. It is adjustable for right or left-hand taps, and likewise for long or short tapers.

* * *

The Norling Rotary Engine Company of Chicago, has recently perfected a self-locking one-ton straight-line chain hoist, which combines the four good qualities of simplicity, safety, durability and light weight.

* * *

Pneumatic motor hoists in capacities up to 2 tons are now being made by the Independent Pneumatic Tool Company of Chicago. The speed lift is 32, 16, and 8 feet, respectively, for the ½, 1 and 2 ton sizes.

* * *

A very serviceable punch, which may be used either for hand or bench work on 20-gauge or less, and up to a half-inch hole, has been placed on the market by the Parker Supply Company of New York. The total weight of the machine is 4½ pounds.

* * *

An automatic temperature regulator has recently been placed on the market by Charles Engelhard, 30 Church Street, New York. By means of a motor and suitable gearing a slotted link, adjustable to different strokes, is caused to oscillate, and by the action of two electro magnets in circuit with a pyrometer, a shaft is revolved in one direction or the other, depending on the magnet in action, so that the control valve may be opened or closed according to the temperature desired.

* * *

Among the many tools that Alfred Herbert, Ltd., of Coventry, Eng., placed on the American market recently, are a universal turret lathe, a heavy duty combination turret machine, and a special heavy-duty slotter. The turret lathe, which is known as the No. 4, is designed for both bar and chuck work. The spindle has a hole for 2-inch stock, and has a range of eight speeds. Four automatic feeds are provided. The hexagon turret may be rotated automatically or by hand. Adjustable stops for each position of the turret are likewise provided; they act as dead stops in addition to tripping the feeds. The heavy combination turret machine is made in three sizes, the two larger provided with sixteen changes of speed. The turret slide apron is fitted with reverse feeds so that the cutting tools may be operated in either direction. The spindle holes are for 2½, 3½ and 4½-inch stock respectively. Net weights are 5,280 lbs., 6,680 lbs., and 11,050 lbs. The Muir slotting machine is designed for exceptionally heavy service, and is particularly recommended for crank web work, and work beyond the economic scope of the ordinary milling machine. These slotters are made in four sizes, ranging from 8½ to 18-inch maximum stroke, with table diameters of from 27 to 42 inches.

NEW CATALOGUE

The Geo. F. Foss Machinery and Supply Company, of Montreal, has just issued an elaborate and well-arranged catalogue, containing 1,300 pages, exclusive of index, the latter occupying about 50 pages. The book is profusely illustrated with cuts and diagrams. A prominent feature of this catalogue is the arrangement of the various lines and the systematic grouping of the different articles. The illustrations on a given page are designated by the same number, being distinguished from each other by the addition of different letters. A special index has been devised for locating all articles described and instantaneous reference is practically assured. A considerable section in the back of the book is devoted to useful and valuable information.

The iron deposits at Boisdale, Cape Breton, Nova Scotia, are being opened up by the Dominion Steel Corporation in order to determine the quality and quantity of the ore. At the present time it is understood that fully 10,000,000 tons are in sight, and it is believed that this is not by any means the full extent of the deposit.

Stretcher Waggon of Unique and Simple Design

By George Laidler

NEARLY every large industrial plant has its hospital or first aid department. With the increasing size of plants it is important that there should be provided a ready means of conveying an injured employee from any part of the works to the works' hospital or first aid post.

The ordinary hospital type of wheeled stretcher is too delicate and expensive for factory or outdoor use. To meet its own needs one firm has devised the simple vehicle shown on the accompanying drawings, to accommodate a standard stretcher. The stretcher vehicle is kept at the works' hospital.

At certain well-known points where a telephone is available (usually foremen's offices) stretchers are placed in readiness. In case of accident a message to the hospital causes the vehicle to be hurried to the scene. Meanwhile the local stretcher has been taken to the injured employee, and when the vehicle arrives, or is met by its bearers, the patient is carefully wheeled to the medical man, without the inconvenience of transferring the sufferer from the original stretcher.

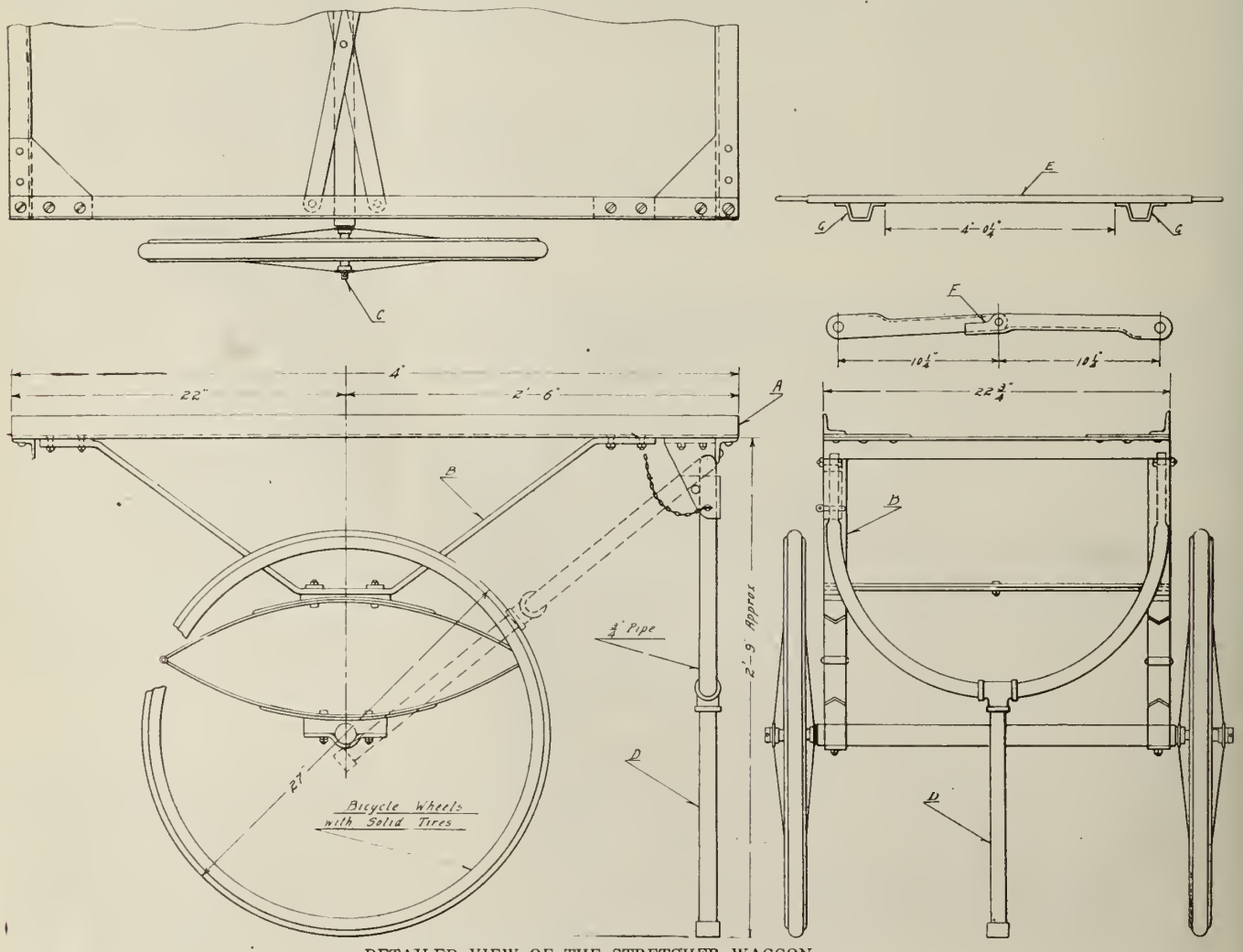
In construction, the gussetted frame A of light angles is arranged to take the stretcher easily. A cross-braced underframe B flat bar rests upon two springs such as are **sold for wagon** seats. These in turn rest on hardwood blocks which are held to the **tubular axle** by bolted straps. The wheels are of the common bicycle type, with solid rubber tires one inch diameter. Pneumatic tires are unsuitable as they are liable to be punctured or to be found deflated when suddenly a call comes. For strength and simplicity the standard cycle spindle with ball bearings is replaced by a parallel pin C with a flanged end, which is driven into the inch pipe axle and pinned.

The hinged leg D consists of a pipe with a cap, joined by a tee to a semicircular member with flattened ends. These ends are attached to a knee of bent plate bolted to the frame. When down, the leg is rigidly held by a chained pin passing through bent plate and flattened pipe, on one side of the vehicle only. When in motion the leg is swung towards the axle and kept there by inserting the pin in another hole.

The stretcher E consists of stout canvas over hardwood side pieces. When opened, hinged arms of inch angle interlock in a position beyond the dead centre. (See detail F). The iron brackets G serve to keep the canvas above the floor or ground, and also to prevent end play when the stretcher is placed on the vehicle. The end straps are for fastening the stretcher when rolled up, and the central strap is long enough to encircle a patient who might be violent, as in a fit.

The cost of labor and material for one vehicle and twelve stretchers as described amounted to $125.

A plate-bending roll which has recently been made in America is claimed by the makers to be one of the largest ever turned. It is 35 ft. 6 in. by 3 in. in the body, 40 feet 8 inches overall, and weighs 60 tons. The ingot from which it was forged weighed 119 tons, and was 67 inches in diameter.



DETAILED VIEW OF THE STRETCHER WAGGON.

Intricate Welding of Aluminum Crank Case

It is Often Surprising What Can Actually be Accomplished by the Welding Process—This Description From "Acetylene and Welding Journal" Shows Some Wonderful Work on an Aluminum Crank Case

THE accompanying photographs which show an aluminium crank-case before and after repair by the oxy-acetylene process, demonstrates that no matter how bad the damage may appear, and in this case the casting was broken into twenty-seven pieces—it was also badly cracked and several parts were missing—it is possible to repair it provided that technical skill and ingenuity are used.

Aluminium as a material for casting presents many advantages on the score of lightness and strength, and the enormous number of aluminium castings which are now employed in aeronautical, automobile, and other classes of work opens up a wide field for the application of the oxy-acetylene process for the repair and alteration of such castings.

Pure aluminium is not usually employed for castings subjected to stress, owing to its comparative softness and lack of strength. In order to raise the tensile strength and increase the hardness it is usual to add small percentage of some hardening metal, such as zinc, copper, nickel, etc., the amount and nature of the added metals depending upon the physical and mechanical properties desired. There are two main classes of aluminium casting alloys; those containing zinc (either with or without the addition of small quantities of other metals) and those containing copper as their principal hardening medium. The extensive researches of the British Aluminium Company, Ltd., into the properties of aluminium alloys have enabled them to select and standardize a number of alloys. These alloys are supplied in the form of a notched ingot weighing about 6 lbs.

In the case of new castings, shrinkholes, pinholes, and other surface defects may be repaired in a very satisfactory manner with the oxy-acetylene blowpipe, and the casting thus repaired is quite as strong and reliable as one cast perfectly. After the repaired portion is cleaned up and any excess metal removed it should be impossible to distinguish the welded part from the rest of the casting.

A suitable alloy for crank-cases consists of zinc, about 13 per cent., copper about 2½ per cent., and the remainder aluminium.

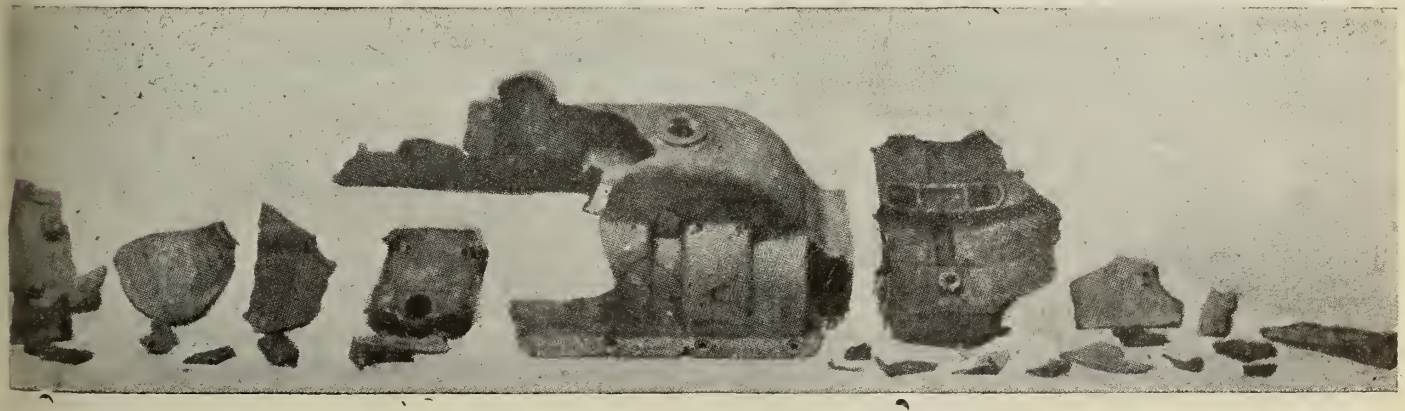
The success of welding aluminium castings by the oxy-acetylene process depends to a great extent upon the skill and intelligence of the operator. The average aluminium casting is somewhat complicated in its design, hence the necessity for skill in carrying the work through, especially during the preliminary portion. An expert in aluminium welding is distinguished by the careful preparation of the work, the arranging of supports, chills, temporary moulds, etc.; the sound judgment as to whether total or partial preheating is necessary; the choice of a correct size and well-designed blowpipe; the adjustment and maintenance of the correct proportions of oxygen and acetylene. In this connection many writers still recommend the use of excess acetylene in the flame in order to prevent oxidation and reduce the temperature of the flame. With well designed and a good range of blowpipes this is not necessary. It is essential, and the expert will pay attention to this, that the oxygen and acetylene should be very pure; aluminium absorbs nitrogen if present as an impurity in the oxygen and other gases and the presence of these will render the welds porous, brittle and unreliable. Dexterity in manipulating the flame so as to avoid deformation and rapidity and ease of operation are essential if overheated and damaged welds are to be avoided.

A first-class aluminium flux is a great advantage and a skilled operater has no difficulty in determining the relative merits of fluxes. The welding rod should be of practically the same composition as the casting, pure rod should not be used and for crank-case repairs rods of about half inch diameter, which are difficult to obtain, are a distinct advantage. The rods in common use at the present time are usually too short and too small in diameter. Since aluminium alloys have a low melting point, high conductivity for heat, and become fragile previous to fusion, preheating and cooling must be carried out very carefully.

The use of a flux on aluminium castings has been abandoned by many welders. In place of it they break down and remove the oxide by means of an iron

Continued on page 62

THE CYLINDER AFTER WELDING.



THE CYLINDER AS IT APPEARED BEFORE WELDING.

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Daylight Saving Muddle

DAYLIGHT saving is meeting with an indifferent reception this season. Places that had it last year are staying with the clock this year, and letting the sun and the moon alone.

It suits some families, and others find that it does not work to their advantage at all. The result is that we have this year a splendid example of hit-and-miss time all over the country.

This country has had some years of experience with this sort of thing now, and those who have been benefited are a minority when compared with those who have found the new idea a nuisance and a drawback.

And so we have the spectacle of railroads running on old time through places on new time: Toronto on new time and Hamilton and places in between the two on old time.

The whole thing as it stands is a mess.

Put the hands of the clock where they properly belong and quit tinkering.

Just Half the Truth

SERIOUS mischief often comes to pass from some hot-head grabbing a half-truth and making use of it.

For instance a little book published by radical printers in United States has this:—

The day operator, working for the scale and producing 28,000 ems of eight-point type (which, according to the scale of prices, is a fair day's work), receives a few cents over $7. The employer, according to the schedule of rates of the composition association (which we understand has recently been revised upward), receives for this 28,000 type $21. On a weekly basis this means that the operator receives $42 and the employer $126.

Do the above figures make you feel contented and perfectly satisfied with the present scale? Whisper your answer so you will not be overheard by the Bolshevik raiding crew.

Yes, we get you, Steve. We agree with you.

Facts were at once brought out to nail this mischief maker, and it was shown that the business under review has made profits of about 6.8 per cent.

The figures were from the books of chartered accountants in Chicago who audited the firm's business.

The agitator is always ready to pick up half-baked figures, odds and ends that are miserably deceptive, and out of these patch up material with which to harangue and distort.

The wise employer will fight figures with real figures, and falsehoods with absolute, sworn-to if necessary, statements of actual conditions.

Declining Steel Inquiries

THERE has been a perceptible falling-off in inquiries for steel during the past month. It may be that part of this is due to the fact that people become weary of asking for things they cannot get, but that will not explain it all.

The most likely explanation is that buyers are getting weary of paying two or three prices for everything they take into stock, and unless they must buy to avoid a close-down, they are out to stay until there are more signs of sanity in steel prices.

For instance a salesman dropped into Toronto this week with the information that he had a fair tonnage of black sheets at 8 cents per pound. He found several firms ready to talk business. These warehouses have to add their profit, which will mean, exchange added, a re-sale price of around 10 cents to the consumer in Canada for black sheets.

There are firms that must have black sheets or go out of business, and for this reason they pay through the nose. It is not correct to say they are willing to pay these prices. They pay them because they have to pay them or close up shop.

To get some idea of the average prices for sheets at Pittsburgh, take the five years 1910 to 1914 inclusive, and the prices will average this way:

Year	Per Ton
1910	$45.80
1911	40.60
1912	40.00
1913	44.00
1914	37.80
1920	87.00

Prices for Canada are not always regarded as domestic business by United States mills. The recently announced schedule of the American Sheet and Tin Plate at Pittsburgh was 4.35. Add one cent per pound, or $20 a ton for Canada and we have $100.70 per ton. Freight, duty, exchange added will put the Canadian user in for a sheet that will cost him around 7.35 without any profit for a dealer. When you get into the premium class and start 2.65 per pound higher than the Canadian price from the Steel Corporation, and add the profits of a dealer here on the basis of the increased capital necessary to handle the stuff, you are going to have an article that will cost the Canadian buyer around $240.00 per ton.

How is the Canadian manufacturer going to turn out material to compete with articles made in United States under such conditions?

The result is to be seen in the falling off of the demand in the steel trade. It does not mean that there is not a demand and a scarcity for steel. Rather, the real interpretation is that buyers are dropping off unless for absolutely vital supplies, until such time as some of the premium brokers get off the map.

TRANSPORTATION HAS BEEN THE ONE REAL PROBLEM

And Traffic Has Increased With Much Greater Speed Than the Cars to Take Care of It

By E. A. McCARTHY, Hyatt Roller Bearing Co.

DURING the past winter I have seen office men of mediocre physique spend night after night in various railroad switching yards out in the snow and rain to make sure that their shipments were moved. I have seen these same men roll up their sleeves alongside freight handlers and help transfer stuff from one car to another. I have seen farm tractors do switching work day after day—switching that technically was the duty of the railroads. I have known manufacturers to send men across several states to get a trunk or a suit case full of parts to be used for completing machines—machines that were often sold at a loss.

One Michigan manufacturer, within the next few weeks, will begin operating a fleet of trucks between his factory and his sources of supply—in some instances a distance of over 700 miles!

In our own organization every man who has visited our factory during the past six months has been instructed to bring back as many bearings as he could carry as baggage.

During the express handlers' strikes over half of our office force went down into the railroad yards and spent day after day—sometimes far into the night, unloading express cars containing our product in order to expedite deliveries to our customers.

It is hard for the public to realize just how many difficulties have beset the manufacturer in making deliveries during the past two years. Never before have so many different obstacles had to be overcome.

Although on every hand we hear cries of greater production, I believe that a thorough analysis would convince anyone that it is more a question of transportation, for even with disturbed labor conditions the majority of delays in manufacturing can be traced directly or indirectly to delays in transporting material.

During the past three years transportation has been the "neck of the bottle." No one has been free from the effects. The manufacturer has been delayed in getting his material. He is dependent upon the steel mills and the parts makers, and they in turn are dependent upon the mines, and then again the mines are dependent on other manufacturers for mining equipment with which to operate.

The farmer is dependent on many phases of the manufacturing industry to supply his needs and absolutely everyone is directly dependent upon the farmer.

Thus we get an endless circle of dependencies and analyzing the situation from its various angles the wonder is that things are moving along as smoothly as they are.

Since 1915 the volume of freight handled in this country has increased 45 per cent. During the same period the increase in number of freight cars amounts to only 2 per cent.!

This deficiency in freight car equipment is seen reflected in express service: when a shipper realizes the congested freight condition he routes more and more of his goods by express.

As a result of this condition express shipments have increased more rapidly than ever before. Few express cars have been built during the past three years. To-day it is quite the practice to ship commodities by express that under normal conditions would have always gone by freight. This has been a substantial factor in increasing prices.

The railroads are the arteries through which the very life blood of the nation flows. These arteries are hardened, they no longer expand, the blood pressure is high. Goods cannot be freely transported from one section of the country to another and as a result of this our whole industrial system is out of joint.

The only way to compensate for the deficiency is to speed the flow of products through the available channels. It is up to the traffic men—both with the railroads and with private corporations to accomplish this.

It is a "man's size job." It is an unending job. Conditions are serious—if we give up to them they will immediately become disastrous!

More work, more thought and less talk are needed. High-brow legislation will not change the economic condition. The problem is practical rather than political. We have no time to spend in proving who is to blame. It's a question of making the best of things by putting forth constructive effort and real "sweat."

Speaking of Gardening

ABOUT this time most every year when bullfrogs make a sound, men get a hankerin' in their souls to gouge into the ground, and there to plant a seed or two, or stretch 'em in a row, and wield a shovel and a rake to coax the truck to grow.

Ah! Well, I mind when once I went and bought a rake and spade, likewise a hoe, the slickest thing a man had ever made. I got a shovel and a trowel, wheelbarrow and a line, and reckoned in the winter on spuds and beans we'd dine.

The outfit cost me seven bones, stripped from my fading wad, before I ever made a hole or turned the thistled sod.

Tomato plants and radishes, cucumbers, onions too, I stuck in carrots, beets and corn—the plot was ten by two.

Whene'er I saw a weed in there I got the spade and hoe, and said you evil sproutin' thing from this here place you go. It was a joy unto my eye to see the green stuff sprout, until the slugs and bugs and lice began to look and shout, and tell their friends about my stuff, about my tender shoots, and while I tinkered on the top they tinkered at the roots.

Tomatoes were a bilious hue, the worms they weighed a pound, they got their fists clenched for a scrap whene'er I came around; the lice they swiped the radishes, they riddled them right through, I had six carrots from the wreck to figure in a stew.

My garden was a mess all right, old Hicost stayed with me, I'd reckoned to have chased that prune into some lofty tree.

But every time when spring comes round I grab my rake and hoe, and out on my ten feet of earth I start to make a show. I know I aint no gardener, but then, by heck, it's nice, for easy marks like me to feed tomato worms and lice.—Ark.

THE overall fad and the strike against using potatoes fell asleep at the side of the road. One reliable report has it that Old Man Hicost ran over them with his cart.

* * *

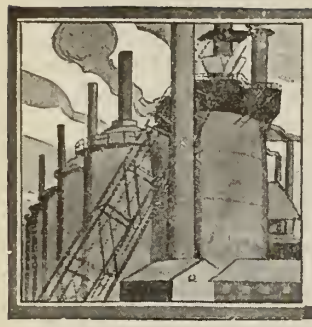
IN THE machinery, iron and steel world just now, it is one thing to buy goods, and quite another to receive them.

* * *

THE Germans now say that the Kaiser lost the war, and they were prepared to can him early in 1918. All these postmortems are wasted time and energy. The fact is that had the war been going well the Kaiser would have been regarded as a dandy. Nothing succeeds like success, and nothing is so unpopular as a failure.

* * *

A NORWEGIAN astronomer has discovered that the real color of the sky is black, and not blue. A man who has eaten a dollar meal and found he had 50 cents to pay for it has made the same discovery.



MARKET DEVELOPMENTS

Shipping is a Serious Matter for the Trade Now

Embargo Against Many Points is Still On—Many Orders Have Left the Mills in States, But There is No Trace of Them Yet—Falling Off in Steel Inquiries Noticed

THE steel warehouse trade in Toronto is of the opinion that there has been a falling off in the number and extent of the inquiries, as compared with a month or six weeks ago. Their volume of business is still satisfactory, and their accounts are in splendid shape, but the fact remains that some of the insistence has left the market. High prices and the operations of the premium brokers and mills may have something to do with this, as it is not likely that any consumer would buy a pound more of premium material than he had to have to keep the doors of his shop open. The distance between Steel Corporation prices and those asked by premium brokers is very marked, and business inquiries are dropping off as a result.

The strike is a much more serious matter than is generally recognized. Firms in Canada are having serious times trying to get cars from U.S. points. Embargoes are holding back materials that are absolutely necessary to the operation of plants. There are cases where shipments of boiler tubes, for instance, left the mills at the end of March, and have not been heard of since either by customer or shipper.

The machine tool trade believes there is a lot of business in the country that will come out later on, viz., the replacement selling. Firms wanting to replace old equipment have stayed out of the market on account of long and indifferent deliveries and the high prices. This booking will all come in due season, and makes a nice reserve in the way of business for the future.

The scrap trade continues stagnant. The embargo is still on and trading is confined to Canada. The demand here is not brisk. Prices, though, have not suffered, and are still quoted at the rates prevailing a couple of months ago.

TIRED ORDERING AND NOT GETTING

That May Account for Some of the Falling Off in Inquiries in Steel Market.

TORONTO—The steel trade reports that inquiries have fallen off as compared with a month ago, but they will not state that the sales have sagged a great deal. It may be that some of the buyers have become wearied of asking for material which they have been unable to secure, and a supply and some definite promise of delivery might do much to bring them back into the market.

The railroad troubles in United States have played havoc with deliveries. The representatives of one of the large machine tool plants was in Toronto today, and speaking with this paper stated that during the past month the deliveries they had been able to make amounted to some $20,000. The rest of the material was piled and stored waiting for some betterment in the shipping situation.

There are several views on the machine tool situation that have value as causing people to think. "There are a number of plants," stated one dealer, "where they have put in a lot of money in plant and equipment. They have been held back by a hundred and one things from getting production on a paying basis. It is necessary for them to stay in the market and keep on buying in order to get production to the point where their money will start to come back. It is very natural that they should wish to reach this point while their selling values are still at the high mark.

The Resale Market Still Here

"Then there is the re-sale market for machinery. By that we mean the taking in of machinery for the purpose of replacing tools that are either worn out or out of date. That market is still here, and it is going to be a good one when some of this special business gets attended to. There are plenty of places that are doing what people are, viz., making the old stuff do. This business is piling up, and a certain amount of it is forced into the market every now and then by necessity, but there is a lot of it that has not come and it forms a very nice reserve for the future."

"We are certainly placing no orders for stock," stated one dealer to-day. "A good many of the makers of machinery are enforcing the non-cancellation clause again. We will order only against a certain and definite sale."

Demand is Falling Off

Inquiry has fallen off in the steel market in the past few days. That is the consensus of opinion of several dealers. The month of April was an exceptionally good one. The steel trade is in good shape here, though, for whatever happens. One manager stated that he was certain they did not have $1,500 on their books now, and all of this, he thought, could be gathered up in a short time were it necessary. Others report the same state of the market. "We can't slump," laughed one of the steel merchants when speaking of the matter, "for the very good reason that there is hardly anything in our warehouse to slump on." He went on to state that the reason for Japan's trouble financially now has been the high prices they have been paying for all classes of steel material. Every agency from the commission man, jobber, through to the user, is stuck with high priced material there. Canada has not sinned in this regard. We have paid higher prices than ordinary because we have had to do it."

Premium dealers are booking more business in Toronto this week. A good tonnage of black sheets went at 8½ cents f.o.b. United States points, and that will mean a pretty fair advance when the material passes out of the warehouses here.

A representative of one of the largest steel mills who was in Toronto this week stated that he had seen hardly a single freight car moving between Pittsburgh and Buffalo. Shipments for

this district are very bad, and not a few manufacturers are in bad straits waiting for some material in order to finish up and release a lot of goods that have a more or less seasonable sale. In one case a large number of gas engines are waiting for a few parts to let them out.

One Toronto firm ordered 150 tons of boiler tubes, and were delighted with the manner that the first two cars got over the border. That would account for about 60 tons. Since then they have heard nothing of them. The rest of the shipment is either caught in the embargo or lost.

A number of shipments were started from U. S. points at the end of March. Where are they? No person seems to know. Efforts that have been made to trace them have not been successful.

The Scrap Trade is Quiet

Dealers are inclined to blame the embargoes for the unusual dullness that has settled down on the scrap metal trade. Any business that is carried on is confined of necessity to Canada. The reds and yellows are very dull, and about all the trading that is being done is being held for future delivery or speculation. The demand for iron and steel is not very insistent or pressing. It is possible to get orders filled now for a fairly wide range of wanted materials, although there is still room for a holder of stove plate, cast scrap or heavy melting to get a hearing in the market at a good figure. Prices are not being changed yet, although it is easy to see that there is a weaker feeling in the market.

GERMAN TOOLS NOT IN MUCH FAVOR

At Least That Is the Report That Comes from Germans Out to Make Investigation.

Special to CANADIAN MACHINERY.

NEW YORK, May 13.—Improvement in railroad transportation has brought a better feeling in the machine-tool trade. Some plants are now making shipments for the first time in weeks. Locally the demand for machine tools has fallen off in the past week, but it is not to be expected that buying in volume would continue under the uncertain conditions which prevail.

The Norfolk & Western Railroad has not yet begun placing orders against the list issued a couple of weeks ago, but it is understood these orders, amounting to hundreds of thousands of dollars' worth of shop equipment, will be forthcoming soon. The Long Island Railroad has inquired for a few tools. The General Electric Co. is again in the market for tools. Aside from some of the large automobile companies, the General Electric Co. has probably been the largest buyer of machine tools in the United States during the past year. A new list has been issued for the recently acquired plant at Bridgeport, Conn. About 15 milling machines, eight shapers, several grinders and other tools are required. Some of the equipment recently bought for the Bridgeport plant was diverted to the new Baltimore, Md., plant. The Simms Magneto Co., East Orange, N. J., has purchased additional tools, its purchases in the past several weeks having been fairly large. The Van Sicklen Speedometer Co., Newark, N. J., and Toledo, Ohio, has cancelled some of its recently-placed orders, as it will not make magnetos, but will confine its production to speedometers. The S. S. White Dental Mfg. Co., Staten Island, has bought several tools.

Export trade is not notably large, but some business is coming through, notably from England. It is stated that the automobile manufacturers there will copy American production methods to some extent, and are seeking American production tools. Multiple spindle drills and milling machines are particularly in demand. A newspaper dispatch from Berlin, Germany, quotes a letter written from London by the leading member of a German committee which was sent to England to foster trade relations between Great Britain and Germany, in which it was stated that owing to the huge quantities of American machine tools with which England has been flooded during and since the war the latter country offers small encouragement to German manufacturers of machine tools. "These American tools," he writes, "are of excellent quality and made to the English foot and inch measure. For that reason they are preferred. Moreover, English workmen still have strong objection to tools of German make. The German manufacturer must have patience."

One of the largest export inquiries before the trade is from Anderson, Meyer & Co., 80 Wall street, New York, an export concern, which wants about 30 tools for shipment to China.

THE RAILROAD STRIKE IS WORSE THAN HAS BEEN GENERALLY STATED

Special to CANADIAN MACHINERY.

PITTSBURG, May 13.—Pig iron production in April, curtailed by the rail strike, was at the rate of about 33,650,000 gross tons a year, or at 75 per cent. of capacity, if capacity be estimated at 45,000,000 tons a year, and that seems to be a fair estimate, though possibly it may be found to be a trifle low, if favorable manufacturing conditions, like those obtaining before the war, ever return. The March rate had been 90 per cent. of capacity, and as the rail strike did not apply to the entire month of April it is evident that when the strike was at its worst the rate of pig iron production was more than one-sixth off from the March rate. Had it not been for the strike production would probably have increased, since all the trends were in that direction. The production of steel was probably affected by the rail strike in about the same manner as was the production of pig iron. The April steel ingot report of the American Iron and Steel Institute should appear in a few days and will permit of an exact comparison being made.

Production of pig iron and steel has continued to grow, although at a rather slow rate. Among producers there is a disposition to complain that reports as to the rail strike waning are altogether too favorable, that the strike is still very bad, but on the other hand one can observe also that the producing trade has a disposition to magnify the effects of the strike upon production, by not making sufficient allowance, in the general average, for the plants that are working practically full. Thus the South and East are scarcely affected at all, and some of the plants on the lake front are doing quite well, almost normal. The Youngstown district, the one most affected, seems to be producing at more than half capacity, while the immediate Pittsburgh district is probably doing better than 80 per cent.

Trainload Movements.

In the territory affected by the strike, most of the freight movement in connection with the iron and steel industry is of the solid trainload variety. Such coal and coke as reached the Youngstown district, for illustration, is altogether by trainloads, direct from coal mines in the case of coal, and from yards in the Connellsville region in the case of coke. Inasmuch as it is much more difficult to make up solid trainloads of finished steel products, the movement out of works is smaller than the movement of raw materials to works, and thus, in the main, steel is accumulating at mills. There are a few large consumers who can take entire trainloads of steel, but the ordinary consumer cannot. There has been some movement of trainloads to Western classification yards, whence individual cars are dispatched to Western consumers. Permits to ship carloads are obtainable with slightly more ease than a week ago, and a few districts have had their embargoes entirely removed. There is the further difficulty that car supplies for loading are very poor.

Steel consumers are affected not only by not receiving steel, but also by not receiving coal and other necessities. In Detroit, for instance, the lack of coal is greater than the lack of steel, and factory operations in that district are now probably below 50 per cent. of normal. On the whole it would seem that the consumption of steel is curtailed more than the production, and the balance of probability is that when the strike is over steel will reach consumers in large

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$42 40
Lake Superior, charcoal, Chicago	57 00
Standard low phos., Philadelphia	50 00
Bessemer, Pittsburgh	43 00
Basic, Valley furnace	42 90
Toronto price:—	
Silicon, 2.25% to 2.75%	52 00
No. 2 Foundry, 1.75 to 2.25%	50 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 50
Steel bars, base, Toronto	5 50
Iron bars, base, Montreal	5 50
Steel bars, base, Montreal	5 50
Reinforcing bars, base	5 00
Steel hoops	7 00
Norway iron	11 00
Tire steel	5 75
Spring steel	10 00
Band steel, No. 10 gauge and 3-16 in. base	6 00
Chequered floor plate, 3-16 in.	9 40
Chequered floor plate, ¼ in.	9 00
Staybolt iron	9 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	4 00
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 90
Small shapes under 3"	3 62

C.L. L.C.L.

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points		
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

Gross.

	Montreal	Toronto
Lake copper	$25 00	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	72 00	75 00
Spelter	12 00	12 25
Lead	11 50	12 00
Antimony	14 50	14 00
Aluminum	34 00	35 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$ 7 25	$ 7 25
Plates, ¼ up	6 50	6 50

PIPE—WROUGHT

Price List No. 44—April, 1920.

STANDARD BUTTWELD S/C

	Steel		Gen. Wrot. Iron	
	Black	Galv.	Black	Galv.
⅛ in.	$6 50	$ 8 50	....	....
¼ in.	5 13	7 26	$ 5 43	$ 7 56
⅜ in.	5 13	7 26	5 43	7 56
½ in.	6 84	8 42	7 27	8 84
¾ in.	8 45	10 58	9 03	11 16
1 in.	12 50	15 64	13 35	16 49
1¼ in.	16 91	21 16	18 06	22 31
1½ in.	20 21	25 30	21 59	26 68
2 in.	27 20	34 04	29 05	35 89
2½ in.	43 00	53 82	....	....
3 in.	56 23	70 38	....	....
3½ in.	71 30	88 32	....	....
4 in.	84 48	104 64	....	....

STANDARD LAPWELD S/C

	Steel		Gen. Wrot. Iron	
	Black	G lv.	Black	Galv.
2 in.	$30 90	$37 74	$34 60	$41 44
2½ in.	45 34	56 16	51 19	62 01
3 in.	59 29	73 44	66 94	81 09
3½ in.	73 14	90 16	82 34	99 36
4 in.	86 66	106 82	97 56	117 72
4½ in.	0 98	1 23	1 24	1 49
5 in.	1 15	1 44	1 44	1 73
6½ in.	1 49	1 86	1 87	2 25
7 in.	1 94	2 43	2 42	2 90
8-L in.	2 04	2 55	2 54	3 05
8 in.	2 35	2 94	2 92	3 51
9 in.	2 81	3 52	3 50	4 21
10-L in.	2 61	3 26	3 25	3 90
10 in.	3 36	4 20	4 18	5 03

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.

4½" and larger 50%.

4" and under, running thread, 30%.

Standard couplings, 4-in. and under, 30%

Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices.

Per 100 Pounds.

	Montreal	Toronto
Copper, light	$15 00	$14 00
Copper, crucible	18 00	18 00
Copper, heavy	18 00	18 00
Copper wire	18 00	18 00
No. 1 machine composition	16 00	17 00
New brass cuttings	11 00	11 75
Red brass cuttings	14 00	15 75
Yellow brass turnings	8 50	9 50
Light brass	6 50	7 00
Medium brass	8 00	7 75
Scrap zinc	6 50	6 00
Heavy lead	7 00	7 75
Tea lead	4 50	5 00
Aluminum	19 00	20 00

	Per Ton	Gross
Heavy melting steel	18 00	18 00
Boiler plate	15 50	15 00
Axles (wrought iron)	22 00	20 00
Rails (scrap)	18 00	18 00
Malleable scrap	25 00	25 00
No. 1 machine east iron	32 00	33 00
Pipe, wrought	12 00	12 00
Car wheel	26 00	26 00
Steel axles	22 00	20 00
Mach. shop turnings	11 00	11 00
Stove plate	26 50	25 00
Cast boring	12 00	12 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜-in. and less	10
Carriage bolts, 7-16 and up	Net
Coach and lag screws	25
Stove bolts	55
Wrought washers	45
Elevator bolts	Net
Machine bolts, 7/16 and over	Net
Machine bolts, ⅜-in. and less	15
Blank bolts	Net
Bolt ends	Net
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square, blank	add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 50
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	25 and 5
Sq. and hex. hd. cap screws	22½
Rd. and fil. hd. cap screws	plus 17½
Flat but. hd. cap screws	plus 30
Fin. and semi-fin. nuts up to 1-in.	20
Fin. and Semi-fin. nuts, over 1 in., up to 1½-in.	10
Fin. and Semi-fin. nuts over 1½ in., up to 2-in.	Net
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$60 00
Open-hearth billets	60 00
O.H. sheet bars	76 00
Forging billets	56 00-75 00
Wire rods	52 00-70 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 70
Cut nails	5 85
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 35½
British Manila rope	0 28
New Zealand hemp	0 28
Transmission rope, Manila	0 47
Cotton rope, ¼-in. and up	0 88

POLISHED DRILL ROD

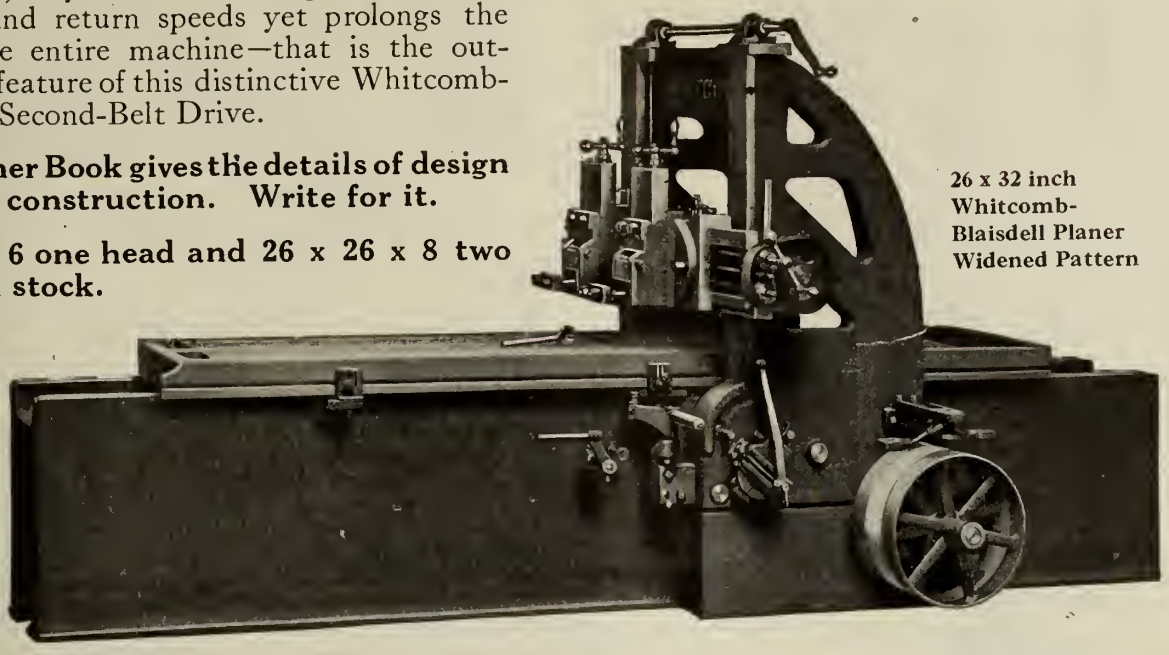
Discount off list, Montreal and Toronto	net

The Planer With the Second-Belt Drive

A smooth, easy reverse—which permits higher cutting and return speeds yet prolongs the life of the entire machine—that is the outstanding feature of this distinctive Whitcomb-Blaisdell Second-Belt Drive.

Our Planer Book gives the details of design and construction. Write for it.

24 x 24 x 6 one head and 26 x 26 x 8 two heads in stock.

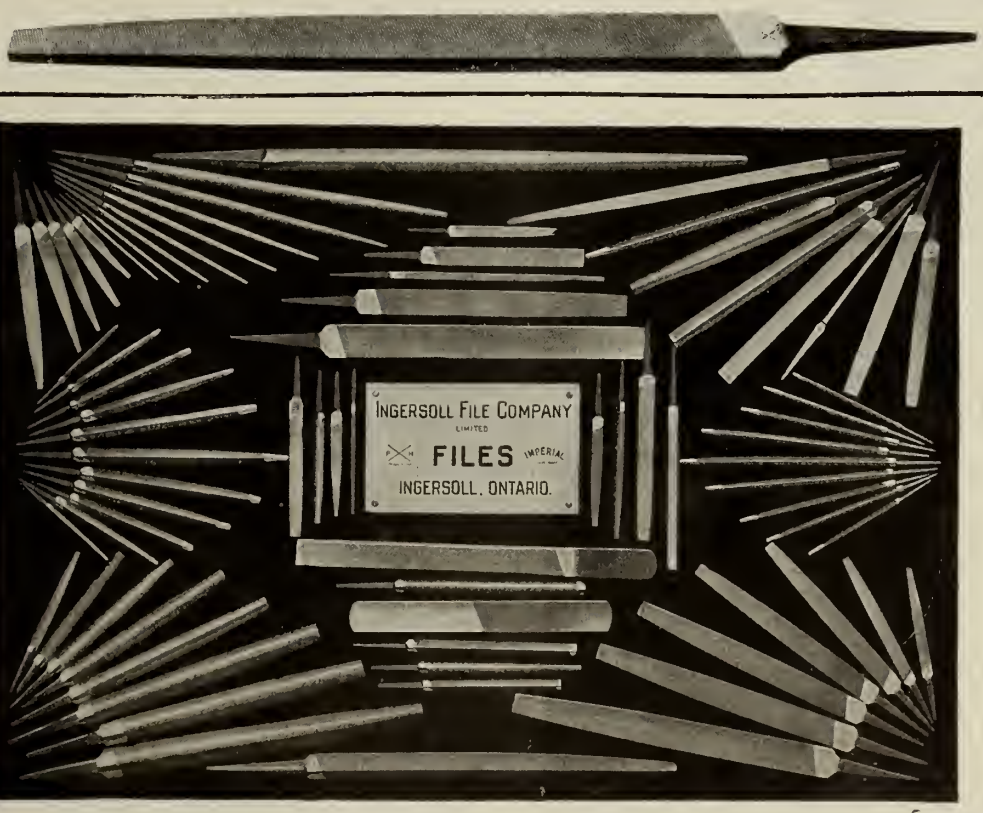


26 x 32 inch Whitcomb-Blaisdell Planer Widened Pattern

THE A. R. WILLIAMS MACHINERY CO., LIMITED

Halifax, St. John, Montreal, Winnipeg, Vancouver

64 W. Front St. TORONTO



P H

IMPERIAL

INGERSOLL

quantities, perhaps uncomfortable quantities in some instances.

Steel Shortage

Whatever shortage in steel exists now is due to transportation conditions. There is a new situation. The market is no longer wholly in favor of the sellers and as trends are now it may be only a short time until the market is wholly in favor of buyers. The fancy premiums recently obtained so readily for prompt shipments are melting away. One cannot buy much steel for early delivery, but that is on account of transportation conditions. When it becomes possible to move steel freely there will not be much tonnage demand at the highest prices.

There is an easier situation as to moderately forward deliveries, such as are made by the larger independent producers, but this has not resulted in much price decline, at least thus far. The mills are maintaining their prices, except perhaps when a particularly desirable contract for extended deliveries is offered. The policy is to maintain prices, even though current sales are considerably less than current production, as larger sales could hardly be made by reducing prices. The mills have enough business on books to carry them comfortably for a while yet and feel that there is no occasion to make price concessions until they are forced to do so in order to maintain operations.

There is a question, indeed, whether some of the mills would not prefer that there be a period of slack operation, for the purpose of reducing production costs, and particularly of showing labor that jobs are not guaranteed to be of indefinite life at whatever wages are asked and irrespective of the amount of work done to earn the wages. The feeling has been growing rapidly of late in banking and manufacturing circles that the country needs a readjustment before it can be really prosperous, a readjustment that will make everybody willing and really anxious to work and will bring down the cost of living.

Coke and Pig Iron.

The increase in opportunity to ship foundry coke noted in last report has not continued, chiefly because car supplies have become poorer instead of increasing further. The blast furnaces have much less difficulty than the foundries, since Connellsville coke is moving through to blast furnaces in solid trainloads, and when the cars are unloaded the empties go straight back. Foundry coke, on the other hand, is shipped in single carloads, and many regions are entirely closed by embargo, although occasionally a shipping permit can be secured in the case of embargoed territory. Prompt Connellsville coke has gone up $1 a ton on both furnace and foundry, being now quoted strong at $12 for furnace and $13 for foundry, per et ton at ovens. Foundry coke on contracts beginning July 1 is held at $11 to $12, depending on grade and reputation.

There is considerable discussion as to the extent to which the consumption of foundry iron is being curtailed by the strike, and particularly as to the relation the consumption now bears to the production. The balance of probability is that consumption is curtailed more than production. Many furnaces are piling iron, some of them practically their entire make. The spot most affected by the rail strike, the Mahoning valley, produces hardly any foundry iron, the furnaces there being attached to steel works with only one or two exceptions.

Pig iron prices are firmly maintained, but transactions are confined to small lots, for early shipment. The market stands at $42.50 for Bessemer, $43 for basic and $43 to $45 for foundry, valley basis, freight to Pittsburgh being $1.40.

POINTS IN WEEK'S MARKETING NOTES

Transportation problems are serious for many Canadian manufacturers now. There are cars of material on the way, and that is about all that is known of them.

—

One Toronto warehouse has had cars of tubes on the way from Pittsburgh since the end of March, with no word of their whereabouts.

—

It is stated that all that one firm of machine tool makers were able to ship in the month of April was $20,000 worth.

—

Dealers report a smaller inquiry for steel than a month ago, but state, on the other hand, that their sales remain very satisfactory.

—

The scrap metal market, owing to the embargo, is very quiet. Business must be either for use at home or storing for future shipment or speculative prices.

—

Pittsburgh intimates this week that the market may soon turn in favor of the buyers.

—

The production of pig iron in April, due to the strike, was about 75 per cent. of the capacity of the U. S. furnaces.

—

Germans have had representatives in England trying to find out what chance there is for getting the German machine tool on that market again.

—

A large number of makers of machinery and engines in Canada have a quantity of production partly finished, but cannot complete it because some of the parts are lacking.

BRANTFORD FIRM JOINS ONE IN ERIE

A Large Factory is Under Consideration —John R. Hall Co. is the Canadian Concern

The John Hall & Sons, Ltd., pipe machinery manufacturers of Brantford, have merged with the Williams Tool Corporation of Erie, the largest manufacturers of pipe machinery in the United States, with a capital of one million dollars. John R. Hall & Sons, Ltd., are the largest manufacturers of pipe machines in Canada.

The Brantford plant will be known as the Hall plant of the Williams Tool Corporation. At present it is running to full capacity, and have been operating a night shift for some months past. No radical change will be made in the management.

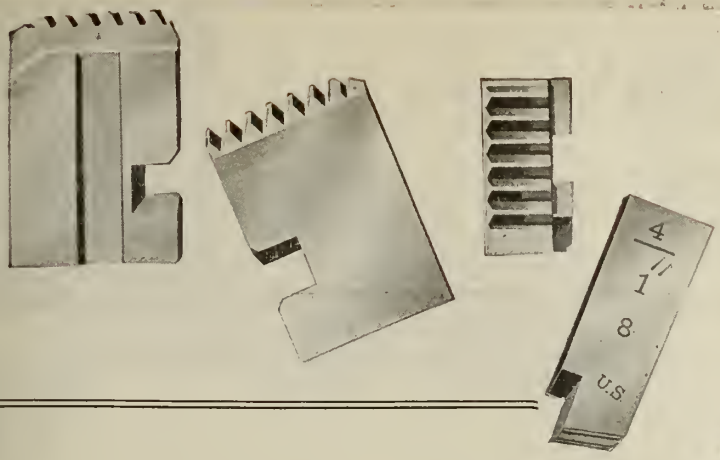
Leslie S. Hall, president and general manager, will be vice-president of the American company, taking an executive position between the two plants. A. R. Hall will be manager of the local plant, and E. L. Williams in charge of the office. E. W. Hall is retiring as secretary and treasurer of the company, and E. L. Hall will no doubt continue with the new corporation on his return from England.

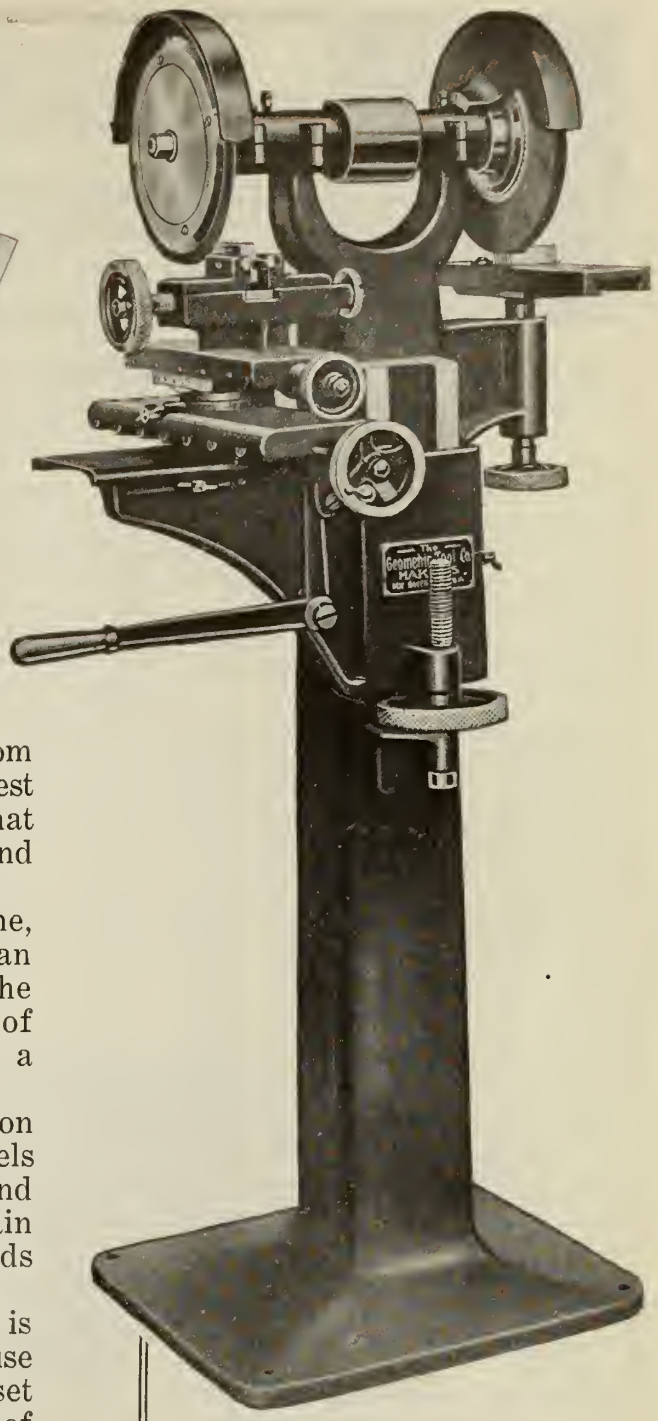
A larger factory is under consideration, but it is too early to give definite plans. The Brantford company set a number of records for speedy manufacture of war munitions machinery.

DAVIS-BOURNOVILLE MOVE TO TORONTO

Factory and Office Will Be United in New Building at 32-34 Eastern Avenue

The Davis-Bournonville Co. announce the removal of their plant from Niagara Falls, Ont., to Toronto. After the first of June the plant and offices will be situated at 32-34 Eastern Avenue, Toronto. The office, which has been maintained at 168 King Street West, will be transferred to the above address. The new building is 50 x 110 feet of brick and steel, and is about completed now. In it will be installed a model generator installation, which will distribute by pipes through the factory. The oxygen will be manifolded and piped through the premises as well. They will manufacture oxy-acetylene welding and cutting apparatus, and make automatic equipment, oxygraphs for die cutting, barrel welding machines and other automatic equipment. Mr. J. F. Crowley, who has been the district sales manager, speaking to CANADIAN MACHINERY of the changed location, stated that they were certain that with office and factory under one roof they would be able to get much better results in the way of service and output. The change of location becomes effective on the first of June.





Sharp Chasers Cut Clean Threads

Accurate, uniform threads result only from dies which are maintained in the highest state of cutting efficiency. This means that chasers must be kept sharp, and ground uniformly.

Even if just touched up from time to time, the chasers respond splendidly, with clean threads. And with this machine — the Geometric Chaser Grinder—the matter of keeping threading tools up to scratch is a comparatively simple matter.

Various makes of chasers can be ground on this adaptable machine. The two wheels permit the easy grinding of both milled and tapped chasers. In addition, the plain wheel lends itself readily to various kinds of tool grinding.

Uniform grinding of a set of chasers is purely a mechanical matter through the use of adjustments which can be accurately set to govern the grinding of an entire set of chasers.

The Catalogue describing this machine is a mine of information on chaser grinding. Write for it.

THE GEOMETRIC TOOL COMPANY

NEW HAVEN **CONNECTICUT**

Canadian Agents: Williams & Wilson, Ltd., Montreal; The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg, and St. John, N.B.; The Canadian Fairbanks-Morse Co., Ltd., Manitoba, Saskatchewan, Alberta.

If interested tear out this page and place with letters to be answered

INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS PERSONAL AND TRADE NOTES

SHORTAGE OF HYDRO POWER HAS STOPPED THE WORK AT BALDWIN'S

Owing to lack of Hydro power all construction work at Baldwin's Canadian Steel Corporation, Ashbridge's Bay, Toronto, has been stopped. The president, Mr. A. M. Russell, is now waiting to hear from the directors of the concern in England to decide what steps to make next. The company has threatened to move to Quebec Province.

On May 5 the president wrote a letter to Sir Adam Beck calling attention to the Hydro's assurance that the plant would be able to get adequate power, and the later admission of Sir Adam that there was a shortage. "We acknowledged receipt of a letter signed by Mr. Pope, dated the 3rd instant, on the subject of the power supply for the operation of our plant," says the letter of Mr. Russell. "This letter is to the effect that the commission will supply us with 2,500 horsepower after June 1, 1920." The letter continues that a year ago, when Mr. J. C. Davies, managing director of Baldwin's, Ltd., England, was considering the purchase of the assets of the British Forgings, Ltd., the Hydro Commission assured them that there would be plenty of power, and the commission was willing to agree to 20,000 kilowatts in blocks of 1,500 kilowatts as required by the company. Negotiations as to price took place.

"The price was settled and there never was a suggestion that the power requirements would not be met," continues the letter. "Obviously a plant such as the British Forgings is useless without power to operate it, and Baldwin's Ltd. would not have purchased it if they were not assured of power."

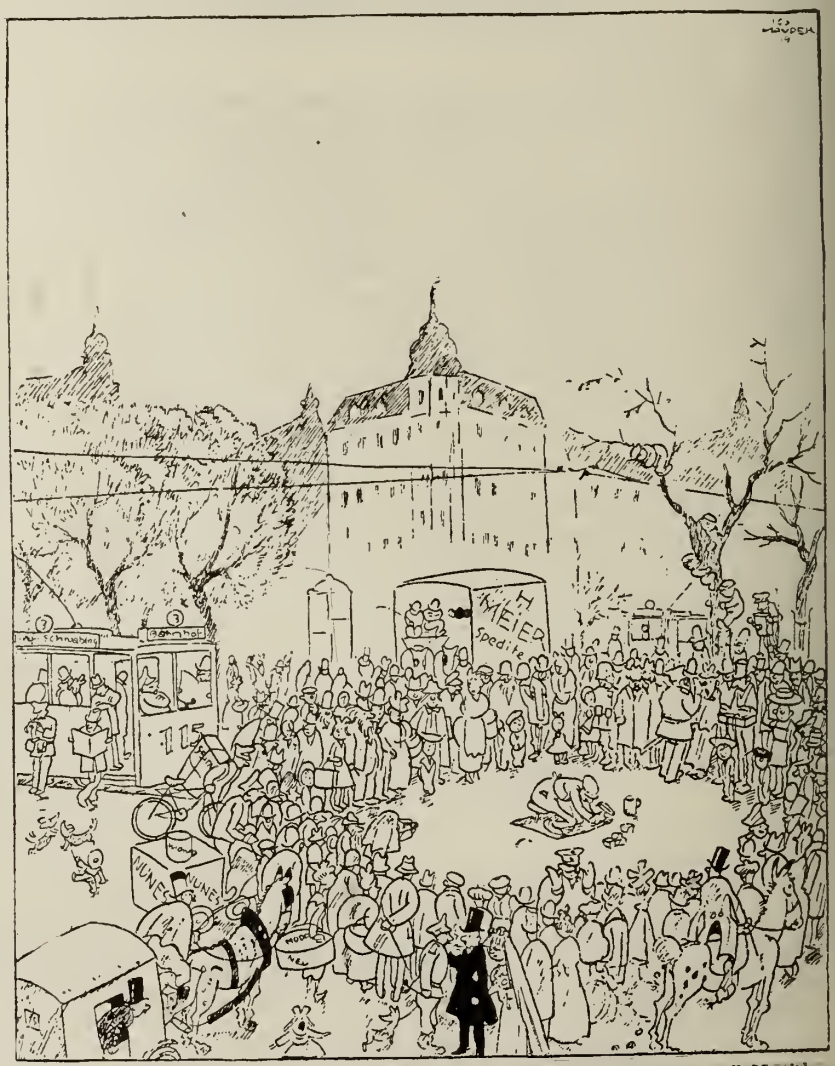
The minimum amount of power necessary for the next 18 months would be 2,500 horsepower in June next, for the first unit of the rolling mill; 2,500 horsepower by next September for the second unit of the rolling mill, and 3,500 horsepower by 1921 for the sheet bar mill.

Mr. Russell, president of Baldwin's, stated that if the company could continue its programme as intended they would be employing between 2,000 and 2,500 men by next year at this time. At present work has stopped on several large steel buildings.

Price of Coal—A Montreal report says: "Another jump in the price of coal brings with it the gloomy news that still another 75 cents or $1 may be shortly added. The new price of $16 a ton, an advance of 75 cents on the price set, is due, says the coal dealers, to the increased wages that will be given to the miners in consequence of the recent settlement with them. An increase in the freight rates is daily expected, and one dealer thinks that $17 coal will be the order of the day before the month is out. As for after that—no one is bold enough to prophecy. The dealers state emphatically that none of the present increase goes into their pockets, but is all swallowed by the miners and the railroads.

Fight Over Patent.—Jack A. Manns is said to have disposed of rights in a mechanical electric railroad and safety signal device to the Grand Trunk for a large sum. William A. Wilson was granted an injunction by Justice Kelly at Osgoode Hall restraining Manns from finally disposing of the rights until May 12. Wilson says he is a machinist and that for six months he and Manns worked on a

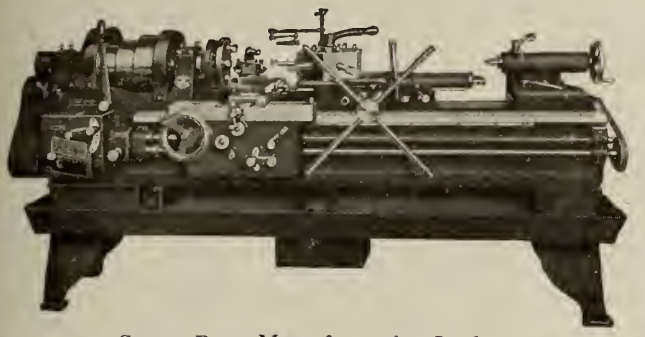
IN GERMANY—OR ELSEWHERE



From "Meggendorfer Blaetter," Munich.

Somebody At Work

LATHES LATHES LATHES



Severe Duty Manufacturing Lathe

Practical equipment for every plant.

Sizes 16″ to 28″; belt or motor drive.

Cone type or geared head.

Features — wide range quick change gear box; double wall apron; chasing dial; automatic stop; cabinet leg, etc.

A Lathe for Every Purpose

All attachments such as taper, relieving, draw-in, pump connections, turret on carriage or on bed. Metric gears, etc. for all sizes.

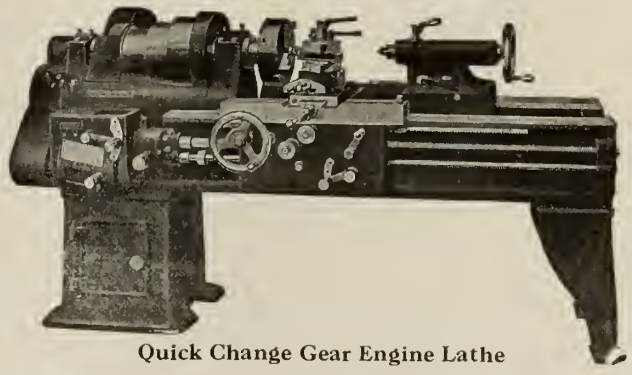
CINCINNATI Lathes, though powerful in every detail, are neither complicated in construction nor cumbersome to handle on any work. They have none of the intricate mechanism that means endless repairs and short-lived efficiency.

And BETTER STILL, we are offering these machines for PROMPT SHIPMENT.

"RESULTS COUNT EVERYWHERE"

Let us tell you more about
CINCINNATI LATHES

Manufactured by
Cincinnati Lathe & Tool Company
Cincinnati, O.



Quick Change Gear Engine Lathe

We would remind you that we have in our Toronto warehouse a large number of GOOD USED lathes ranging in size from 7″ to 36″ and MACHINE TOOLS for every operation.

May we have your enquiries

Garlock-Walker Machinery Company, Limited

32 Front Street West

MONTREAL **TORONTO** **WINNIPEG**

If interested tear out this page and place with letters to be answered

model at the rear of the Avonmore Hotel, Jarvis Street, and he advanced $2,500. He says that he was to receive a third interest in the invention. Alfred Senior, in an affidavit, says he advanced $700, for which he was to receive 3 per cent. interest.

TRADING WITH THE WEST INDIES

Good Service is Kept Up and Is of Benefit to Canadians in That Market

Operating under a Royal Charter granted them in September, 1839, the Royal Mail Steam Packet Company, with headquarters in Halifax, N.S., runs a line of mail steamers from St. John, N.B., and Halifax, N.S., to the Bermudas and the other Islands of the British West Indies, making their most southerly call at Georgetown, Demerara, in British Guiana. Their boats carry both passengers and freight and at all times keep up an excellent service.

The advantages of this direct line to Canadian manufacturers, those manufacturing for export and those desirous of importing the products of the islands, is obvious, and especially so in the light of the fact that the Jamaican Government is about to pass a tariff law which will give preference to Canadian products in that market, and that the rest of the islands are anxious to deflect from the United States to Canada the portions of their trade that Canada can take care of.

Messrs. T. McAvity & Sons, Ltd., of St. John, N.B., have in the past year carried on quite an extensive trade with the various firms in the West Indies, shipping to them manufactured brass and iron work in the form of engineers' supplies, steam fittings, valves, etc., and now realizing that their trade can be greatly extended under the new tariff they have sent their representative down to work up and cement their trade connections.

Mr. J. W. Davidson is making an extended tour of all the islands in Messrs. McAvity's interests and will be about eight or ten weeks on his visit.

TRADE NOTES

Mr. H. N. Reynolds, formerly sales manager, has been appointed general manager of the Wilt Twist Drill Company of Canada, Limited, to succeed Mr. F. R. Humpage, who resigned.

Inspecting Shipyards. — Col. Grant Morden, Mr. Roy M. Wolvin, and Mr. J. W. Norcro are on a tour of inspection of the shipyards which will be included in the big steel merger. They will first visit the Davis Shipbuilding Co. at Levis, and go from there to the plant of the Tidewater Shipbuilding Co. at Three Rivers. The latter yard is one of the subsidiaries of the Canada Steamship Lines.

Proposed Share Arrangement.—The latest proposal with reference to the shares of the big steel merger is that they will be of $100 denominations in Canada, and in one pound in England. These will be made interchangeable at the rate of 20 one pound shares for one $100 share. It is possible that arrangements will be made to issue $5 shares, but nothing definite on these lines has yet been announced.

Business Still Dull and Prices Decreasing

The reports from all over the United States speak of a weak market, and a continued tie-up of shipments. Where there are any price quotations given the tendency is downward. The fact that consumers are either shut down or on a very much curtailed operating basis, and that railroads are not moving out material, has practically put the scrap market to sleep for the time being. There has been a little trading among dealers, but they have mostly been stocktaking.

Orders More Locomotives.—The Canadian Locomotive Co. has completed the order of ten locomotives for the Jamaican Government, and received an order from the Ontario Government for four locomotives for the Timiskaming and Northern Ontario Railroad. The engines will be of the Mikado type, and construction will be commenced at once. With the additional large orders already on hand there is work at the Kingston Locomotive Company to keep the plant operating full strength until the end of October at least.

The Benzol Plant.—Steel Company of Canada's benzol plant that is being installed in connection with the coke ovens at the Hamilton plant will be completed by the beginning of September. It is expected that 100,000 gallons of motor fuel per month will be produced as a by-product of the coke manufacture. The shortage of coke has interfered with the operations of the Steel Company plant recently, and there is no certainty when the transportation situation will be sufficiently improved to make it possible to resume complete operations.

Foundry Reopens.—An official statement has been given out that the Canadian Steel Foundries of Welland, which plant has been closed for a year, will commence operations again in six weeks' time. The rolling mills will engage in steel bars and angles as previously, but the foundry will not manufacture couplers and parts, but miscellaneous castings. The foundry will be in operation within 24 days. Mr. Fred Curtin, former purchasing agent, has returned from Hamilton to take charge of his old position. This plant, when running at full capacity, will employ 700 men, about 300 being required by June.

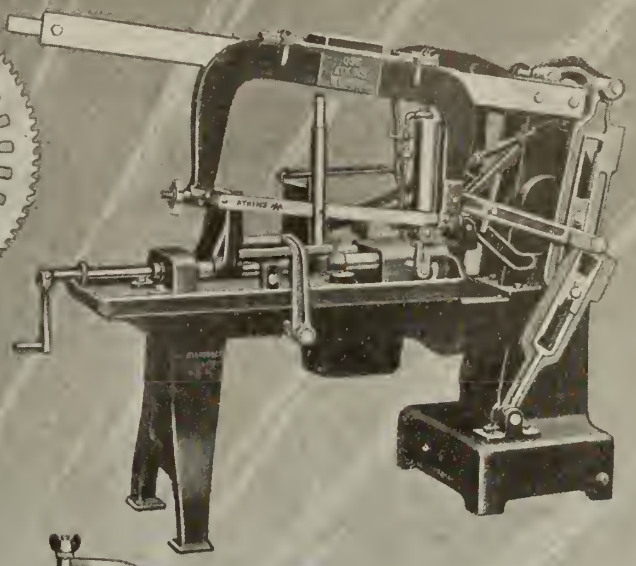
Enlarge London Plant.—The recent reports of the intention of the Ford Motor Company to enlarge its London plant received official confirmation from Windsor. The company's options on Pall Mall and Colborne Street property expire on May 15, but it is expected that they will be closed at once, and that steps will be immediately taken for the erection of a huge five-storey factory building, in which between 1,500 and 2,000 hands will be employed. The Ford Company selected London for the plant after a recent scientific survey which is reported to have established the fact that higher efficiency has been obtained there than elsewhere.

Lower Ocean Rates.—According to a statement from Sir Alfred Booth at the annual meeting of the Cunard Co., lower freight rates are at hand. He added that the "sooner the storm is over the better," and he hoped the result will be a break in the vicious circle of rising wages and rising prices. Sir Alfred Booth said that the cost of converting the Aquitania into an oil burner would be more than recovered by the advantages derived from greater earning capacity. He added, besides two Cunarders recently launched and eleven vessels now under construction and serviceable at the end of next year, would burn oil.

A Costly Business. — The strike of iron moulders, which was called on May 1, 1919, at Toronto, in conjunction with the other unions of the metal trades industry, has cost the International headquarters of the union and the local organization in the neighborhood of $200,000, according to union officials. The union held its regular meeting in the Labor Temple. Mr. H. Webber, its financial secretary, reported that twenty-two moulders of the original eight hundred were still on the strike payrolls at $16 a week. Mr. Webber explained that for a month or six weeks following the strike order, the eight hundred members drew strike pay at the rate of $8 a week.

Conductor's Good Work. — In the C. P. R. "Educational Bulletin" for May reference is made to creditable work on the part of one employee as follows, for which he received ten merit marks: "Conductor A. Samson, in charge of Extra 483 north, St. Maurice Valley Subdivision, noticed bad spot in rail and immediately stopped train and went back found broken rail between switches. He immediately set switches for siding, flagged train No. 388 and advised conductor of that train and asked him to advise Trois Rivieres upon arrival. He advised Dispatcher to put on a 31 order and informed section foreman of the location of broken rail. Conductor Samson's action in this case is certainly very commendable." The same bulletin draws attention again to a dangerous practice as follows: "Notwithstanding the disastrous results which invariably follow, the practice of going between moving cars for the purpose of adjusting couplers is apparently still indulged in by employees to a very large extent, as three employees have sustained serious personal injuries since the beginning of the year as the result of using their hands or feet in adjusting couplers."

ATKINS STERLING QUALITY SAWS



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North South East West

Atkins Sterling Quality Saws

are noted for their efficiency. Their use will increase your production.

Ask for new literature describing Atkins Kwik Kut Power Hack Saw and Metal Cutting Band Saw Machines, Circular Metal Cutting Saws, AAA Hack Saw Blades and Frames, etc.

"A Better Saw For Every Use"

Write for Catalog

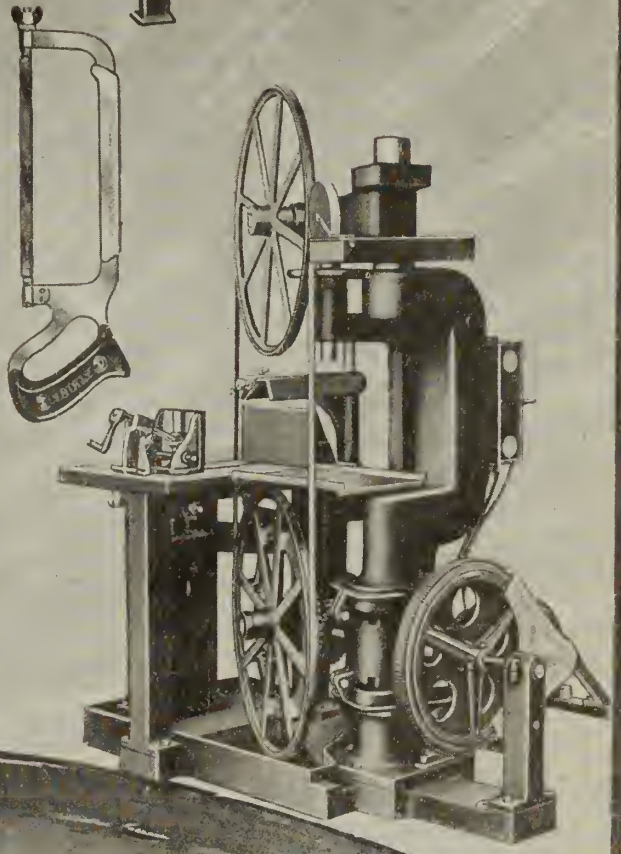
E. C. Atkins & Co.

Established 1857

"The Sterling Quality Saw People"

Factory: HAMILTON, ONT.

Branch: VANCOUVER, B. C.



CANADA'S EXPORT.—Canada's exported produce in the twelve months ending March 31 this year, was valued at $1,239,492,098; for the previous fiscal year the total value was $1,216,443,806, and for the 12 months ending March 31, 1918, $1,540,027,788, according to the report from the Dominion Bureau of Statistics. Among the principal articles of Canadian produce exported during the three fiscal years were: Autos—1918, 8,447, $3,807,278; 1919, 14,180, $7,303,-678; 1920, 24,506, $14,883,607. Auto parts exported increased in value from $1,55,712, in 1918, to $3,079,466, in 1920. Iron and steel—1918, $45,810,367; 1919, $58,854,318; 1920, $61,912,659.

NEW STEEL MILL

Building is Under Way for Structural Material of a Much Larger Size

One of the largest recent developments in the steel industry of Central Canada is the construction of the structural steel mill by the Algoma Steel Corporation at a cost of approximately $7,000,000. This work has already been commenced in Sault Ste. Marie, and it will be completed within the next twelve months, according to the company's plans. Equipment will be installed that will enable the corporation to produce structural steel shapes up to 24-inch channels and beams. Ultimately it is intended to produce 27-inch beams when the demand for this size is sufficiently large in Canada to warrant this. Canada's imports of structural steel of all descriptions have been estimated at approximately 300,000 tons a year. At the outset the Algoma Corporation plans to produce about one-third of the entire requirements of the Dominion, and it will eventually manufacture enough structural material to provide for all domestic needs. In addition to the initial output of 100,000 tons of structural steel, it is planned to roll the greater part of the corporation's rail products in the new mill. Thus, within the next year, the output at the Sault will be raised from 300,000 to 400,000 tons of steel per year, and the number of men on the payroll will be raised from 3,000 to 3,600.

INCORPORATIONS

Insulation and Moulded Products, Ltd., head office in Toronto. The purpose, as set forth in the official notice, is to buy and sell or make insulation material, electrical and mechanical compounds, etc.

Electro Medical Appliance Co., Ltd., has been incorporated in Ontario, to make, buy, sell, etc., electrical goods, machinery, apparatus, etc. The head office is in Toronto, and the provisional directors are G. F. avis, A. J. Layzell, C. Rhydwenn, W. Herdmand and T. J. Wetherald.

Toronto Castings, Ltd., is incorporated in Ontario, with head office in Toronto. The purpose is to carry on the business of iron founders, makers of tools, castings, machinists, etc., and dealers in iron, steel and other metals in its various stages. The provisional directors are V. Smith, M. M. Affleck, F. A. Dewey, H. G. Smith and J. F. Boland. The capital is placed at $500,000, with shares at $100 each.

PERSONAL

Mr. W. H. McIntyre, assistant general superintendent of the Ottawa Electric Co. and the Ottawa Gas Company, has resigned this position to become general manager of the Ottawa Car Manufacturing Co., Ltd. Mr. McIntyre has been with the Ottawa Electric Company for a period of twenty-nine years, and is one of the best known business men in Ottawa. He will assume his new duties at once, the appointment dating from May 1st.

PIG IRON EXPORTS

The following table shows the exports of pig iron from the United Kingdom and the United States in thousands of tons:—

	U.K.		U.S.A.
1913 average monthly	93.7	..	23.9
1919			
January	34.9	..	36.7
February	21.8	..	20.8
March	21.3	..	22.2
April	24.6	..	17.0
May	23.9	..	37.1
June	27.8	..	39.8
July	23.4	..	42.2
August	30.3	..	—
September	32.4	..	—
October	35.3	..	—
November	31.9	..	—
December	48.9	..	—

During the first six months of the year the exports from the United Kingdom were thus less than 40 per cent. of the pre-war exports, whereas during the same period the exports from the United States were more than 20 per cent. in excess of pre-war exports.

It is fairly certain that unless the United Kingdom output of pig iron can be expanded more than at present appears probable, a good deal of the export trade which formerly fell to this country will be permanently diverted to America.

Iron and Steel Material

The production of steel is governed by the supply of pig iron and the ability of the United Kingdom to maintain its pre-war position as an exporter of steel material depends very largely upon whether British steel makers are able to obtain adequate supplies of pig iron, either home produced or foreign, at a price which will enable them to compete in overseas markets with large steel producing countries like America and Germany.

The present scale of pig iron production in this country leaves room for much improvement, but factors tending to restrict output are operating to-day, which it is hoped will disappear when more normal industrial conditions return.

With the exception of ship boiler, etc., plates and black sheets, the volume of trade done in 1919 falls considerably short of the pre-war level. The increase in the plate and sheet trade is attributable to some extent to the enormous demand for this class of material for shipbuilding purposes and to the fact that works in this country were particularly well placed to give prompt delivery as soon as the export restrictions were removed, having been largely engaged in its production during the period of the war.

The outstanding development in the British steel industry brought about by the war was associated with the basic open hearth process, and the 1918 production of this grade of steel was greater than that of 1913 by nearly 1,700,000 tons. The following table shows the steady annual increase in the output during the five years 1913-18, and for purposes of comparison the makes of each of the other classes of steel (with the exception of electric) are included:

	Open Hearth		Bessemer	
	Basic	Acid	Basic	Acid
Year	tons	tons	tons	tons
1913	2,251,793	3,811,382	551,929	1,048,772
1914	2,874,749	3,680,848,	482,444	797,072
1915	2,958,968	4,090,752	579,816	821,408
1916	3,012,558	4,393,004	505,817	1,096,153
1917	3,421,170	4,413,843	602,265	1,059,281
1918	3,924,415	3,901,136	567,659	788,355

The year 1918 thus, in one striking particular, marked a new departure in the British steel industry, as it was the first occasion on which the output of steel by the basic open hearth process exceeded that by the acid process.

TRITRICATE WELDING OF ALUMIUM CRANK CASE

Continued from page 441

rod which is also used to smooth off the surface of the weld after it is completed but as already stated, the use of a good flux is advantageous.

There are many repairs on aluminium crank-cases which can be done without preheating and others which can be carried out by more or less inexperienced operators. No matter how badly damaged a case may be, a repair by the oxy-acetylene process will generally prove a paying proposition. In the example shown in the photographs, for which we are indebted to the Bow-Welding and Sheet Metal Co., who carried out the repair, the makers could not supply a new crank-case for eight months. The cost of a new case would have been $200. The time between the placing of the order and the return of the crank case as new was eight days. The total cost of the repair was in the neighbourhood of $97.

"Acquaint yourself with the operations of other employees in similar work. Wherever you find a plan better than yours, take advantage of it."

A Bunch of Knowing Ones Who Use Only Morrow Drills

MORROW

—High Speed Drills are made of the highest price High Speed Steel procurable (18% Tungsten). The drills are then *Forged* and hot twisted—The grain of the metal runs with the twist.

Made for difficult drilling and maximum production.

Make Morrow Drills Standard In Your Plant

THE JOHN MORROW SCREW & NUT CO., LIMITED

INGERSOLL, CANADA

7 Hop Exchange, Southwark St., London, England

Largest Canadian makers of Engine Studs, Cap and Set Screws, Semi-Finished Nuts, Files, Rasps, etc.

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Upon the Health of your employees depend your profit and production

Don't be contented with half-way goodness or make shift drinking arrangements.

Throw out the germ-laden Drinking Cup!

Give your men a clean drink

PURO (MADE IN CANADA) **SANITARY DRINKING FOUNTAIN**

Allows just the proper amount of cool, clean fresh water to come through the bubbler. No spurting, overflowing, no loss. "Puro" regulates itself. "Puro" saves 35% on water bills, too. You can attach it in a few minutes. Tell us now many men, how many departments and we'll tell you how much the cost will be.

Puro Sanitary Drinking Fountain Co.

Canadian Agents:

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18 St. Alexis St. Montreal, P.Q.

Eclipse Interchangeable Counterbores, Core Drills, Connecting Rod Cutters, Countersinks, Inverted Counterbores, Spot Facers, Adjustable Length Holders See first issue of each month.

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DROP FORGE DIES

Send us your blueprints and specifications. Entrust your requirements to experienced workmen and up-to-date equipment. Have your dies made in Canada. First-class workmanship guaranteed.

THE KIMBER & HILLIER MFG. CO.,
Thorold Road, St. Catharines, Ont.

MARINE

OTTAWA.—Before the end of this month eight more vessels will have been added to the Canadian Government Merchant Marine, increasing the number of ships built and actually delivered to 34. By the end of the fiscal year, it is said at the Marine Department, the shipbuilding program will be practically complete. All but eight of the vessels contracted for will then have been delivered, and the remaining eight will be well on the way.

The total output of pig iron in Germany in 1919 was approximately 6.3 million tons, as compared with 11.9 million tons in 1918 (the Luxemburg and Lorraine figures for November and December being left out of consideration), a decline of about 5½ million tons. The steel output was about 8½ million tons, against nearly 15 million tons—a decrease of 6½ million tons, and that of rolling mill products 5.9 million tons, as compared with 10.13 million tons. The average daily output of pig iron fell from 32,503 tons to 17,341 tons, and that of steel from 49,113 tons to 25,469 tons.

Montreal Gives Contracts.—The Administrative Commission of Montreal has awarded contracts for electric pumps and apparatus, in connection with the waterworks, to the following firms: The Fraser Chalmers Co., one 30,000 gallon pump at a cost of $50,250, one similar pump to the E. Laurie & Co. at a cost of $45,200. The Canadian General Electric Co. have been awarded contracts for manufacture and installation of transformers, motors, etc., at a cost of $48,640.

The report of the Department of Mines of Western Australia for the year 1918 states that the quantity of tin exported was 415 tons, valued at £76,952, an increase in tonnage on the preceding year of 32 tons and in value of £31,664. The good price which obtained for this mineral rendered many low grade propositions payable, hence the improved output. The value of the copper exported was £66,146, being £19,592 less than in 1917. The output of coal for the year was 337,039 tons, being 10,489 tons more than in 1917, which was the largest on record. The total value of the minerals produced in 1918 was £4,265,577, in which gold entered for £3,723,183; it was £4,629,027 in 1917, in which total gold entered for £4,121,645.

A society for the organization of the refrigeration industry is being established in Japan. Foodstuffs will be conveyed from Manchuria to Japan in ships fitted up with refrigerating apparatus. Big refrigerating factories are to be constructed at Darien, Fousan, Moji, Kobe, Yokohama, Tokio and Tsingtao, and all railways will be provided with refrigerator vans. The society's capital is fixed at about two million pounds sterling.

AND NOW THE DETACHABLE BROOM HANDLE

Oxywelded Device Combats the "H. C. of L."

This is the day of H. C. L. plus—but it is also the day of new and crafty ways of sidestepping the onslaughts of the ugly ogre. The latest device to enlist on the side of the people is the detachable broom handle.

At first thought the broom handle seems inconsequential. Isolated and individually, it is. Multiply it by millions, which probably approximates the number of brooms sold yearly, and you have something quite different.

The detachable broom handle is a brand new idea, and it is "taking." At the present time there is a factory in Vermont devoted exclusively to manufacturing brooms with this type of handle. The handle is of wood fitted into an oxwelded metal holder that clamps easily on to the brush of the broom. The metal part is light but very strong, being securely welded by the oxy-acetylene process, which not only makes it rigid but allows the entire piece to be neatly finished.

This is but one of a long list of interesting new departures from man's habitual thriftlessness that have sprung out of the need for widespread economies to combat living costs. In fact the oxy-acetylene process itself is perhaps the most far-reaching of all modern economies in the metal-working industries. Owing to the superior quality of welds made by this process, its remarkable speed and almost unbelievable economy, it is now almost universally applied in manufacture, construction and repair work. All that is required for a complete portable outfit is an oxweld blowpipe for welding, cutting torch, a cylinder of Linde oxygen and a tank of Prest-O-Lite dissolved acetylene, with which practically everyone is familiar.

INTERESTING PAMPHLET

The Page Steel and Wire Co., Monessen, Pa., have published a very attractive and useful pamphlet which presents in convenient form, data and tables pertaining to the properties of their lines. This book should be of interest to engineers, superintendents and purchasing agents in general, for the tables contained in it are well worth while.

Ottawa.—The Government's steamships will be incorporated into individual companies, that is each boat will be a company in itself. Each vessel will be capitalized and run as a separate concern, independent of any of the others. This is a plan that is widely adopted by shipping firms in England.

NEW INDUSTRY IS LOCATED IN QUEBEC

Magnesite Used to Come Largely From Austria—Big Development Taking Place

In two weeks the first magnesite mining and refining plant in Canada will be in operation, supplying the steel industry with magnesite, which, prior to 1914, came almost exclusively from Austria. The plant is located sixteen miles north of Grenville, Que., and the Scottish-Canadian Magnesite Company has an investment of nearly $500,000.

T. L. Dates, manager, has been in Toronto. "Ours is the second plant on the American continent, the other being in the State of Washington," he said. "We are located near the only known magnesite deposit in the Dominion, and our plant will have a capacity of 100 tons daily, obtaining 50 per cent. of finished material from our ore. We will later obtain from the West, magnesium, sulphate and other by-products. We have our own power plant a few miles from our camp, where we develop 2,000 horsepower. We are maintaining a little village of our own in the midst of the Laurentians."

J. M. Kilborne, of Owen Sound, who is vice-president of the Canada Cement Company, and one of the pioneers in the manufacture of malleable iron in Canada, controls the enterprise to the extent of ninety per cent.

PORT ARTHUR.—The freight steamer, Canadian Runner, 330 feeet length and 4,400 tons deadweight, built for the Canadian Government merchnat marine, was launched at the Port Arthur Shipyards. Mrs. James Whalen acting as sponsor. The Runner will be sut in two at Buffalo to be taken through the Welland Canal to the sea.

DOMINION CHUCKS

STEEL OR CAST-IRON BODY
BUILT FOR HEAVY DUTY

All Screws Are Reversible

SCREWS are made of the best grade steel. Both ends are broached and are heat treated after machining. They are reversible, so that either end may be used, are large enough in diameter to stand the torsional strains applied by operator when setting up his work. They are made to give the best service—and may be depended upon to stand up under the hardest usage.

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Engineers • Manufacturers
BRANTFORD, CANADA

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CABLE ADDRESS "BREVET"

THE TUBE COMPANY OF CANADA LIMITED
Steel Tubing
for all purposes
Electric and Oxy-Acetylene Welded
Also
Butt Seam Tubing
Hot or cold rolled, in sizes ⅜ to 2 inches outside diameter, from 16 to 22-gauge.
We furnish any shape — Rounds, Squares, Hexagons, Ovals and Special Shapes to customers' specifications.
Expert advice given on all Steel Tubing Problems.
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OVENS
Japanning and Varnishing Ovens heated by Gas, Electricity, Steam or Coal. Kernchen Siphonage Ventilators, Bakers' Ovens, trucks, casters, etc. Write for Booklet.
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HEAVY DUTY MACHINE TOOLS
Planers, Engine and Axle Lathes, Slotters, Boring and Turning Mills, Horizontal Boring and Drilling Machines.
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PORTABLE PLANERS
DRAW CUT SHAPERS
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FINISHED MACHINE KEYS
STATIONARY & PORTABLE KEY WAY CUTTERS
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OFFICE — WORKS, MUSKEGON HEIGHTS U.S.A.

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is the problem of markets—the problem of finding, of creating, an outlet for the goods we make or buy to re-sell.

Markets for desirable goods are all about us, for markets are in human minds, and can be created through skillful, persistent advertising.

The convention will show you *how* to find these markets *now*. The program will be built around this idea: "Advertising, How and Now."

Every progressive business man and woman is invited to attend the

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and to embrace this remarkable opportunity to obtain facts, ideas and impressions pertaining to better advertising.

Truthful, well-planned, constructive advertising is the greatest single force in the modern business world. But to use it with success, you must keep up to date.

Again this year, the business man or woman who desires to attend may do so without holding membership.

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ELECTRIC STEEL & METALS, Ltd.

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Steel Castings

of Any Analysis

Carbon, Manganese, Nickel, Chrome and Forging Ingots, etc.

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Mining Machinery

Iron Castings, Crushers, Rolls, Tanks, Pumps, etc.

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Lindsay, Ont.

Turbine Water Wheels

Pumps for pulp and paper mills, Pumping Engines for municipal purposes, Centrifugal Pumps.

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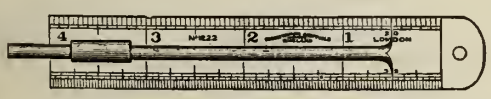
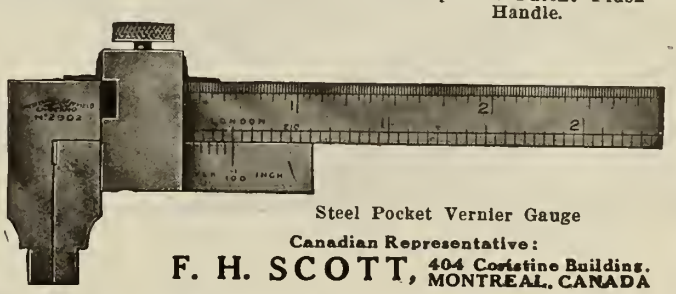
SHEFFIELD, - ENGLAND

Wind-up Measures, Steel, Linen and Metallic. With Improved Patent Flush Handle.

Chesterman tools are the highest standard of accuracy in the British Empire, and the quality of steel and substantial build guarantee a maximum of service and economy.



Steel Depth Gauge



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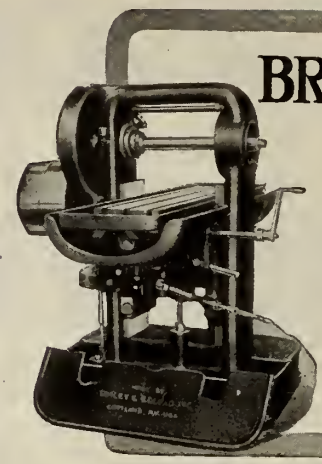

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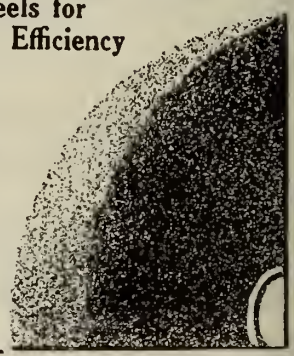

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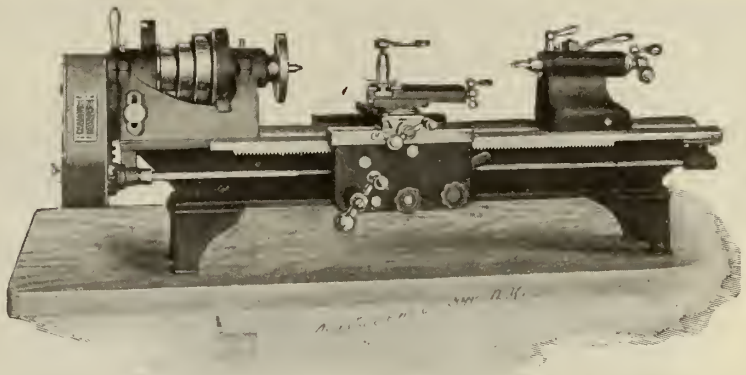

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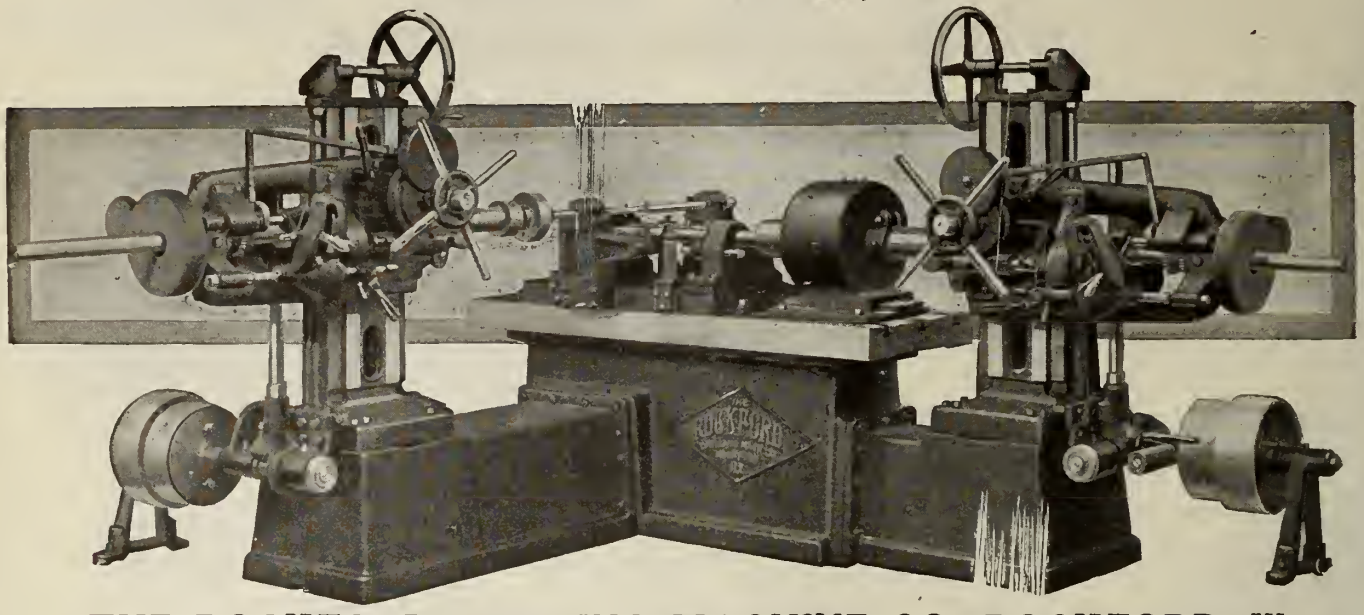

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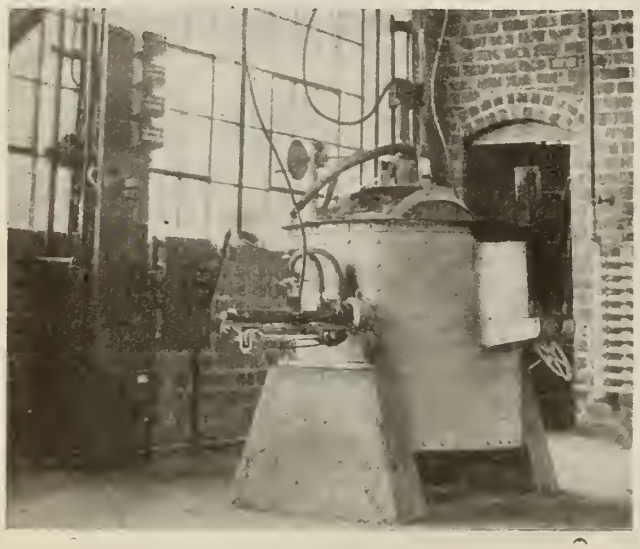

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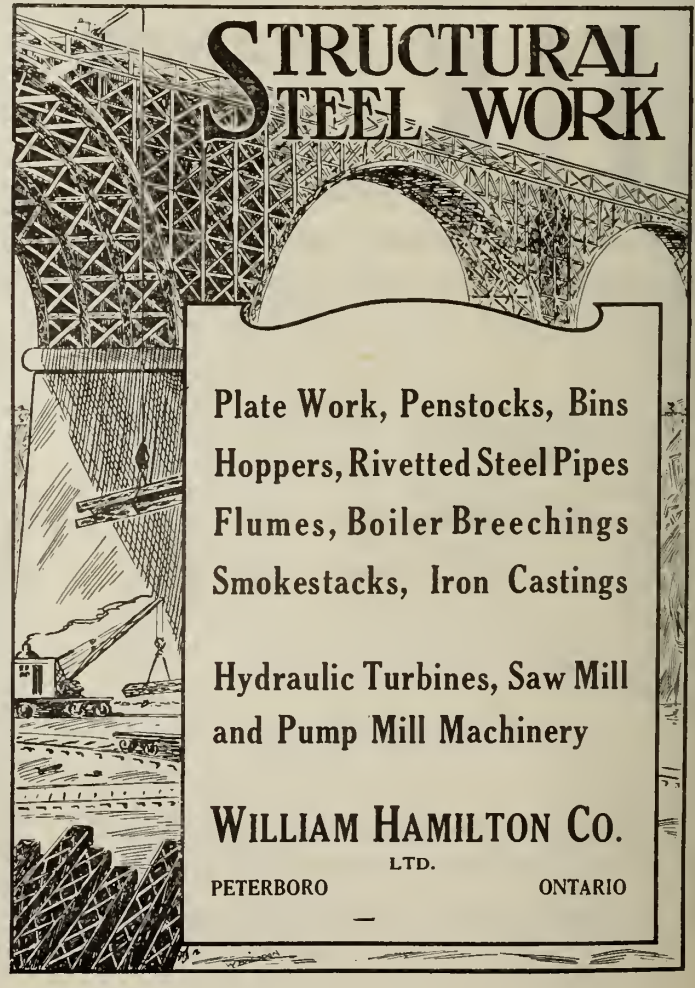

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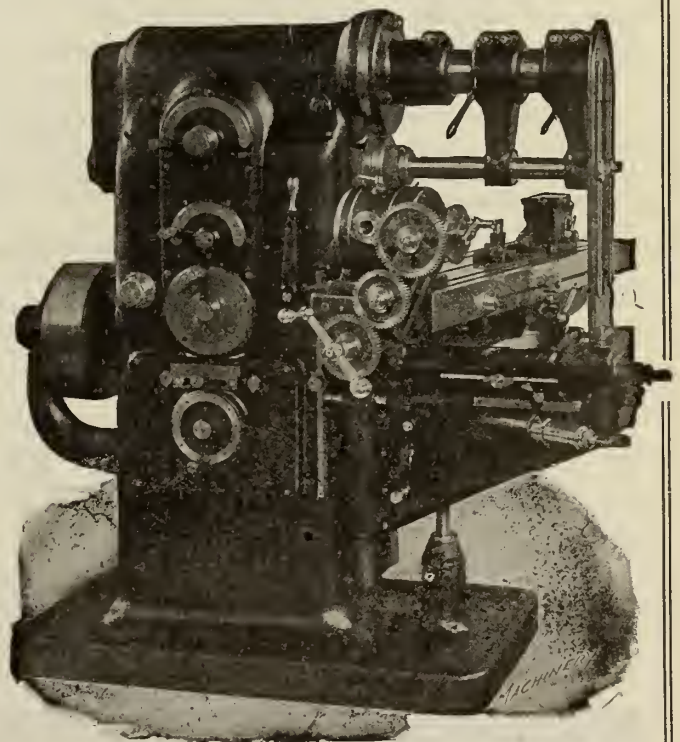

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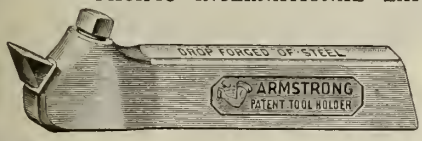

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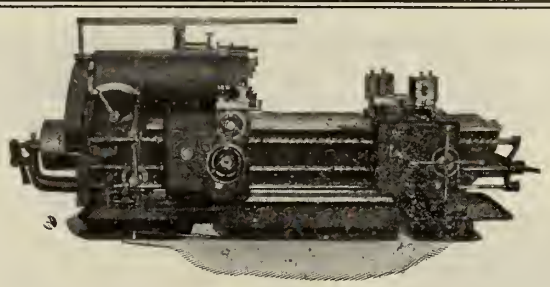

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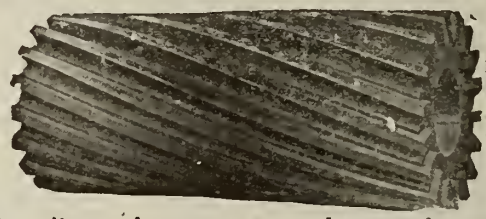

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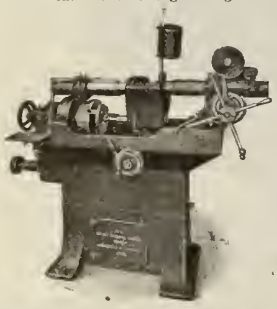

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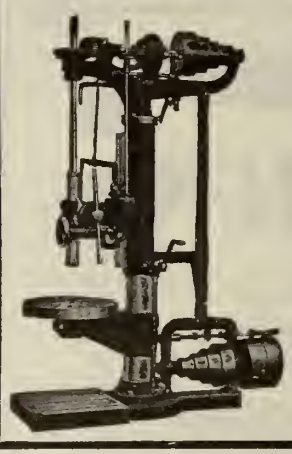

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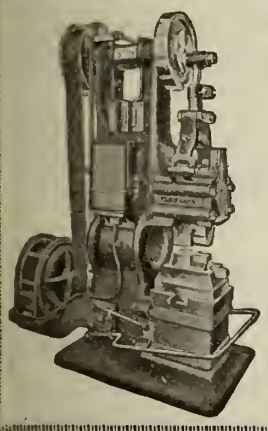

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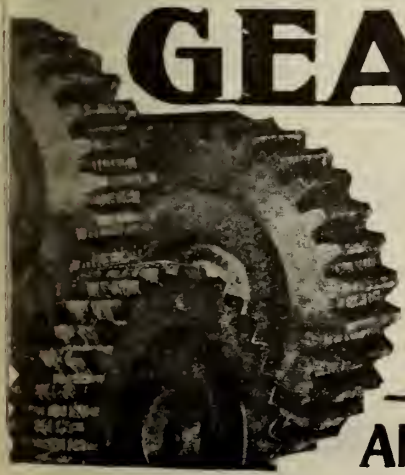

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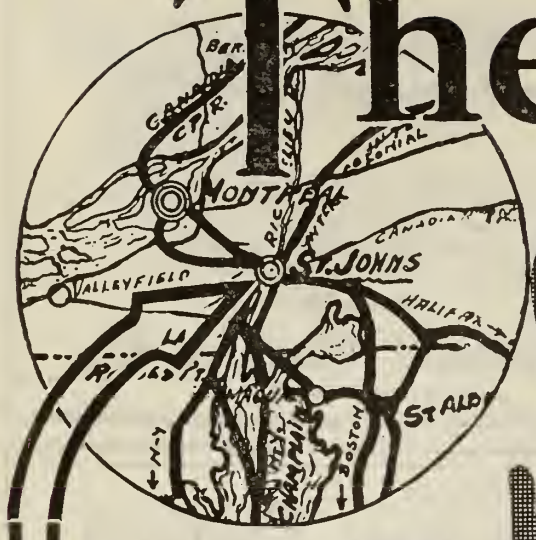

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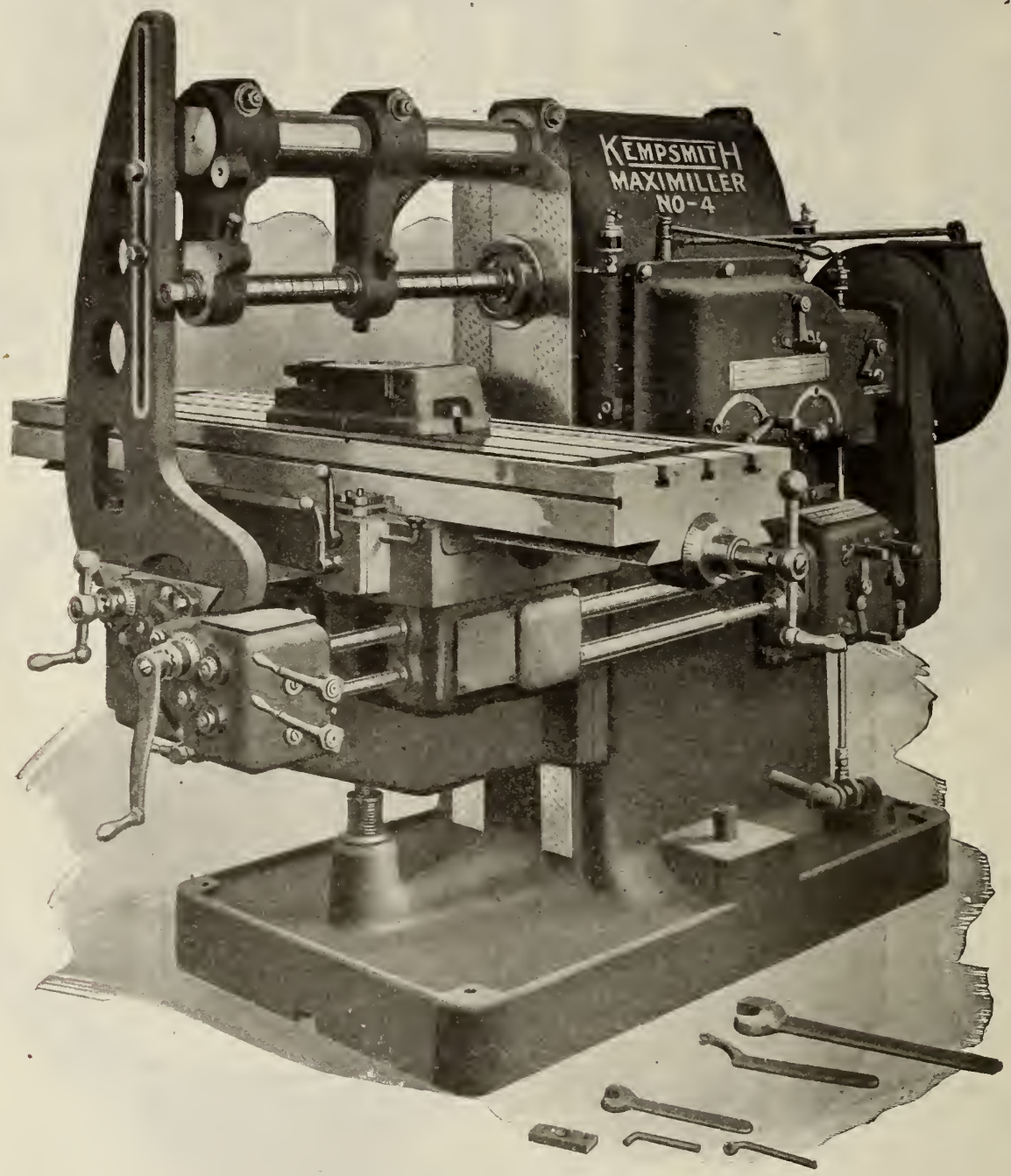

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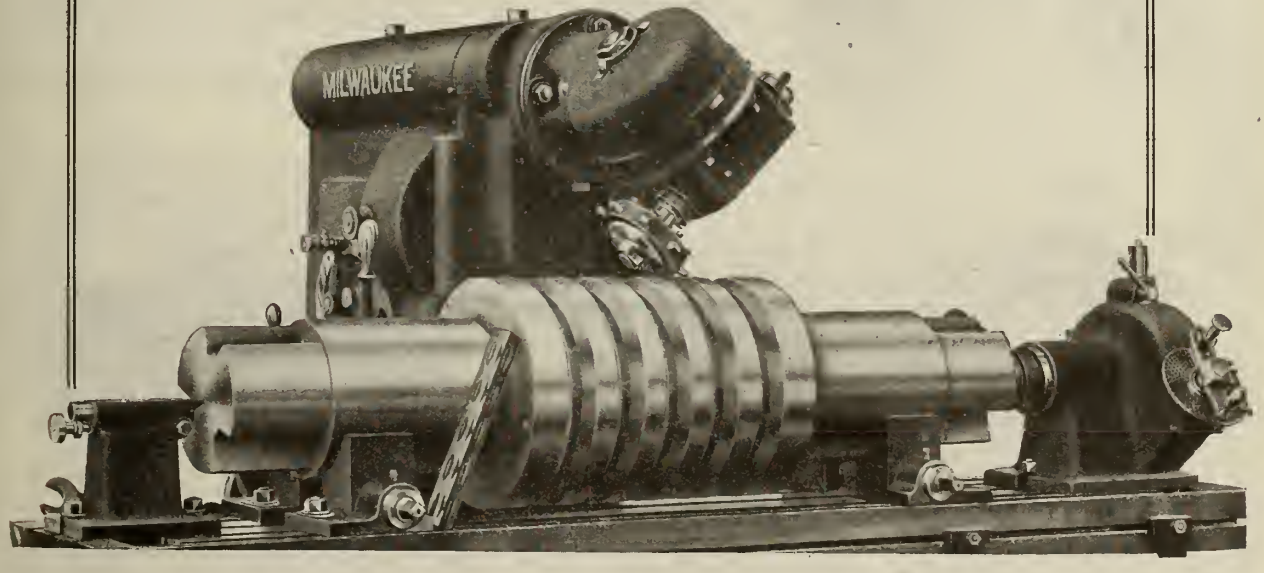

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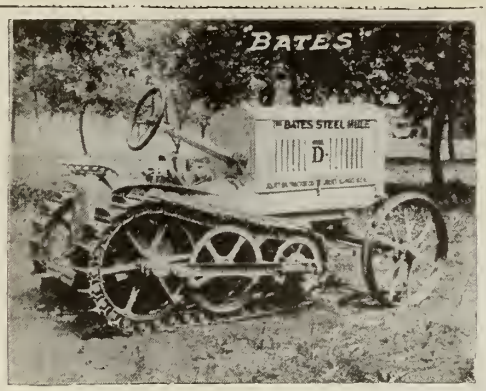

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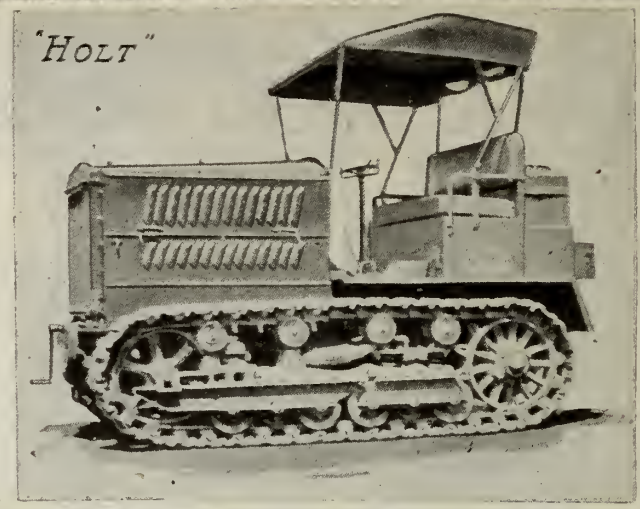

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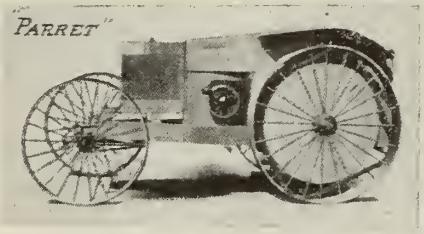

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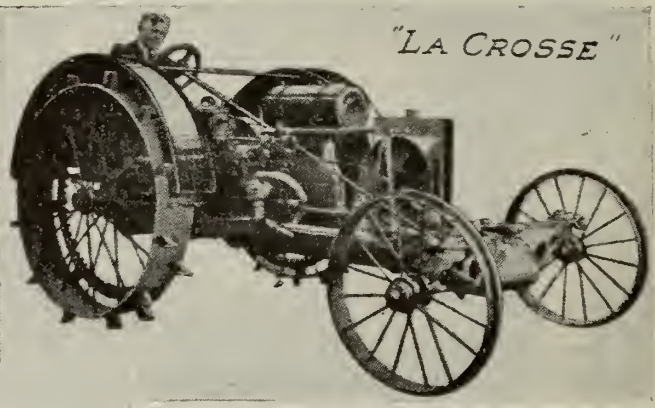

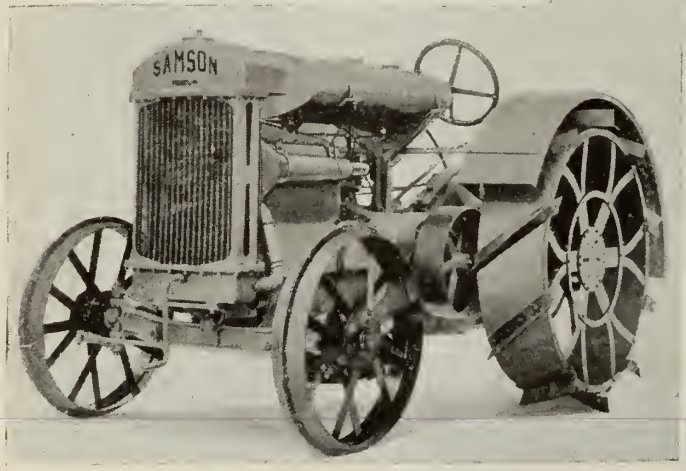

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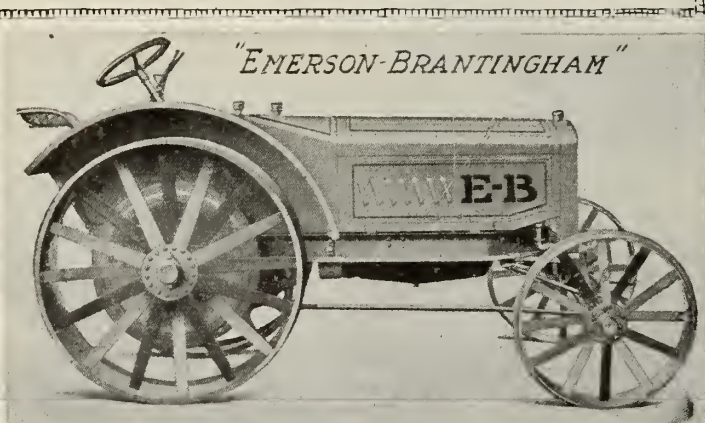

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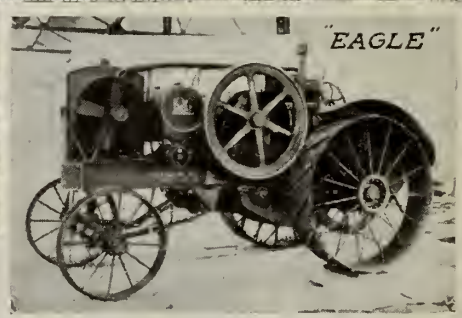

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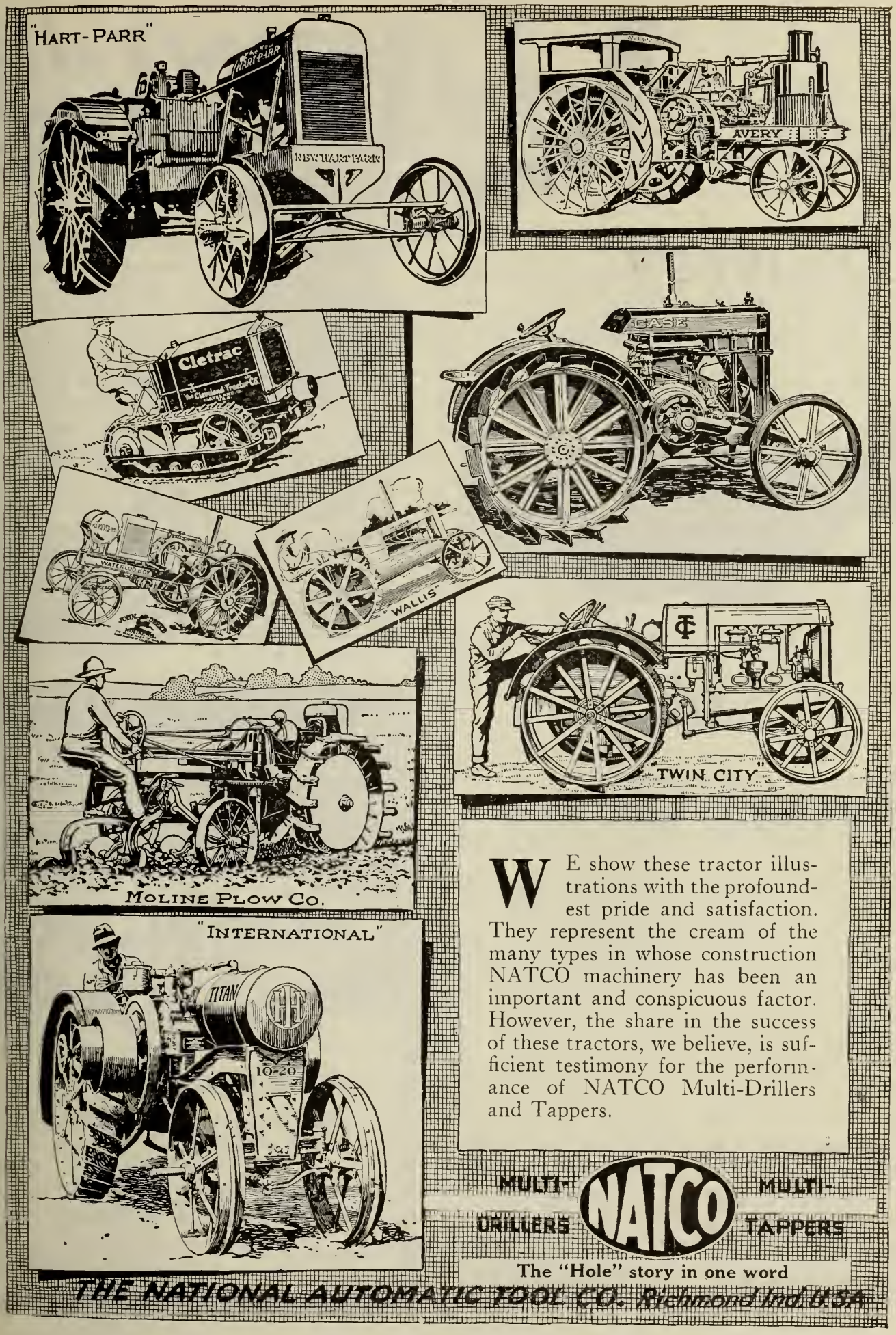

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Niles-Bement-Pond Co., New York.
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Williams & Co., J. H., Brooklyn, N.Y.

BARS, CONCRETE REINFORCING
Algoma Steel Corp., Sault Ste. Marie

BARS, MERCHANT
Algoma Steel Corp., Sault Ste. Marie.
Peckovers, Ltd., Toronto, Ont.

BASE FACING MACHINES
Victoria Foundry Co., Ottawa, Ont.

BATTERIES
Northern Electric Co., Ltd., Montreal Que

BEADING MACHINES
Quickwork Co., St. Marys, Ohio.

BELT CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Summer & Co., New York, N.Y.
Williams Mchy Co., A. R., Toronto, Ont.

BEARINGS, DIE CAST
Franklin Mfg. Co., Syracuse, N.Y.

BEARINGS, GRAPHITE BRONZE
Lyman Tube & Supply Co., Montreal, Que.

BEARINGS, ROLLER
Lyman Tube & Supply Co., Montreal, Que.

BELT-LACING MACHINES, HOOKS AND PINS
Clipper Belt Lacer Co., Grand Rapids

BELT LACING LEATHER
Aikenhead Hardware Co., Toronto, Ont.
G. F. Foss Mchy. & Sply. Co., Montreal.
Graton & Knight Mfg., Worcester, Mass.
Rice Lewis & Son, Toronto, Ont.

BELTING, BALATA
Federal Engineering Co., Toronto, Ont.

BELT HOOKS, WIRE
Clipper Belt Lacer Co., Grand Rapids

BELTING, RUBBER
Can. Consolidated Rubber Co., Montreal.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.
Goodyear Tire & Rubber Co., of Canada, Ltd., Toronto.
Gutta Percha & Rubber Ltd., Toronto, Canada.

BELTING, CHAIN
Can. Fairbanks-Morse Co., Montreal.
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Whitney Mfg. Co., Hartford, Conn.
Williams Mchy Co., A. R., Toronto, Ont.

BELTING, CONVEYOR
Can. Consolidated Rubber Co., Montreal.
Can. Link-Belt Co., Ltd., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal
Federal Engineering Co., Ltd., Toronto.
Gutta Percha & Rubber, Ltd., Toronto, Canada.
Graton & Knight Mfg., Worcester, Mass.
International Mchy. Spls., Ltd., Montreal.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
McLaren Belting Co., J. C., Montreal.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Quaker City Rubber Co, Philadelphia, Pa.
Rice, Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Williams Mchy Co., A. R., Toronto, Ont.

BELTING, FRICTION AND SURFACE
Can. Con. Rubber Co., Ltd., Montreal.
Gutta Percha & Rubber, Ltd., Toronto.

BELTING, HAIR
Summer & Co., New York, N.Y.

BELTING, LEATHER
Can. Graton & Knight Mfg. Co., Montreal
Gutta Percha & Rubber, Ltd., Toronto, Canada.
John Tullis & Son, Glasgow, Scotland.

BELTING, RUBBER
International Mchy. Spls., Ltd., Montreal.
Quaker City Rubber Co, Philadelphia, Pa.

BELTING, STITCHED COTTON DUCK
Dominion Belting Co., Hamilton, Ont.
Gutta Percha & Rubber, Ltd., Toronto.

BELTING, WOVEN
Federal Engineering Co., Ltd., Toronto
Summer & Co., New York, N.Y.

BENDING MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.
Bertram & Sons Co., John, Dundas
Brown-Boggs Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Kitchener.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Mach. Co., Toronto.
Petrie, Ltd., H. W., Toronto.

BLAST GATES
W. S. Rockwell Co., New York, N.Y.

BLASTING MACHINES, SAND
Garlock-Walker Machinery Co., Toronto.
Jardine, A. B., & Co., Hespeler, Ont.
National Mach. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

BILLET MARKERS
Matthews & Co., Jas. H., Pittsburgh, Pa.

BILLETS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Swedish Steel & Importing Co., Ltd., Montreal.
Algoma Steel Corp., Sault Ste. Marie
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.

BILLETS, FORGING
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.

BINS, STEEL
Dennis Wire & Iron Works, London, Ont
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Toronto Iron Works, Ltd., Toronto, Ont.
William Hamilton Co., Peterboro, Ont.

BLACKSMITH WORK
The Thos. Pink Co., Ltd., Pembroke.

BLOCKS, CHAIN
Oliver Engineering Co., Montreal.

BLOOMS AND SLABS
Algoma Steel Corp., Sault Ste. Marie

BLOWERS
Can. Blower & Forge Co., Kitchener, Ont.
Garlock-Walker Machinery Co., Toronto.
MacGovern & Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
U.S. Ordnance, Toronto, Ont.

BLOWING ENGINES
General Combustion Co., Ltd., Montreal, Que.

BLOW PIPES AND REGULATORS
Carter Welding Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

BLUE PRINTING MACHINERY
Commercial Camera Co., Providence, R.I.

BLUE PRINT PAPER
Hughes, Owens Co., Ltd., Montreal, Que.

BOARDS, GLASS CUTTING
Lufkin Rule Co., of Can., Windsor, Ont.

BOARTZ
Joyce, Koebel & Co., Inc., New York.

BOLT CUTTERS
Greenfield Tap & Die Corp., Greenfield Mass

BOILER TUBES
Lyman Tube & Supply Co., Montreal, Que.

BOILER BREECHINGS
Que.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
St Lawrence Welding Co, Ltd., Montreal
William Hamilton Co., Peterboro, Ont.

BOLT CUTTERS
Fellows Gear Shaper Co., Springfield, Vt.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros., of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.

BOILERS, RANGE
Can. John Wood Mfg. Co., Ltd., Toronto, Ont.

BOILERS
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.

BOLT CUTTERS AND NUT TAPERS
Aikenhead Hardware Co., Toronto, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Landis Machine Co., Waynesboro, Pa.
A.B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Wells Bros. Co. of Canada, Galt, Ont.
Petrie, Ltd., H. W., Toronto.

BOLTS
Aikenhead Hardware Co, Toronto, Ont.
London Bolt & Hinge Wks., London, Ont.
Morrow Screw & Nut Co., John, Ingersoll.
Peckovers, Ltd., Toronto, Ont.
Rice, Lewis & Son, Toronto, Ont.
Steel Co., of Canada, Ltd, Hamilton.
Wilkinson & Kompass, Hamilton, Ont.
Williams & Co.,, J. H. Brooklyn, N.Y.

BOLTS, COUPLING
Gast Machine Screw Co., Ltd., Galt, Ont.

BOLTS, STAY
Morrow Screw & Nut Co., John, Ingersoll.

BOLTS, SPRING SHAKLE
Can. Winkley Co., Ltd., Windsor, Ont.
Morrow Screw & Nut Co., John, Ingersoll

BOLTS, PATCH
Morrow Screw & Nut Co., John, Ingersoll.

BOLT AND NUT MACHINERY
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas, Ont
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto
Gardner & Son, Robt., Montreal.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Universal Mach, Co., Bowling Green, O.
Williams Machinery Co., A. R., Toronto

BOLT THREADING MACHINERY
Jardine & Co., Ltd., B., Hespeler
Landis Machine Co., W esboro, Pa.
National Acme Co., Cleveland, Ohio.
Victor Tool Co., Waynesboro, Pa.

BONDING MACHINES (Electric Railway)
The Lincoln Electric Co., Toronto, Ont.

BORING MACHINES, PNEUMATIC CYLINDER
Cleveland Pneumatic Tool Co., Toronto.
Canadian Fairbanks-Morse Co., Montreal
Can. Ingersoll-Rand Co., Sherbrooke Que
Garlock-Walker Mach. Co., Toronto.

BORING MACHINES, UPRIGHT AND HORIZONTAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto
Oliver Mach'y Co., Grand Rapids, Mich.
Gisholt Machine Co., Madison, Wis.
Hoefer Mfg., Co., Freeport, Ill.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Rockford Drilling Mche. Co, Rockford, Ill

BORING AND TURNING MILLS
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Foss Mch. & S'ply Co., Geo. F., Montreal
Knigbt Metal Products, Toronto.
Oliver Mach. Co., Grand Rapids, Mich.
Niles-Bement-Pond Co., New York.

BOXES, CAST IRON
Brown & Sharpe Mfg. Co., Providence, R.I.

BOXES, STEEL SHOP AND TOTE
Cleveland Wire Spring Co., Cleveland.

BRAKES
Brown, Boggs & Co., Hamilton, Can.
Electric Steel & Metals. Ltd., Welland.

BRASS—SHEETS, ROLLS, PLATES, and RODS
Brown's Copper and Brass Rolling Mills, New Toronto.

BRASS ALLOYS
British Smelting & Refining Co., Ltd., Montreal, Que.

BRASS AND COPPER TUBING
Lyman Tube & Supply Co., Montreal, Que.

BRASS FOUNDERS
Canada Metal Co., Toronto.
St. Lawrence Welding Co., Montreal.
Tallman Brass & Metal Co., Hamilton.

BRASS GOODS
Crane, Ltd., Montreal, Que.

BRASS PIPE AND TUBE
Crane, Ltd., Montreal, Que.

BRASS WORKING MACHINERY
Barber Mchy. Co., Ltd., Toronto, Ont.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machinery Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Prest-O-Lite Co., Inc., Toronto, Ont.
Wood Turret Machine Co., Brazil, Ind.
Williams Machy. Co., A. R., Toronto.
Brown's Copper and Brass Rolling Mills, New Toronto.

BRAZING EQUIPMENT
Chicago Flexible Shaft Co., Chicago, Ill.

BRICKS, FIRE
Elk Fire Brick Co., Can., Ltd., Hamilton, Ont.

BRIDGES, RLY. AND HIGHWAY
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.

BRINELL MACHINES
U. S. Ordnance, Toronto, Ont.

BRONZE—SHEETS, ROLLS, PLATES, and RODS
Brown's Copper and Brass Rolling Mills, New Toronto.

BRONZE, NAVAL
Canada Metal Co., Toronto.
Tallman Brass and Metal Co., Hamilton.

BRONZE COPPER
Canada Metal Co., Toronto.

BRUSHES, CARBON
Lyman Tube & Supply Co., Montreal, Que.

BUFFING AND POLISHING MACHINERY
Ford-Smith Mach. Co., Hamilton.
Foss Mchy. & S'ply Co., Geo. F. Montreal
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.

BUCKETS, DUMP
MacKinnon Steel Co., Sherbroooke, Que.
Morris Crane & Hoist Co., Herbert. Niagara Falls, Ont.
St Lawrence Welding Co, Ltd , Montreal

BUCKETS, ELEVATOR
Can. Link-Belt Co., Toronto, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
nce **Welding Co, Ltd.**, Montreal

BUCKETS, CLAM SHELL, CRAB, DUMP
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Ltd, Walkerville.
St Lawrence Welding Co, Ltd., Montreal

BULLDOZERS
Bertram & Sons Co., John, Dundas.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.
Williams, White & Co., Moline, Ill.

BURNERS, OIL AND NATURAL GAS
Northern Crane Works, Ltd., Walkerville.
W. S. Rockwell Co., New York, N.Y.

BURRS, IRON AND COPPER
Parmenter & Bulloch Co., Gananoque,.

BUSHINGS, BRONZE
Morrow Screw & Nut Co., John, Ingersoll.
St Lawrence Welding Co, Ltd., Montreal

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R.I.
Pangborn Corporation, Hagerstown, Md.

CABINETS, SAND BLAST
Pangborn Corporation, Hagerstown, Md.

CABLE, ELECTRIC
International Machinery & Supply Co., Ltd., Montreal, Que.

CABLES, TRANSMISSION AND TELEPHONES
Northern Electric Co., Ltd., Montreal.

CALKS, BOOT
Lufkin Rule Co., of Can., Windsor, Ont.

CANNERS' MACHINERY
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Can.

CANNERS' CONVEYORS
Can. Link-Belt Co., Toronto, Ont.

CARBIDE
Union Carbide Co., of Canada, Limited, Weland, nt.

CARBONIZING BOXES
Can. Driver-Harris Co., Ltd., Walkerville
Katie Foundry, Galt, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
Swedish Crucible Steel Co. Windsor.

CARRIERS, PNEUMATIC TUBE
Jones & Glassco, Montreal.

CARS, INDUSTRIAL
Can. Blower & Forge Co., Kitchener, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
St Lawrence Welding Co, Ltd., Montreal

CASES, FILING
Economy Drawing Table Co., Adrian, Mich.

CASTINGS, ALUMINUM, BRASS BRONZE, COPPER, AND GUN METAL
Algoma Steel Corp., Sault Ste. Marie.
Franklin Mfg. Co., Syracuse, N.Y.
Canada Metal Co., Ltd., Toronto, Ont.

CASTINGS, DIE CAST
Canada Metal Co., Ltd., Toronto, Ont.
Franklin Mfg. Co., Syracuse, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Tallman Brass & Metals Ltd., Hamilton, Ont.

CASTINGS, STEEL—ALL KINDS
Can. Elec. Steel Castings, Aurora, Ont.
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Electric Steel & Metals Co., Welland.
Mesta Machine Co., Pittsburgh, Pa.

CASTINGS, ELECTRIC AND ALLOY STEEL
Can. Elec. Castings Co. Ltd., Orillia, Ont
Dominion Foundries & Steel Ltd., Hamilton, Ont.

CARRIERS COUPLING BOLTS
John Morrow Screw & Nut Co., Ingersoll
Alexander Fleck Ltd., Ottawa.
Greenleafs Ltd., Belleville, Ont.
St. Lawrence Welding Co., Montreal.
Tallman Brass & Metal Co., Hamilton.

CASTINGS, BENCH LEG.
Brown & Sharpe Mfg. Co., Providence, R.I.

CASTINGS, BRASS AND IRON
Algoma Steel Corp., Sault Ste. Marie.
International Machinery and Supply Co., Ltd., Montreal, Que.

CASTINGS, BUILDING
Katie Foundry, Galt, Ont.

CASTINGS, GRAY IRON
Bernard Industrial Co., A., Fortierville, Q.
Brown & Sharpe Mfg. Co., Providence, R.I.
Brown, Boggs Co., Ltd., Hamilton.
Can. Elec. Castings Co, Ltd., Orillia, Ont
Alexander Fleck, Ltd., Ottawa.
Gardner & Son, Robt., Montreal.
Hull Iron & Steel Foundries, Ltd., Hull
International Malleable Iron Co., Guelpb
Kennedy & Sons, Ltd., Wm., Owen Sound.
Katie Foundry, Ltd., Galt, Ont.
Hamilton Co., Wm., Peterboro.

CASTINGS, PLUMBERS'
Katie Foundry, Galt, Ont.

CASTINGS, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville

CASTINGS, HARDWARE
Katie Foundry, Galt, Ont.

CASTINGS, STEEL CHROME AND MANGANESE STEEL
Thos. Davidson Mfg. Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hull Iron & Steel Foundries, Ltd., Hull.
Kennedy & Sons, Ltd, Owen Sound.

CASTINGS, MALLEABLE
International Malleable Iron Co., Guelpb

CASTINGS, NICKEL STEEL
Hull Iron & Steel Foundries, Ltd., Hull.

CEMENT, ELASTIC, IRON AND FURNACE
Warminton Co., J. N., Montreal.

CEMENT MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gardner, Robt., & Son. Montreal.

CEMENT HANDLING MACHINERY
Can. Link-Belt Co., Toronto, Ont.

CEMENT TOOLS
Atkins & Co., E. C., Hamilton, Ont.

CENTERING MACHINES
Victoria Foundry Co., Ottawa, Ont.

CENTRE REAMERS
Bertram & Sons Co., John, Dundas.
Butterfield & Co., Inc., Rock Island, Que.
Gardner, Robt. & Son, Montreal.
Hurlburt, Rogers Mch. Co., South Sudbury, Mass.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co., of Canada, Galt, Ont.

CHAIN, WELDED COIL
Morris Crane & Hoist Co., Herbert, Niagara Falls. Ont.

CHAIN BLOCKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford Chain Block & Mfg. Co., Phila., Pa.
Garlock-Walker Machy. Co., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & HoistCo., Herbert, Niagara Falls, Ont.
Oliver Engineering Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Jones & Glassco, Montreal, Que.

CHAINS, AGRICULTURAL
Canadian Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.

CHAINS, AUTOMOBILE ENGINE
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.

CHAINS, BICYCLE, DRIVE AND BLOCK
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAINS, FOR ELEVATORS AND CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que,
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAIN, MALLEABLE, DETACHABLE AND RIVETED
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAINS, POWER TRANSMISSION
Canadian Link-Belt Co., Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, New York. Glasgow, N.S.

CHAINS, SPROCKET WHEEL
Can. Link-Belt Co., Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAIN DRIVES
Can. Link-Belt Co., Toronto, Ont.
Coventry Chain Co., Coventry, England.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHASERS
National Acme Co., Cleveland, Ohio.
Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont.

CHEMISTS
Toronto Testing Lab'tory, Ltd., Toronto

CHUCKS, AERO, AUTOMATIC
Garvin Machine Co., New York.

CHUCKS, CENTERING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKS, COLLET, AIR
Elliott & Whitehall Mach. & Tool Co. Galt, Ont.
Smalley-General Co., Inc., Bay City, Mich.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, LATHE AND UNIVERSAL
Aikenhead Hardware Co., Toronto, Ont.
Almond Mfg. Co., Ashburnham, Mass.
Bertram & Sons Co., John, Dundas.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford.
Foss Mchy. & S'ply Co., G. F., Montreal
Gardner, Robt., & Son, Montreal.
Garlock-Walker Mach'y Co., Toronto.
Gisholt Machine Co,, Madison, Wis.
Hardinge Bros., Chicago, Ill.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Jacobs Mfg. Co., Hartford, Conn.
Ker & Goodwin Machine Co., Ltd., Knight Metal Products, Toronto.
Modern Tool Co., Erie, Pa.
Rice Lewis & Son, Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, AUTOMATIC AND KEYLESS
Aikenhead Hardware Co., Toronto, Ont
Can. Blower & Forge Co., Kitchener.

CHUCKS, FRICTION AND TAP
Victor Tool Co., Waynesboro, Pa.

CHUCKS, MACHINE MILLING
Hoggson & Pettis Mfg. Co., New Haven Conn.

CHUCKS, MAGNETIC
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

CHUCKS, RING WHEEL
Ford-Smitb Mach. Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.

CHUCKS, WHEEL, CAR
Hoggson & Pettis Mfg. Co., New Haven Conn.

CHUCKING MACHINES
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Windsor, Vt.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Wood Turret Mach. Co., Brazil, Ind.
Williams Mchy Co., A. R., Toronto, Ont.

CIRCULATING SYSTEMS FOR LUBRICATING OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

CLAMPS, BELT
Hoggson & Pettis Mfg. Co., New Haven Conn.

CLAY FIRE
Elk Fire Brick Co., Can., Ltd., Hamilton, Ont.

CLEANERS, METER, WASTE, GENERAL
Oakley Chemical Co., New York, N.Y.

CLEANING COMPOUND
Oakley Chemical Co., New York.

CLOCK SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

CLOCKS, WATCHMAN, PORTABLE
Gisholt Machine Co., Madison, Wis.
Hardinge Bros,, Inc., Chicago, Ill.

CLOSETS
Crane, Ltd., Montreal, Que.

CLUTCHES, CHAIN
Wright Mfg. Co., Lisbon, Ohio.

CLUTCHES, FRICTION AND PULLEY
Bernard Industrial Co., A., Fortierville, Q
Can. Link-Belt Co., Toronto, Ont.
Carlyle Johnson Mach. Co., Manchester, Conn.
Positive Clutch & Pulley Wks., Aurora, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.

COAL CRUSHERS
Canadian Link-Belt Co., Ltd., Toronto, Ont.
Canadian Mead-Morrison Co., Limited, Montreal, Que.

COAL HANDLING MACHINERY
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Nova Scotia Steel & Coal Co., New

Appearance
High finish and clean cut graduations are the factors that have made
Brown & Sharpe
Machinists' Tools
the choice of three generations.

Brown & Sharpe Mfg. Co.
Providence R.I.U.S.A.

If interested tear out this page and place with letters to be answered

COLD ROLLED STRIP, ALL METAL
COLLARS, SHAFTING
Can. Driver-Harris Co., Ltd., Walkerville.
Williams & Co., J. H., Brooklyn, N.Y.
COLLECTORS, PNEUMATIC
Can. Blower & Forge Co., Kitchener.
Sturtevant Co., B. F., Galt, Ont.
COLLETS
Becker Milling Machine Co., Boston.
COMPOSITION INGOT
Canada Metal Co., Toronto, Ont.
COMPOUNDS, CUTTING AND GRINDING, DRAWING, STAMPING
Oakley Chemical Co., New York, N.Y.
COMPRESSORS, AIR
Atkins & Co., E. C., Hamilton, Ont.
Can. Ingersoll-Rand Co., Sherbrooke.
Cleveland Pneumatic Tool Co., Toronto.
Curtis Pneumatic Machy. Co., St. Louis
Elliott & Whitehall, Galt, Ont.
Garlock-Walker Machy. Co., Toronto.
MacGovern & Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Superior Machinery Co., London, Ont.
Williams Mchy Co., A. R., Toronto, Ont.
CONDENSERS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
MacGovern & Co., Montreal, Que.
Smalley-General Co., Inc., Bay City, Mich.
CONDUITS
Northern Electric Co., Ltd., Montreal Que
CONNECTING RODS
Canada Found's & Forgings, Ltd., Welland. Ont.
CONTRACTORS' HOISTS
Canadian Mead-Morrison Co., Limited, Montreal, Que.
CONTRACT WORK
Brown Engineering Corp., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.
Globe Engineering Co., Hamilton, Ont.
Homer & Wilson, Hamilton, Ont.
Katie Foundry, Ltd., Galt, Ont.
Victoria Foundry Co., Ottawa.
CONTROLLERS, MAGNETIC BRAKES, ELEC. WINCHES, MONO RAIL HOISTS
Volta Mfg. Co., Welland, Ont.
CONTROLLERS AND STARTERS
Williams Mach'y Co., A. R., Toronto.
CONTROLLING INSTRUMENTS
Taylor Instrument Co., Rochester, N.Y.
CONVERTERS, ROTARY
MacGovern & Co., Montreal, Que.
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.
CONVEYORS—McCASLIN GRAVITY BUCKET
Canadian Mead-Morrison Co., Limited, Montreal, Que.
COOLERS, WITH DRINKING FOUNTAINS
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.
COPING MACHINES
Bertram & Sons Co., John, Dundas, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Can. Blower & Forge Co., Kitchener.
COPPER, BUS BAR, SHEET, PATES, RODS
British Smelting & Refining Co., Ltd., Montreal, Que.
Brown's Copper and Brass Rolling Mills, New Toronto.
Brown's Copper and Brass Rolling Mills, New Toronto.
CORE OIL
Swan & Finch, Inc., 165 Broadway.
COUNTERBORES AND COUNTERSINKS
Aikenhead Hardware Co., Toronto, Ont.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
COUNTERSINKS, INTERCHANGEABLE
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
COUNTERBORES, INVERTED, INTERCHANGEABLE
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
CONNECTING ROD CUTTERS INTERCHANGEABLE
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
COUNTERSHAFTS
Almond Mfg. Co., Ashburnham, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Gray Ball Bearing Co., Ltd., Toronto.
Baird Machine Co., Bridgeport, Conn.
Ford-Smith Machine Co., Hamilton, Ont.
Foster Machine Co., Elkhart, Ind.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams Mchy Co., A. R., Toronto, Ont.
COUPLINGS, FRICTION
Bernard Industrial Co., The A., Fortierville, Que.
Can. Link-Belt Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.
COUPLINGS, RAPID HOSE
Int. Machinery & Supply Co., Ltd., Montreal, Que.
COILING MACHINERY, WIRE AND SPRING
Garlock-Walker Machinery Co., Toronto.

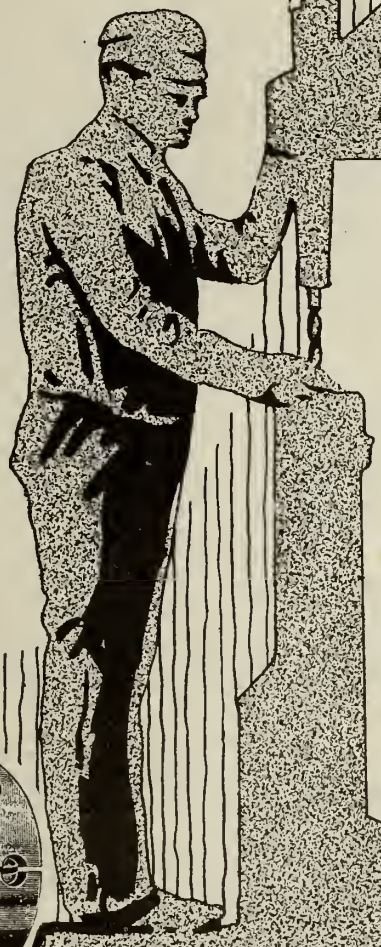
COKE AND COAL
Hanna & Co., M. A., Cleveland, O.
COUPLINGS, PLAIN, FLEXIBLE AND CUT OFF
Cleveland Pneumatic Tool Co., of Canada, Toronto.
CRANES, OVERHEAD, HAND AND
Gardner, Robt. & Son, Montreal.
Independent Pneumatic Tool Co., Chicago
CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.
Northern Crane Works, Walkerville.
ELECTRIC
Volta Manufacturing Co., Welland, Ont.
CUPS, OIL
Can. Winkley Co., Ltd., Windsor, Ont.
COVERS, OIL HOLE
Can. Winkley Co., Ltd., Windsor, Ont.
CRANES, GANTRY
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
CRANE RUNWAYS
MacKinnon Steel Co., Sherbrooke, Que.
CRANES, JIB
Brown Hoisting Machinery Co., Cleveland, Ohio.
CRANES, LOCOMOTIVE
Brown Hoisting Machinery Co., Cleveland, Ohio.
CRANES, GOLIATH, PNEUMATIC AND PORTABLE
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Morris Crane and Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Petrie, Ltd., H. W., Toronto.
CRANES, PILLAR
Brown Hoisting Machinery Co., Cleveland, Ohio.
CRANES, TRAVELLING, ELECTRIC AND HAND POWER
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Machy. Co., St. Louis
Dominion Bridge Co., Montreal.
Hepburn, John T., Ltd., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Niles-Bement-Pond Co., New York.
Northern Crane Works, Walkerville.
Oliver Engineering Co., Montreal.
CRANK SHAFTS
Canada Found's & Forgings Ltd., Welland
Williams & Co., J. H., Brooklyn, N.Y.
CRANES, PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.
CRIMPS, LEATHER
Graton & Knight Mfg. Co., Worcester, Mass.
CRUSHERS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Elec. Steel & Metals, Welland, Ont.
CUPOLAS
Can. Blower & Forge Co., Kitchener.
Northern Crane Works, Walkerville.
CURB PUMPS FOR OIL, GASOLINE
Bowser Co., Ltd., S. F., Toronto, Ont.
CURRENT TRANSFORMERS
Volta Manufacturing Co., Welland, Ont.
CUT-OFF COUPLINGS, FRICTION
Petrie, Ltd., H. W., Toronto.
CUTTERS, BOLT
See Bolt Cutters.
CUTTERS, GEARS
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Fellows Gear Shaper Co., Springfield, Vt.
CUTTERS, FLUE
Cleveland Pneumatic Tool Co., Toronto.
CUTTER HEADS
Oliver Machinery Co. Grand Rapids, Mich
CUTTERS, PIPE (See Pipe Cutters)
CUTTERS, MILLING
Becker Milling Mach. Co., Boston, Mass.
Butterfield & Co., Rock Island, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cleveland Twist Drill Co., Cleveland.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Illinois Tool Works, Chicago, Ill.
Ingersoll Mche. Co., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Whitney Mfg Co., Hartford, Conn.
Wilt Twist Drill Co., Walkerville, Ont.

CUTTER RELIEVING MACHINES
Cleveland Milling Machine Co., Cleveland.
CUTTING-OFF MACHINES
Armstrong Bros., Tool Co., Chicago.
Atkins & Co., E. C., Hamilton, Ont.
Bertram & Sons Co., John, Dundas.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co.,Ltd., Montreal
Foss Mchy & S'ply Co., Geo. F., Montreal
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield, Mass
Hurlburt, Rogers Machy. Co., South Sudbury, Mass.
Hall & Sons, John H., Brantford, Ont.
Kennedy & Sons, Wm., Owen Sound.
Lyman Tube & Supply Co., Montreal, Que.
Niles-Bement-Pond Co., New York, N.Y.
Prest-O-Lite Co., Inc., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Tabor Mfg. Co., Philadelphia, Pa.
Wells Bros. of Can., Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.
CUTTING COMPOUND AND CUTTING OIL
Cataract Refining Co., Ltd., Toronto.
Swan & Finch, Inc., New York.
CUTTING OIL, RECLAIMING SYSTEM
Bowser Co., Ltd., S. F., Toronto, Ont.
CUTTING AND WELDING PLANTS
Davis-Bournonville Co., Jersey City, N.J.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.
CYANIDE AND LEAD BATH POTS
Swedish Crucible Steel Co., Windsor.
CYLINDERS, AIR
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Smalley General Co., Inc., Bay City, Mich
CYLINDERS, AUTOMATIC REBORING JIGS AND REAMERS
Kelley Reamer Co., Cleveland, O.
DEHUMIDIFYING
B. F. Sturtevant Co, Galt, Ont.
DERRICKS
Aikenhead Hardware Co., Toronto, Ont.
Dominion Bridge Co., Montreal.
Hepburn Co., Ltd., J. T., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
DERRICK HOISTS
Canadian Mead-Morrison Co., Limited, Montreal, Que.
DIAMOND (BORTZ)
Furniss, Clarke & Co., Montreal, Que.
DIAMOND TOOLS
Ford-Smith Machine Co., Hamilton, Ont.
Furniss, Clarke & Co., Montreal, Que.
Joyce-Koebel Co., Inc., New York City.
Wheel Trueing Tool Co., Detroit.
Petrie, Ltd., H. W., Toronto.
DIAMONDS, CARBON AND BORTZ
Wheel Trueing Tool Co., Detroit
DIAMONDS, BLACK AND ROUGH
Joyce, Koebel & Co., Inc., New York.
Wheel Trueing Tool Co., Windsor, Ont.
DIE CASTINGS
Fisher Motor Co., Ltd., Orillia, Ont.
Tallman Brass & Metals Ltd., Hamilton, Ont.
DIE HEADS, AUTOMATIC
Greenfield Tap & Die Corp., Greenfield Mass.
Wells Bros. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
DIES, BRASS PRINTING, EMBOSSING AND LETTERING
Matthews, Jas. H., & Co., Pittsburgh, Pa
DIES FOR BIT BRACE USE
Butterfield & Co., Rock Island, Que.
Crescent Mche. Co., Ltd., Montreal, P.Q.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Wells Brothers Co., of Canada, Galt.
DIES AND DIE STOCKS
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Rock Island, Que.
Brown, Boggs Co., Hamilton, Ont.
Crescent Mche. Co., Ltd., Montreal, P.Q.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt. & Son, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Jones & Lamson, Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.
Marshall, Son & Bunney, Toronto.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Rickert-Shafer Co., Erie, Pa.
Stoll Co., Inc., D. H., Buffalo, N.Y.
Wells Brothers of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.
DIES, HAMMERED
Kimber & Hillier Mfg., Co., St. Catharines, Ont.
DIES, DROP FORGE.
Kimber & Hillier Mfg., Co., St. Catharines, Ont.
DIES, METAL STAMPING
Crescent Mche. Co., Ltd., Montreal, P.Q.
Elliott & Whitehall, Galt, Ont.
DIES, PIPE THREADING
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Crescent Mche. Co., Ltd., Montreal, P.Q.
Landis Machine Co., Waynesboro, Pa.
DIES, THREADING
Butterfield & Co., Inc., Rock Island, Que.
Crescent Machine Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.
DIE SINKERS
Becker Milling Machine Co., Boston
Garvin Machine Co., New York.
Kimber & Hillier Mfg., Co., St. Catharines, Ont.
Pratt & Whitney Co., Dundas, Ont.
Walcott Lathe Co., Jackson, Mich
DIES FOR MACHINES
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Rock Island, Que.
Firth & Sons, Thos., Montreal, Que.
Landis Machine Co., Waynesboro, Pa.
Wells Brothers Co. of Canada, Galt.
DIE HEADS
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Canada, Galt, Ont.
DIES, SELF-OPENING
Geometric Tool Co., New Haven.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co, Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Wells Brothers Co. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
DIE FILING MACHINES
Oliver Mach. Co., Grand Rapids, Mich.
DIE STEEL, HOT AND COLD WORK
Armstrong-Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.
Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
DIES FOR SCREW PLATES
Butterfield & Co., Inc., Rock Island, Que.
Wells Bros. Co. of Can., Galt, Ont.
DIES, SHEET METAL WORKING
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada
Globe Engineering Co., Hamilton, Ont.
Stoll Co., D. H., Buffalo, N.Y.
DIES, SCREW AND THREAD
Butterfield & Co., Rock Island, Que.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
National-Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros., Co. of Can., Galt, Ont
DISCS, LEATHER, STEEL
Graton & Knight Mfg. Co., Worcester, Mass.
Swedish Steel & Importing Co., Montreal.
DIRECT CONNECTED UNITS
MacGovern & Co., Montreal, Que.
DRAFT, MECHANICAL
Butterfield & Co., Rock Island, Que.
Can. Blower & Forge Co., Kitchener.
A. B. Jardine & Co., Hespeler, Ont.
Pratt & Whitney Co., Dundas, Ont.
Sturtevant Co., B. F., Galt, Ont.
DRAINAGE FITTINGS
Crane, Ltd., Montreal, Que.
DRAWING INSTRUMENTS
Hughes, Owens Co., Ltd., Montreal, Que.
DRAWING OFFICE SUPPLIES
Hughes, Owens Co., Ltd., Montreal, Que.
DRESSERS, GRINDING AND EMERY WHEEL
Atkins & Co., E. C., Hamilton, Ont.
Can. Desmond-Stephan Mfg. Co., Hamilton
Dominion Abrasive Co., Ltd., Mimico, Ont.
Petrie, Ltd., H. W., Toronto.
Wheel Trueing Tool Co., Windsor, Ont.
DRILL PRESSES
Aurora Tool Works, Aurora, Ind.
Barber Mchy. Co., Ltd., Toronto, Ont.
W. F. & John Barnes Co., Rockford.
Can. Blower & Forge Co., Kitchener.
Canada Machinery Corp., Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
U. S. Mach. Tool Co., Cincinnati, Ohio.
A. R. Williams Machinery Co., Toronto.
DRILL RODS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Kayser-Ellison & Co., Ltd., Montreal.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
Marshall, Son & Bunney, Toronto.
Swedish Steel & Importing Co., Ltd., Montreal.
DRILLING MACHINES, GANG
Barnes, W. F. & John, Co., Rockford, Ill.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bilton Mach. Tool Co., Bridgeport, Conn
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Silver Mfg. Co., Salem, Ohio.
DRILLING MACHINES, LOCOMOTIVE AND MULTIPLE SPINDLE
Barber Mchy. Co., Ltd., Toronto, Ont.
John Bertram & Sons Co., Dundas.
Bilton Mach. Tool Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Mach. Co., Toronto.
Garvin Machine Co., New York.
Hoefer Mfg., Co., Freeport, Ill.
Henry & Wright Mfg. Co., Hartford, Conn
A. B. Jardine & Co., Hespeler, Ont.
Landis Tool Co., Waynesboro, Pa.
Nat. Automatic Tool Co., Richmond, Ind.
Niles-Bement-Pond Co., New York.
Rockford Drilling Mach Co., Rockford, Ill

BUTTERFIELD

Drills
Reamers
Milling Cutters

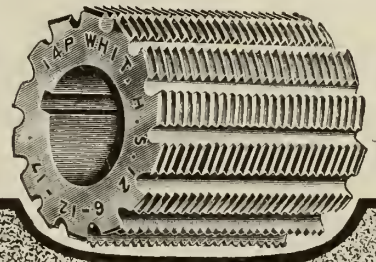
Taps
Dies
and
Screw
Plates

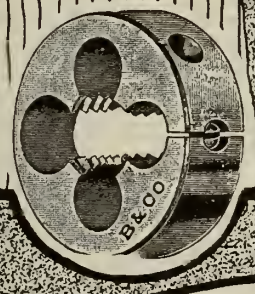


WHEN you order **Butterfield** tools you can depend upon the **quality.** They come to you ready to give long, hard, economical service.

They are made by expert workmen from specially selected material and before leaving the factory are thoroughly tested to prove they are made according to the **Butterfield** standard of efficiency.

You can always depend upon **Butterfield** tools — give them a trial.





BUTTERFIELD & CO. DIVISION
Union Twist Drill Co.
ROCK ISLAND, QUE.

If interested tear out this page and place with letters to be answered

DRILLING MACHINES, RADIAL AND TURRET
Barber Mchy. Co., Ltd., Toronto, Ont.
John Bertram & Sons Co., Dundas.
Canadian Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Henry & Wright Mfg. Co., Hartford,
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLING MACHINES, SENSITIVE
Barber Mchy. Co., Ltd., Toronto, Ont.
Bilton Mach. Tool Co., Bridgeport, Conn.
W. F. & John Barnes Co., Rockford, Ill.
Canadian Fairbanks-Morse Co., Montreal.
Canadian Machinery Corp., Galt, Ont.
Geo. F. Foss Mch. & S'ply Co., Montreal
Garlock-Walker Mach. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
United States Mach. Tool Co., Cincinnati
Williams Mchy Co., A. R., Toronto, Ont.

DRILLING MACHINES, UPRIGHT AND HORIZONTAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Aurora Tool Works, Aurora, Ind.
John Bertram & Sons Co., Dundas.
Garlock-Walker Mach. Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener.
Canada Mach. Corp., Galt, Ont.
Garvin Machine Co., New York.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mach. Co., Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
A. B. Jardine & Co., Hespeler, Ont.
Knight Metal Products, Toronto.
Landis Tool Co., Waynesboro, Pa.
R. McDougall Co., Galt.
Nat. Automatic Tool Co., Richmond, Ind.
Rockford Drilling Mach. Co., Rockford, Ill.
Niles-Bement-Pond Co., New York.
Silver Mfg. Co., Salem, Ohio.
U. S. Ordnance, Toronto, Ont.
A. R. Williams Machinery Co., Toronto.

DRILLING MACHINES, SPECIAL
Hoefer Mfg. Co., Freeport, Ill.

DRILLING POSTS
Aikenhead Hardware Co., Toronto, Ont.
Keystone Mfg. Co., Buffalo, N.Y.
Rice Lewis & Son, Toronto, Ont.
Silver Mfg. Co., Salem, Ohio.

DRILLS, BENCH
Aikenhead Hardware Co., Toronto.
W. F. & John Barnes Co., Rockford, Ill.
Can. Blower & Forge Co., Kitchener.
Can. Fairbanks-Morse Co., Montreal.
Geo. F. Foss Mch. & S'ply Co., Montreal
Garlock-Walker Machinery Co., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

DRILLS, CENTRE
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto.
Rice Lewis & Son, Toronto, Ont.
Wilt Twist Drill Co., of Can., Walkerville

DRILLS, BLACKSMITH AND BIT STOCK
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Can. Blower & Forge Co., Kitchener.
Cleveland Twist Drill Co., Cleveland.
Geo. F. Foss Mch. & S'ply Co., Montreal
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.
Whitman & Barnes Mfg. Co., Akron, O.
Wilkinson & Kompass, Hamilton, Ont.
Wilt Twist Drill Co. of Can., Walkerville

DRILLS, CARBON
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Marshall, Son & Bunney, Toronto.
John Morrow Screw & Nut Co., Ingersoll

DRILLS, ELECTRIC, PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener.
Cincinnati Electrical Tool Co., Cincinnati
Geo. F. Foss Mch. & S'ply Co., Montreal
Haskins Co., R. C., Chicago, Ill.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Pilot Steel & Tool Co., Montreal, Que.
Prest-O-Lite Co., Inc., Toronto, Ont.
U. S. Electrical Tool Co., Cincinnati, O
A. R. Williams Mach. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLS, HAMMER
Samuel Osborne, Ltd., Montreal, P.Q.

DRILLS, EMERY
Garlock-Walker Mach. Co., Toronto, Ont.

DRILLS, HIGH SPEED TWIST
Aikenhead Hardware Co., Toronto, Ont.
Armstrong-Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Canadian Fairbanks-Morse Co., Montreal
H. A. Drury Co., Montreal.
Geo. F. Foss Mch. & S'ply Co. Montreal
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
W. F. & John Barnes Co., Rockford, Ill
Osborne, Samuel, Montreal, P.Q.
Plewes, Ltd., Winnipeg, Man.
Pratt & Whitney Co., Dundas, Ont.
Petrie, H. W. Toronto.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Taylor J. A. M., Stair Bldg., Toronto.
Wilt Twist Drill Co. of Can., Walkerville
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLS, OIL TUBE
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

DRILLS, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Williams Mchy Co, Ltd., A. R., Montreal
Greenfield Tap & Die Corp., Greenfield, Mass.

DRILLS, PNEUMATIC CORNER
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.

DRILLS, RATCHET AND HAND
Aikenhead Hardware Co., Toronto, Ont.
Armstrong Bros. Tool Co., Chicago, Ill.
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal,
Cincinnati Electrical Tool Co., Cincinnati.
Cleveland Twist Drill Co., Cleveland.
Garlock-Walker Mchy. Co., Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilt Twist Drill Co. of Can., Walkerville.

DRILLS, ROCK
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
The Foss Mchy. & Supply Co., Montreal.
Samuel Osborne Ltd., Montreal, P.Q.
A. R. Williams Machy. Co., Toronto.

DRILLS, SQUARE & HEXAGON
Globe Engineering Co.

DRILLS, TRACK
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
The Foss Mchy. & Supply Co., Montreal.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Wilt Twist Drill Co. of Can., Walkerville.

DRINKING FOUNTAINS, SANITARY
Crane, Ltd., Montreal, Que.
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Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Brantford Emery Wheel Co., Brantford
Can. Fairbanks-Morse Co., Montreal.
Carborundum Co., Niagara Falls, N.Y.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Mchy. & S'ply Co. G. F., Montreal
Norton Co., Worcester, Mass.

GRINDING WHEEL DRESSER
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.

GUARDS, WINDOW AND MACHINE
Canada Machinery Corp., Galt, Ont.
Canada Wire & Iron Goods Co., Hamilton
Dennis Wire & Iron Works, London, Ont.
B. Greening Wire Co., Hamilton, Ont.
Page Steel & Wire Co., Adrian, Mich.

GUTTERS AND SKYLIGHTS
H. H. Robertson, Ltd., Sarnia, Ont.

HACK SAW BLADES
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Wks., Buffalo.
Ford-Smith Machine Co., Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Plewes, Ltd., Winnipeg, Man.
Pilot Steel & Tool Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Racine Tool & Machine Co., Racine, Wis.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
L. S. Starrett Co., Athol, Mass.
Standard Machy. & Supplies, Montreal.
Victor Saw Works, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.
Williams Mchy Co., A. R., Toronto, Ont.

HANDLES, BALANCE, CRANK AND MACHINE
Williams & Co., J. H., Brooklyn, N.Y.

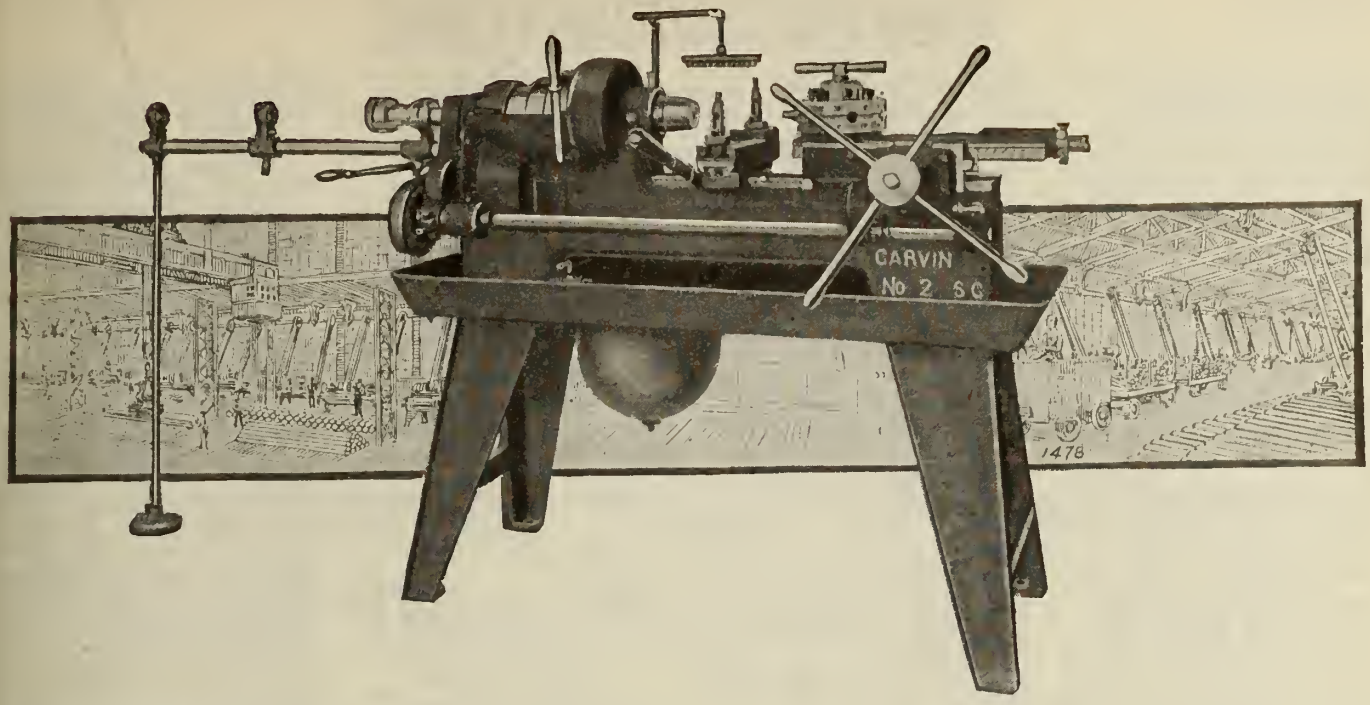
HANGERS, SHAFT
Can. Link-Belt Co., Ltd., Toronto, Ont.

HACK SAW FRAMES
Aikenhead Hardware Co., Toronto.
Atkins & Co., E. C., Hamilton, Ont.
Can. Fairbanks-Morse Co., Montreal.
Ford-Smith Machine Co., Hamilton, Ont.
Garvin Machine Co., New York City.
Victor Saw Works, Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.

HACK SAWS, POWER
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Wks., Buffalo.
Foss Mchy. & S'ply Co., G. F., Montreal.
Ford-Smith Machine Co., Hamilton.
Perfect Machine Co., Galt, Ont.
Starrett Co., L. S., Athol, Mass.
Victor Saw Works, Hamilton, Ont.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

HAMMERS, FORGING
Nazel Eng. & Mach. Wks., Philadelphia.

HAMMERS, ELECTRIC
Haskins & Co., R. C., Chicago, Ill.



It will pay you to make screw parts on a Garvin Screw Machine

Making screw products, rather than buying, may save you considerable money. You do not have to make a big investment for you can install a simple Garvin machine to turn out screw parts in quantity.

One, two or a battery of Garvin Screw Machines will save enough in a very short time to make their purchase well worth while. You can put them at a great variety of work, changing adjustments with scant effort and in little time. You can work to close precision limits with absolute confidence that parts will be perfectly interchangeable when produced in quantity.

Garvin Screw Machines are of advanced design. The little refinements that they embody mark the difference between ability, merely to make screws and that of turning them out at a profit.

Here are a few features:

Solid head to bed design.
Steel oil pan, double strainers and oil reservoir.
Large diameter spindles, hardened and ground.
Hexagon turret with independent stops for each turret hole.
Turret momentum stopped by solid plug, no strain on indexing lock bolt.
Turret revolved in either direction.
Top binders on turret.
Provision made to pass long rods through turret.
Cross slide fitted with plug stops capable of fine adjustment.
Friction countershaft with double equalizing, adjustable expansion ring.
Parts made from drop forgings and tool steel, heavy duty parts hardened. No steel castings used.

You will want to learn more about Garvin Machine Tools—the acquaintance will prove profitable.

The Garvin Machine Company, Spring and Varick Sts., New York, N.Y., U.S.A.

GARVIN

BUILDER OF BETTER MACHINE TOOLS 6-21

If interested tear out this page and place with letters to be answered.

HAMMERS (DROP), MOTOR AND BELT DRIVEN
Beaudry & Co., Boston, Mass.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton.
Can. Billings & Spencer, Ltd., Welland.
Canada Machinery Corp., Galt, Ont.
High Speed Hammer Co., Rochester, N.Y
Jardine & Co., A. B., Hespeler, Ont.
Niles-Bement-Pond Co., New York, N.Y
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
United Hammer Co., Boston, Mass.
Williams Mchy Co, Ltd., A. R., Montreal

HAMMERS, HELVE POWER
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
West Tire Setter Co., Rochester, N.Y.
Williams Mchy Co, Ltd., A. R., Montreal

HAMMERS, CHIPPING, CAULKING, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Garlock-Walker Machinery Co., Toronto
Independent Pneumatic Tool Co., Chicago
Nazel Eng. & Mach. Wks., Philadelphia

HAMMERS, MARKING
Matthews & Co., Jas. H., Pittsburgh, Pa

HAMMERS, NAIL MACHINE
Rice Lewis & Son, Toronto, Ont.
United Hammer Co., Boston, Mass.

HAMMERS, POWER
Nazel Eng. & Mach. Wks., Philadelphia

HAMMERS, STEAM
Canada Machinery Corp., Galt, Ont.
Niles-Bement-Pond Co., New York

HAND PLANERS
Oliver Mchry. Co., Grand Rapids, Mich.

HAND PLANING AND JOINTING MACHINERY
Oliver Engineering Co., Montreal, P.Q

HAND LEATHERS OR PADS
Graton & Knight Mfg. Co., Montreal

HANDLES, FIBRE
Diamond State Fibre Co., Bridgeport, Pa.

HANGERS
Brown & Sharpe Mfg. Co., Providence, R.I
Canadian Link-Belt Co., Ltd., Toronto, Ont.

HANGERS, SHAFT
Algoma Steel Corp., Sault Ste. Marie.
Chapman Double Ball Bearing Co., Toronto.
Gray Ball Bearing Co., Ltd., Toronto.
Baird Machine Co., Bridgeport, Conn.
Can. S K F Co., Toronto, Ont.
Gardner & Son, Robt., Montreal.
Jones & Glassco, Montreal.
Williams Mchy Co, Ltd., A. R., Montreal

HARDNESS TESTING INSTRUMENTS
Shore Instrument & Mfg. Co., New York.

HEAD, AUXILIARY
Hoefer Mfg. Co., Freeport, Ill.

HEATING AND VENTILATING ENGINEERS
Can. Blower & Forge Co., Kitchener, Ont.
Sheldons, Ltd., Galt, Ontario.
Sturtevant Co., B. F., Galt, Ont.

HEAT TREATMENT OF STEEL
Gray Ball Bearing Co., Ltd., Toronto.

HEAT GAUGES, HARDENING AND ANNEALING
Shore Instrument & Mfg. Co., New York

HELMETS, SANDBLAST, AMMONIA
Strong, Kennard & Nutt Co., Cleveland

HIGH SPEED STEEL
See Steel.

HINGE MACHINERY
Baird Machine Co., Bridgeport, Conn.

HINGES
Butterfield & Co., Inc., Rock Island, Que.
London Bolt & Hinge Wks., London, Ont.

HOBS
Greenfield Tap & Die Co., Greenfield, Mass
Pratt & Whitney Co., Dundas, Ont.
Taylor, J. A. M., 318 Stair Bldg., Toronto
Wells Bros. of Canada, Galt, Ont.

HOISTING MACHINERY
Canadian Mead-Morrison Co., Limited, Montreal, Que.

HOISTS, AIR
Can. Ingersoll-Rand Co., Ltd., Sherbrooke
Morris Crane & Hoist Co., Herbert. Niagara Falls, Ont.

HOISTS, CHAIN AND PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Garlock-Walker Machinery Co., Toronto
Ford Chain Block & Mfg., Philadelphia.
Independent Pneumatic Tool Co., Chicago
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert. Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.
Williams Mchy Co, Ltd., A. R., Montreal

HOISTS, ELEC., STATIONARY, MONO RAIL
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
A. Leatty & Sons, Ltd., Welland, Can
Oliver Engineering Co., Montreal.
Volta Mfg. Co., Welland, Ont.

HOISTS, ELECTRICAL
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Montreal, Que.
Electric Steels & Metals Ltd., Welland
Kennedy & Sons, Owen Sound, Ont.
Morris Crane & Hoist Co., Herbert. Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

HODLERS, ADJUSTABLE
Eclipse Counterbore Co., Ltd., Walkerville, Ont.

HOLDERS, STEEL DIE FOR MARKING
Matthews & Co., Jas. H., Pittsburgh, Pa.

HOLDERS, ELECTRIC
Electric Steels & Metals, Ltd., Welland

HOOKS, BELT LACING
Clipper Belt Lacer Co., Grand Rapids.

HOPPERS
MacKinnon Steel Co., Ltd., Sherbrooke.
Dominion Bridge Co., Montreal, Que.
William Hamilton Co., Peterboro, Ont.
Toronto Iron Works, Ltd., Toronto, Ont.

HOSE, FIRE PROTECTION
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal

HOSE, PNEUMATIC
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Gutta Percha & Rubber, Ltd., Toronto.
Independent Pneumatic Tool Co., Chicago.
Quaker City Rubber Co., Philadelphia, Pa.
Wells Bros. Co. of Canada, Galt, Ont.

HOSE, ALL KINDS
Goodyear Tire & Rubber Co., of Canada, Ltd., Toronto.
Gutta Percha & Rubber, Ltd., Toronto.
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.

HOSE, SAND BLAST
Pangborn Corporation, Hagerstown, Md.
Goodyear Tire & Rubber Co. of Can., Ltd. Toronto
Quaker City Rubber Co., Philadelphia, Pa.
Intern'l. Machine Tool Co., Indianapolis.

HOSE, STEAM, SUCTION AND WATER
Gutta Percha & Rubber, Ltd., Toronto.
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.

HUMIDIFIERS
Sturtevant Co., B. F., Galt, Ont.

HYDRAULIC ACCUMULATORS
Dom. Steel Products Co., Ltd., Brantford.

HYDRAULIC MACHINERY
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Machinery Co., Toronto.
Dom. Steel Products Co., Ltd., Brantford.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
West Tire Setter Co., Rochester, N.Y.
Victoria Foundry Co., Ottawa.

HYDRAULIC TURBINES
Que.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,

HYDROMETERS, HYGROMETERS, HYGRODNIKS
Taylor Instrument Co., Rochester, N.Y.

INDICATORS, SPEED
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol, Mass.

INDEX CENTRES
Brown & Sharpe Mfg. Co., Providence, R.I.
Dickow, Fred. C., Chicago, Ill.
Ford-Smith Machine Co., Hamilton, Ont.
Garvin Machine Co., New York.
Petrie, Ltd., H. W., Toronto.

INDICATING INSTRUMENTS
Taylor Instrument Co., Rochester, N.Y.

INDICATING SCALES
Can. Kron Scale Co., Montreal.

INDUSTRIAL SITES
City of St. Johns, Quebec.

INGOTS, BRASS, BRONZE, GUN METAL, PHOSPHOR
Thomas Moore & Son, Montreal.

INGOTS, FORGING AND ROLLING
Electric Steel & Metals Co., Welland.

INSULATING COMPOUNDS
Robertson Co., Ltd., H. H., Sarnia, Ont.

INSTRUMENTS, ENGINEERING
Consolidated Optical Co., Toronto.

IRON ORE
Hanna & Co., M. A. Cleveland, O.

IRON, WROUGHT, ROLLED, PIG
Swedish Steel & Impt. Co., Ltd., Montreal

JACKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Jacks Engineering Co.
Morris Crane & Hoist Co., Herbert. Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Norton, A. O., Coaticook, Que.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.

JACKS, PIT AND TRACK
Canadian Fairbanks-Morse Co., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Northern Crane Works, Walkerville.

JAWS, FACE PLATE
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford.
Skinner Chuck Co., New Britain, Conn.

JOINTERS
Gray Ball Bearing Co., Ltd., Toronto.

JIGS, TOOLS, ETC.
Brown Engineering Corp., Toronto.
Crescent Mach. Co., Ltd., Montreal, P.Q.
Elliott & Whitehall Mach. & Tool Co., Galt.
Gisholt Machine Co., Madison, Wis.
Globe Engineering Co., Ltd., Hamilton.
Homer & Wilson, Hamilton, Ont.
Jones & Lamson, Springfield, Vt.
Toronto Tool Co., Toronto, Ont.

JOURNAL WEDGES
Canada Foundries & Forgings, Welland.
Dominion Foundries & Steel Ltd., Hamilton, Ont.

KEY SEATERS
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Morton Mfg. Co., Muskegon Heights, M.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.

KEYS, MACHINE
Whitney Mfg. Co., Hartford, Conn.
Williams & Co., J. H., Brooklyn, N.Y.

KILNS
Can. Blower & Forge Co., Kitchener, Ont.
General Combustion Co., Ltd., Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Sturtevant Co., B. F., Galt, Ont.

KNIVES, MACHINE
Atkins & Co., E. C., Hamilton, Ont.

KNIFE GRINDERS
Gray Ball Bearing Co., Ltd., Toronto.

LABELS AND TAGS
Matthews & Co., Jas. H., Pittsburgh, Pa.

LABORATORIES, INSPECTION AND TESTING (see Chemists)

LADLES, FOUNDRY
Northern Crane Works, Walkerville.

LACING MACHINES
Clipper Belt Lacer Co., Grand Rapids, M.

LAG SCREW GIMLET POINTERS
National Machy. Co., Tiffin, Ohio.

LATH
Robertson, Ltd., H. H., Sarnia, Ont.

LATHES, CHUCKING
Acme Machine Tool Co., Cincinnati, Ohio.
Petrie, Ltd., H. W., Toronto.
Wood Turret Machine Co., Brazil, Ind.

LATHE CHUCKS (See Chucks)

LATHE DOGS AND ATTACHMENTS
Armstrong Bros. Tool Co., Chicago.
Hendey Machine Co., Torrington, Conn.
Williams & Co., J. H., Brooklyn, N.Y.

LATHES, AUTOMATIC AND SEMI AUTOMATIC
Gisholt Machine Co., Madison, Wis.
Wood Turret Machine Co., Brazil, Ind.

LATHES, AXLE
Barber Mchy. Co., Ltd., Toronto, Ont.
Betts Mach. Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.

LATHES, BORING
Barber Mchy. Co., Ltd., Toronto, Ont.
Bridgeford Mach. Tool Works, Rochester
Canada Machinery Corp., Galt, Ont.
Ledge & Shipley, Cincinnati, O.
Petrie, Ltd., H. W., Toronto.

LATHES, PRECISION, BENCH
W. F. & John Barnes Co., Rockford.
J. G. Blount & Co., Everett, Mass.
Canadian Fairbanks-Morse Co., Montreal.
Geo. F. Foss Machy. & Supply Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Hardinge Bros., Chicago, Ill.
Pratt & Whitney Co., Dundas, Ont.
Seneca Falls Mfg Co., Seneca Falls, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

LATHES, BRASS
Acme Machine Tool Co., Cincinnati, Ohio
Hardinge Bros., Chicago, Ill.
Wood Turret Machine Co., Brazil, Ind.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

LATHES, ENGINE
Acme Machine Tool Co., Cincinnati, Ohio.
Barber Mchy. Co., Ltd., Toronto, Ont.
John Bertram & Sons Co., Dundas.
Canada Mach'y Corp., Galt, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cisco Machine Tool Co., Cincinnati, Ohio.
G. F. Foss Mchy. & S'ply Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis
Kennedy & Sons, Wm., Owen Sound, Ont.
Lehman Mach. Co., St. Louis, Mo.
R. McDougall Co., Galt.
Miles-Bement-Pond Co., New York.
Perfect Machine Co., Galt, Ont.
Rae Mach. Tool Co., Ramilton.
Smalley-General Co., Inc., Bay City, Mich.
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Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Sidney Tool Co., Sidney, Ohio.
U. S. Ordnance, Toronto, Ont.
Walcott Lathe Co., Jackson, Mich.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.
A. R. Williams Machy. Co., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.
Worcester Lathe Co., Worcester, Mass.

LATHES, FOOT POWER
Seneca Falls Mfg. Co., Seneca Falls, N.Y.

LATHES, HORIZONTAL
Intern'l. Mchy. Supplies Ltd., Montreal.
Wood Turret Machine Co., Brazil, Ind.

LATHES, JOURNAL TRUEING
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.

LATHE MANDRELS, HARDENED AND GROUND
Elliott & Whitehall, Galt, Ont.

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Can. Machinery Corp., Galt.
Wood Turret Machine Co., Brazil, Ind.
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Garlock-Walker Machy. Co., Toronto, Ont.

LATHES, POLISHING
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

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Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas, Ont.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Cisco Machine Tool Co., Cincinnati, O
Foss Mchy. & S'ply Co., G. F., Montreal.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Toronto, Ont.
Hardinge Bros., Inc., Chicago, Ill.
Hepburn Ltd., John T., Toronto, Ont.
Lehman Machine Co., St. Louis, Mo.
Niles-Bement-Pond Co., New York.
Rae Mach. Tool Co., Ramilton.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
U. S. Ordnance, Toronto, Ont.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.
Williams Machy. Co., A. R., Toronto.
Wood Turret Machine Co., Brazil, Ind
Worcester Lathe Co., Worcester, Mass.

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Bliss Co., E. W., Brooklyn, N.Y.

LATHES, TOOL ROOM
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Cisco Machine & Tool Co., Cincinnati, O
Canada Machinery Corporation, Galt, Ont.
Knight Metal Products, Toronto.
Lehman Machine Co., St. Louis, Mo.
Rae Mach. Tool Co., Ramilton.
Seneca Falls Mfg. Co., Seneca Falls, N.Y
Worcester Lathe Co., Worcester, Mass.

LATHES, QUICK CHANGE
Lehman Machine Co., St. Louis, Mo.

LATHE SAWS
Atkins & Co., E. C., Hamilton, Ont.

LATHES, TURRET
Hardinge Bros., Chicago, Ill.
Acme Machine Tool Co., Cincinnati, Ohio

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LEAD BURNING
St. Lawrence Welding Co., Montreal.

LEAD BURNING OUTFITS
Turner Brass Works, Sycamore, Ill.

LEATHER STRAPPING
Graton & Knight Mfg. Co., Worcester, M.

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Standard Optical Co., Geneva, N.Y.

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Hoggson & Pettis Mfg. Co., New Haven, Conn.

LEVELS
Hughes, Owens Co., Ltd., Montreal, Que.

LIDS, SCREW TOP AND HINGE
Can. Winkley Co., Ltd., Windsor, Ont.

LINK BELTING
See Belting, Chain.

LIFT TRUCKS
Can. Kron Scale Co., Montreal.

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LOCKERS, STEEL WARDROBE AND STEEL MATERIAL
Canada Wire & Iron Gds. Co., Hamilton.
Dennis Wire & Iron Works, London, Ont.

LUBRICANTS
Cataract Refining & Mfg. Co., Toronto.
Swan & Finch, Inc., New York.

LUBRICANTS, CUTTING AND GRINDING, DRAWING, STAMPING
Oakley Chemical Co., New York, N.Y.

LUBRICATING, OIL FILTERING AND CIRCULATING SYSTEMS
Bowser Co., Ltd., S. F., Toronto, Ont.

LUBRICATORS
Trabern Pump Co., Rockford, Ill.

LUMBERMEN'S TOOLS
Thos. Pink Co., Ltd., Pembroke, Ont.

MACHINE COUNTER WEIGHTS
Katie Foundry, Galt, Ont.

MACHINE TOOLS
Barber Mach. Co., F. F., Toronto, Ont.
Knight Metal Products, Toronto.
Rae Mach. Tool Co., Ramilton.

MACHINERY, CORNER AND BENDING
Peck, Stow & Wilcox, Southington, Conn.

The Right Kind of Belting Will Save Power for You

—and, saving Power, save you money.

That's really the end we're all striving for.

So that it doesn't matter much whether or not we pay a little more in the beginning as long as we are assured of the one result in the end.

That's the idea we had in mind in producing "Gibraltar RedSpecial" Belting.

We felt you would be willing to pay a fair price in return for "Extra" value.

We made this Belt irrespective of cost—made it so good that the demand became great enough to allow us to set a price not out of the way in comparison with inferior brands and the prices asked for them.

Set a price that would net you a real saving on account of the long life and satisfactory service this Belt will render.

"Gibraltar RedSpecial" is a cling-to-the-pulley Belt. That's one of its improved features. It has to do with that tough wear-resisting, friction surface, a non-wearing rubber long-thread cotton combination that will resist water and dampness as well.

The stretch to this belt is of so little consequence that users tell us they haven't had to "take it up" in several years of onerous service.

A big percentage of the orders going through the factory are repeats from those who have tried its worth.

You are welcome to the experience of our Belt Service Department.

Remember this: "Gibraltar RedSpecial" is covered by the broadest guarantee issued by any manufacturer.

Dunlop Tire & Rubber Goods Co., Limited

Head Office and Factories: Toronto Branches in the Leading Cities

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Can. Fairbanks-Morse Co., Montreal.
Elliott & Whitehall, Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Williams Machy. Co., A. R., Toronto.

MACHINERY GUARDS (See Guards)

MACHINERY SUPPLIES
Crescent Machine Co., Ltd., Montreal.
Globe Engineering Wks., Hamilton, Ont.
Knight Metal Products, Toronto.

MACHINERY, SPECIAL
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Crescent Machine Co., Ltd., Montreal, Que.
Globe Engineering Co., Ltd., Hamilton.

MACHINISTS' TOOLS
Atkins & Co., E. C., Hamilton, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.

MAGNETIC BRAKES FOR ELECTRIC MOTORS
Volta Mfg. Co., Welland, Ont.

MANDRELS
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.

MARKING DEVICES
Matthews & Co., Jas. H., Pittsburgh, Pa.

MARKING MACHINERY
Brown, Boggs Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Perrin, Wm. R., Toronto.
Petrie, Ltd., H. W., Toronto.

MATERIALS, HANDLING PLANTS
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MATS, RUBBER MATTING
Quaker City Rubber Co., Philadelphia, Pa.
International Mchy. Sply., Ltd., Montreal.

MEASURING MACHINES
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MEASURES, REGISTERING
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Chesterman & Co., Jas., Sheffield, Eng.

MERCHANTS, IRON AND STEEL
Samuel Osborne (Can.), Ltd., Montreal.

METALLURGISTS
See Chemists.

METAL CLEANERS
Oakley Chemical Co., New York, N.Y.

METAL CUTTING MACHINES
Atkins & Co., E. C., Hamilton, Ont.
Lyman Tube & Supply Co., Montreal, Que.

METAL SAWS
See Saws.

METAL, ANTI-FRICTION
Thos. Moore & Son, Montreal.

METAL SAWS, POWER
E. C. Atkins & Co., Inc., Indianapolis.
Hoefer Mfg. Co., Freeport, Ill.
Lyman Tube & Supply Co., Montreal, Que.

METALS
British Smelting & Refining Co., Ltd., Montreal, Que.
Brown's Copper & Brass Rolling Mills, New Toronto, Ont.
Canada Metal Co., Toronto, Ont.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
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Ford-Smith Machine Co., Hamilton, Ont.
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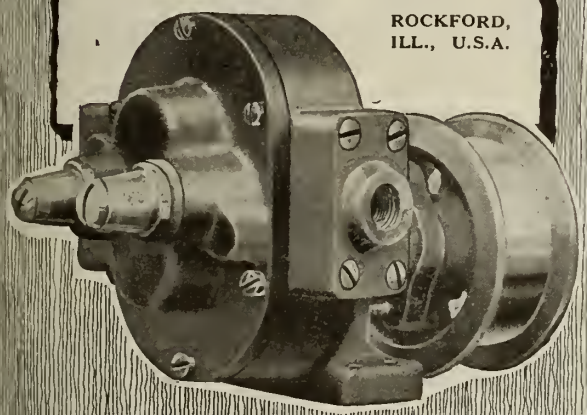

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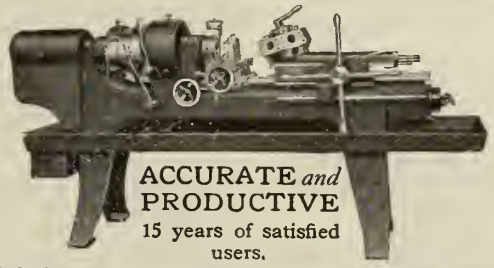

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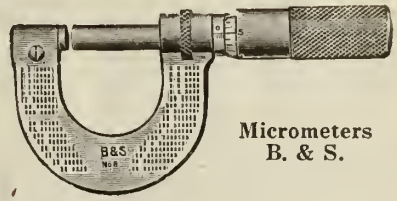

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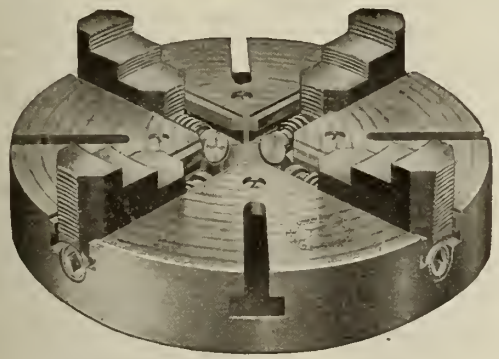

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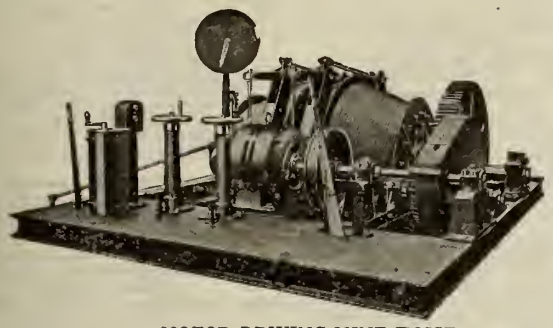

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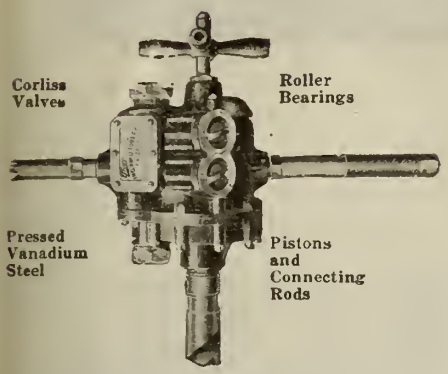

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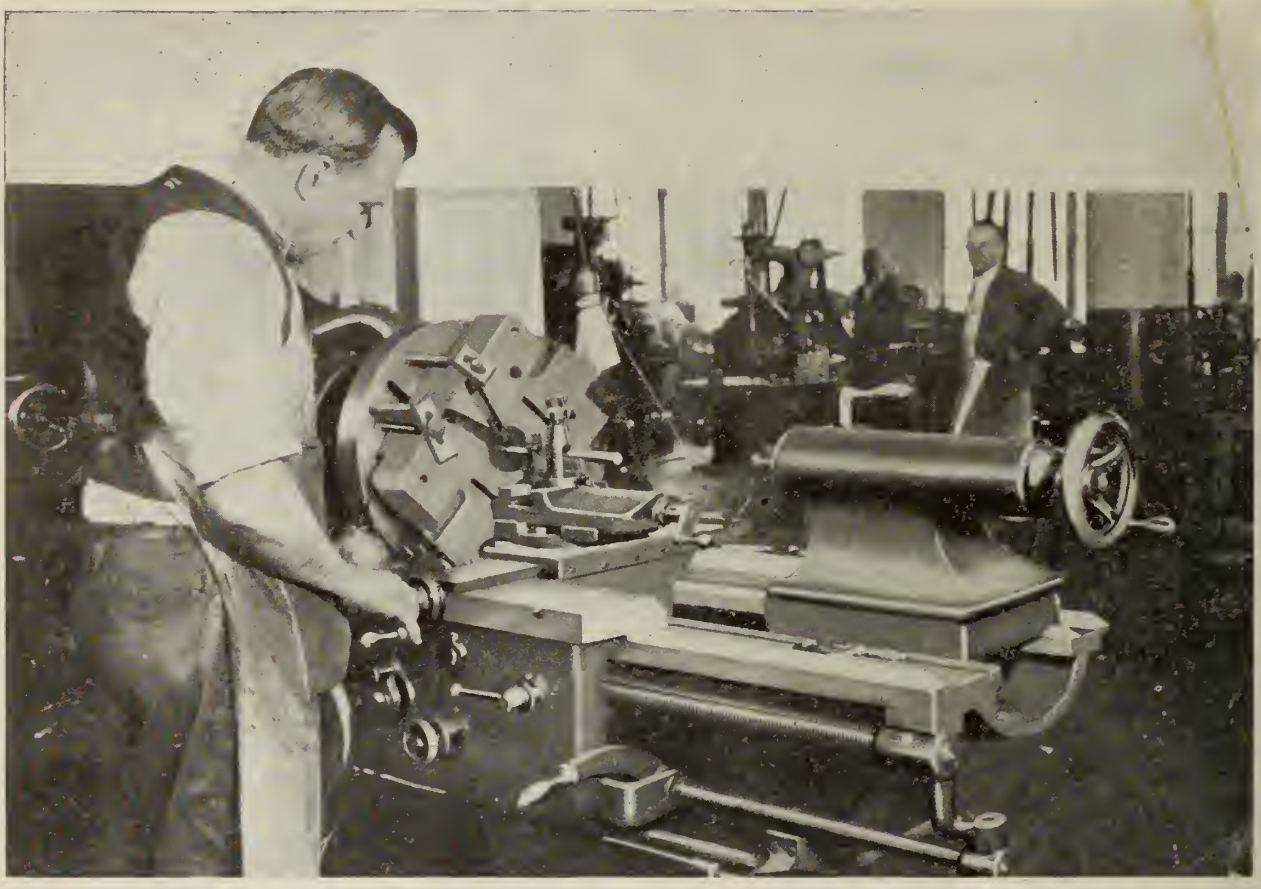

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GALT ONTARIO

TORONTO OFFICE AND WAREROOMS: BROCK AVENUE SUBWAY

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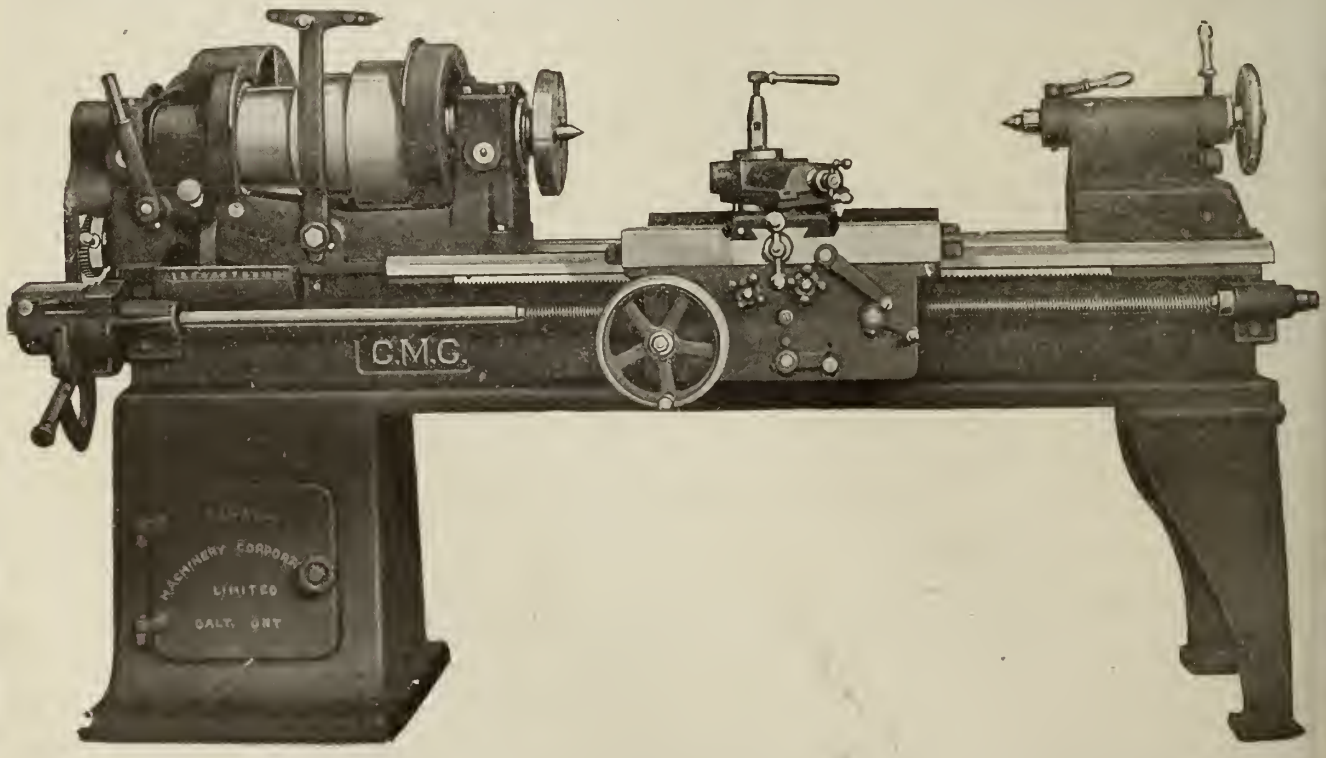

CANADIAN MACHINERY AND MANUFACTURING NEWS

A weekly newspaper covering in a practical manner the mechanical power, foundry and allied fields.
Published by the MacLean Publishing Company, Limited, Toronto, Canada

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HANS RENOLD OF CANADA LIMITED

announce
their recent appointment
by
Hans Renold Ltd., of Manchester, England
as
SOLE CANADIAN REPRESENTATIVES
for

RENOLD STEEL DRIVING CHAINS.

THIS APPOINTMENT TO BE EFFECTIVE FROM JUNE 1st, 1920, AFTER WHICH DATE ALL ENQUIRIES SHOULD BE ADDRESSED TO

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Vice-President,
J. MURRAY CLARK, K.C.

Managing Director,
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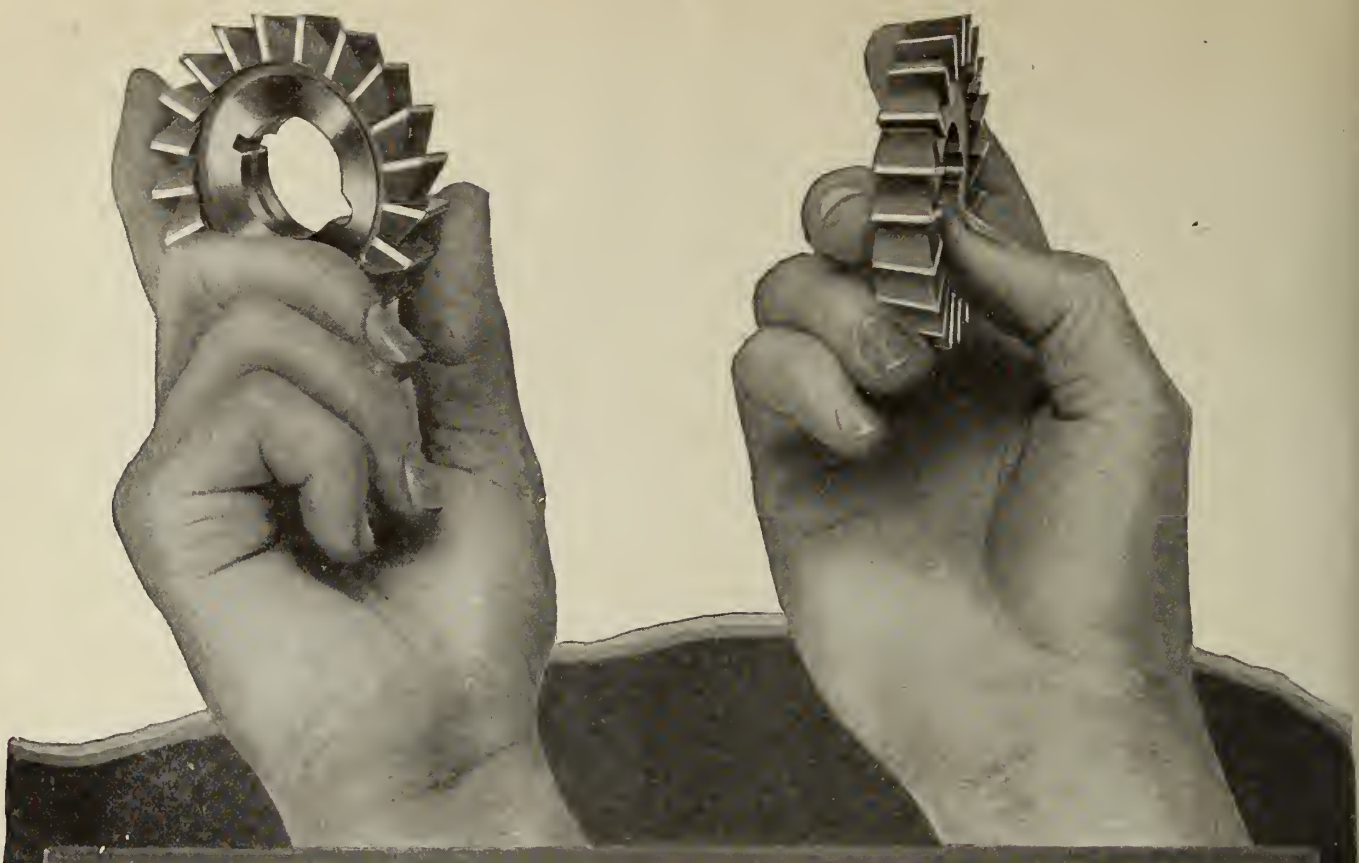

If it's speed you need—

One trial will prove the advantage of Pratt & Whitney Milling Cutters. No matter what the nature of the work they will give you the highest production the machine is capable of.

They're designed for free, fast cutting. And tempered and seasoned to last longer.

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And we make formed cutters for special work also. All are backed by the guarantee for goodness that the P. & W. trademark indicates.

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The BERTRAM Page

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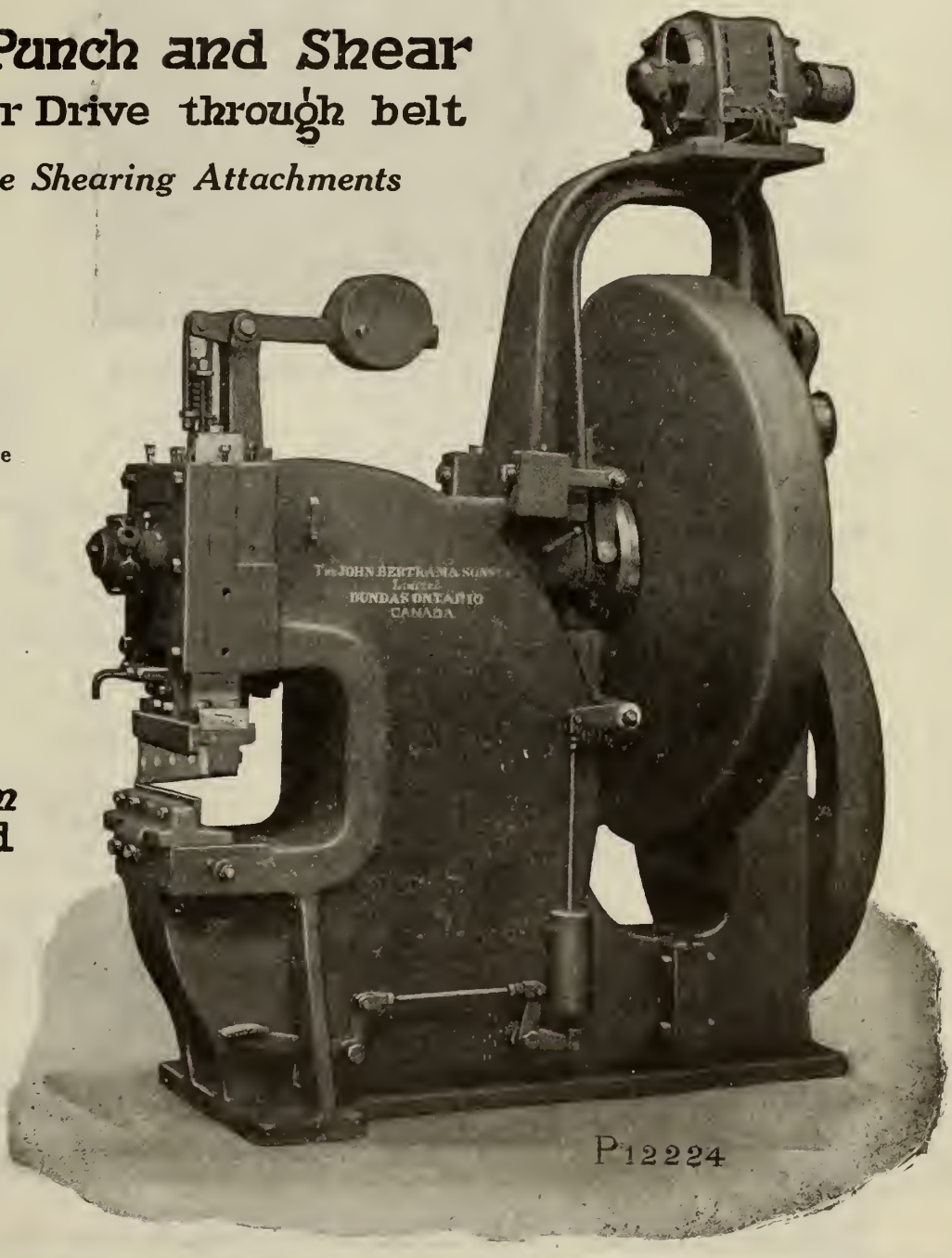
Fitted with Plate Shearing Attachments



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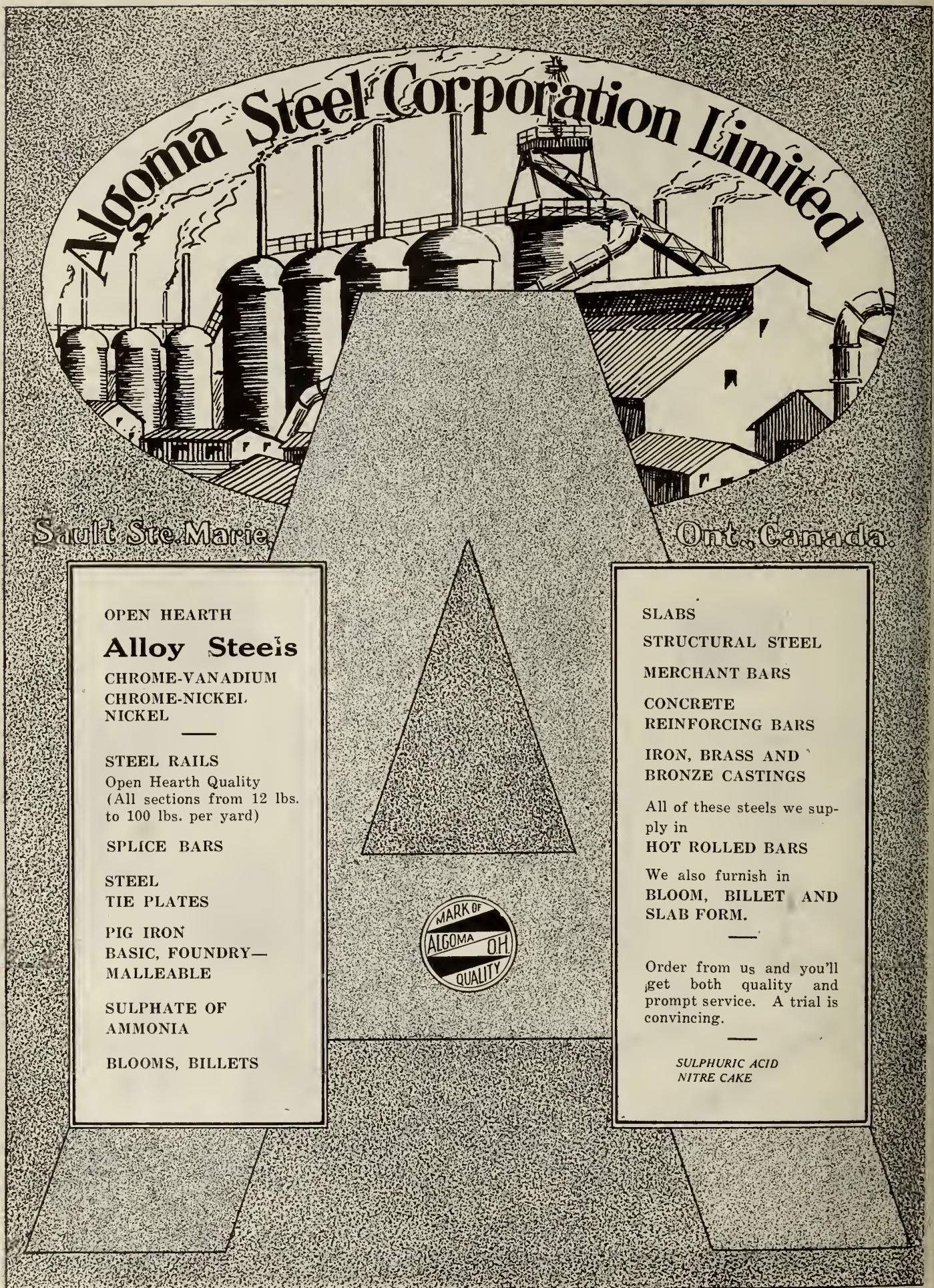

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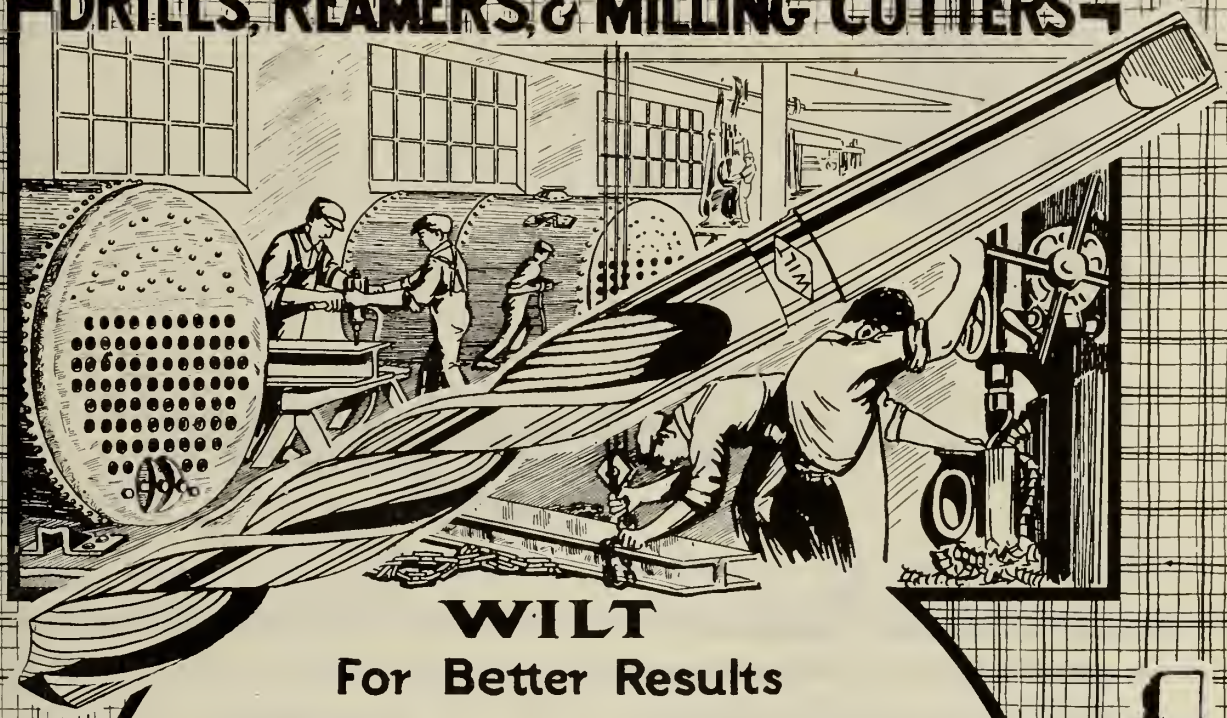

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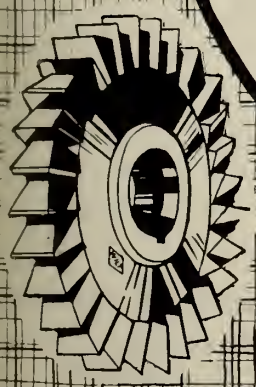

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"Where there's a WILT — There's the Way"

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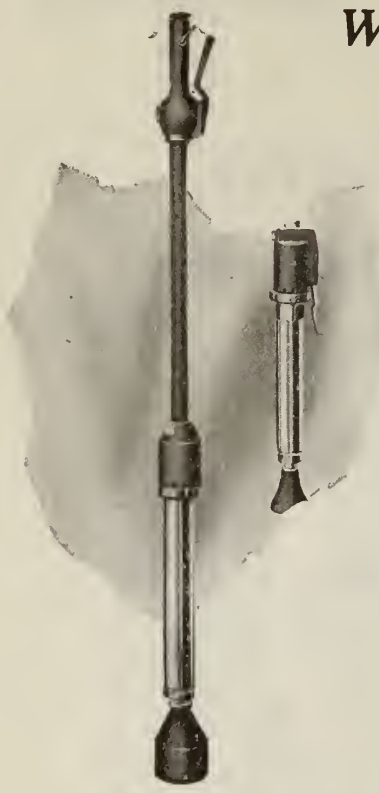

What "LITTLE DAVID" Sand Rammers Will Do

The figures in the following table are not merely "stunt" figures but indicate what can be accomplished every day in the average foundry under ordinary working conditions and include not only the time required for the final ramming but the careful peining as well.

Size of Cope	Time in Peining and Ramming		Ratio of Reduction	Per Cent. Time Saved
	By Hand	By Sand Rammer		
12"x 18"x 4"	5 min.	1 min.	1:5	80
12"x 18"x10"	10 min.	1½ min.	1:6.6	85
6'x 3'x 6"	20 min.	3 min.	1:6.6	85
6'x 6'x 8"	35 min.	8 min.	1:4.4	77
8'x 6'x 6"	1 hr.	10 min.	1:6	83
7'x 3'x12"	1 hr., 30 min.	16 min.	1:5.6	82
15'x 30"x16"	2 hrs.	27 min.	1:4.4	77
12'x 7'x16"	2 hr., 12 min.	34 min.	1:3.9	74
87"x159"x10"	4 hrs.	40 min.	1:6	83
19"x 90"x15"	8 hrs.	1 hr., 30 min.	1:5.3	81

If you are interested in lowering production costs in the foundry and at the same time obtaining better castings or if you wish to cut costs and secure more uniformly tamped concrete work it will pay you to investigate "Little David" Bench and Floor Sand Rammers. The power required to operate them is negligible when compared to the labor saving effected by their use. Compressed air is usually available and where it is not the economy of "Little David" Rammers warrant the installation of an air compressor to operate them alone and in addition the air is then available for hammers, sand blasts, hoists, grinders, etc.

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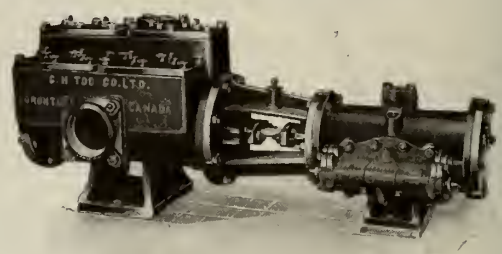

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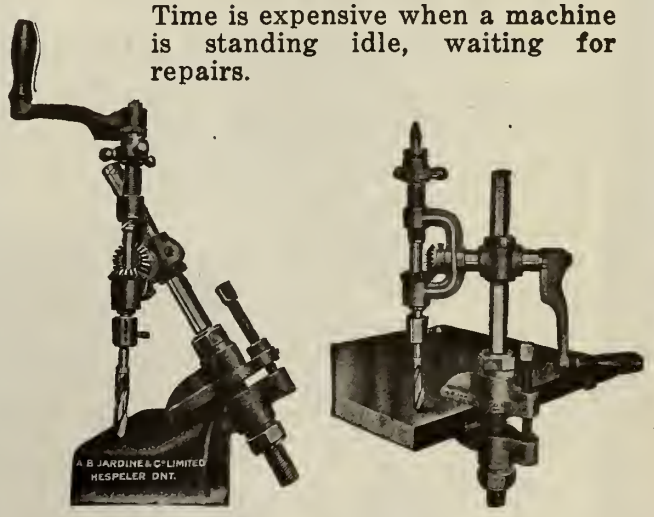

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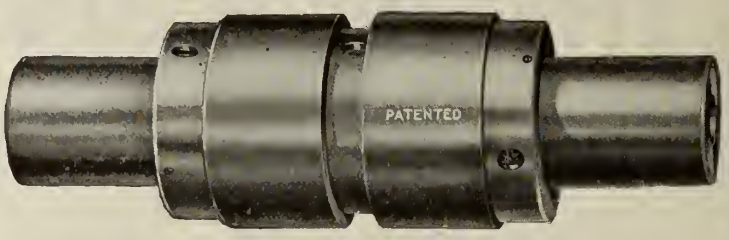

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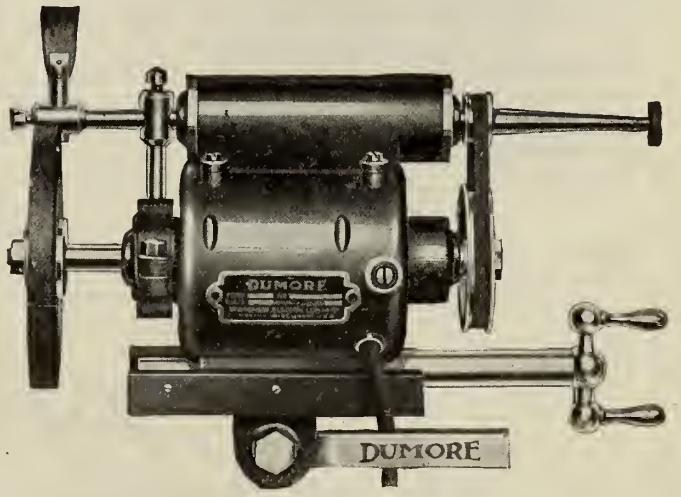
Let us go into the question of Die-Cast parts with you. We are the largest makers of die cast parts in Canada and can assure prompt and efficient service.



Die-Casting Chat No. 8

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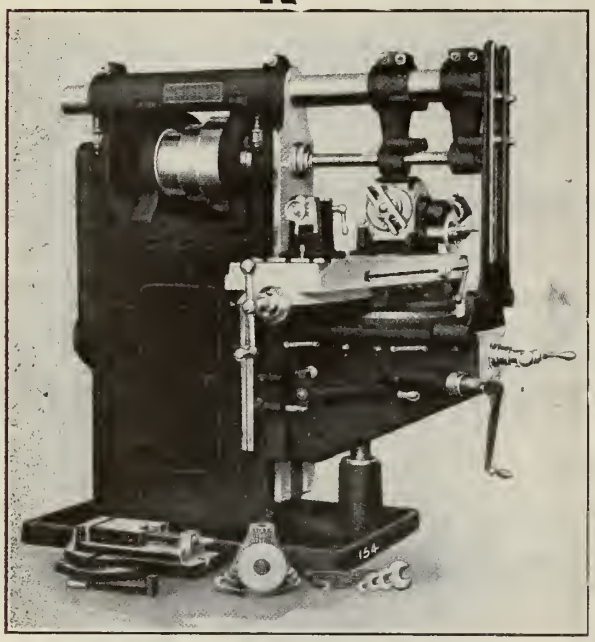

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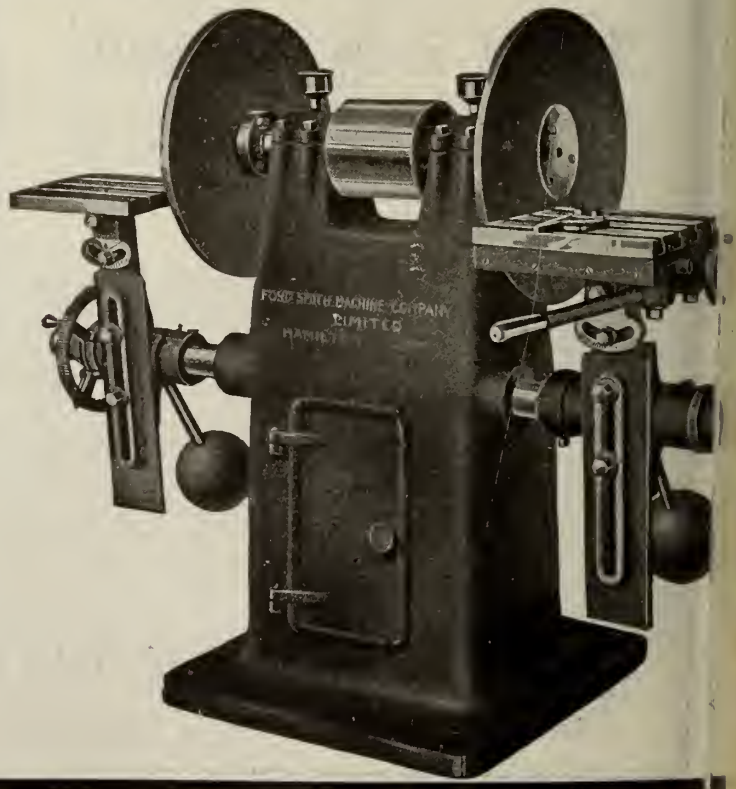

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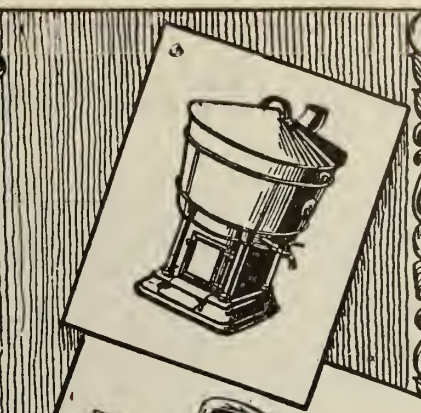
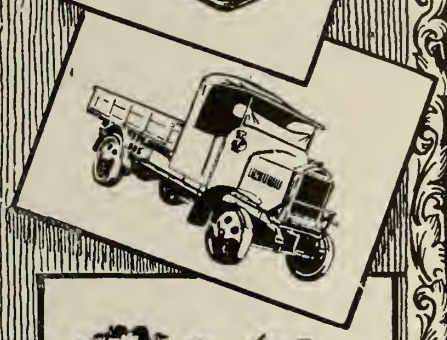
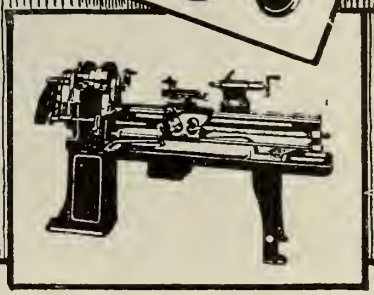
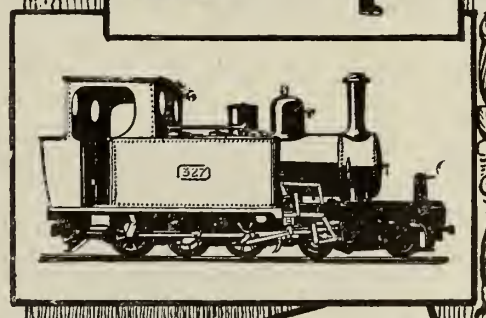
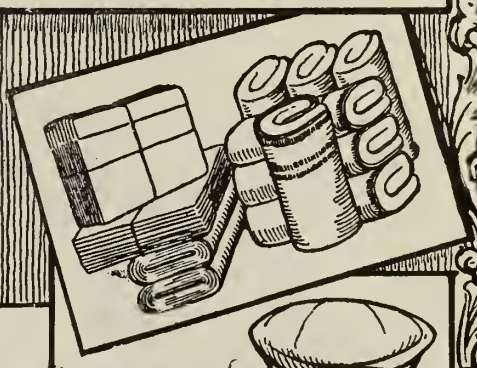

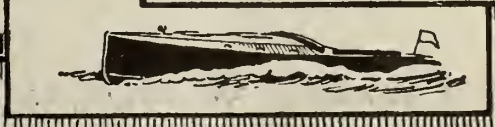
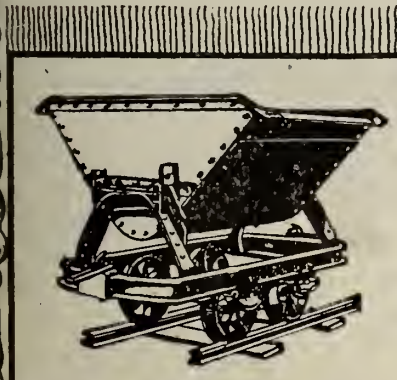
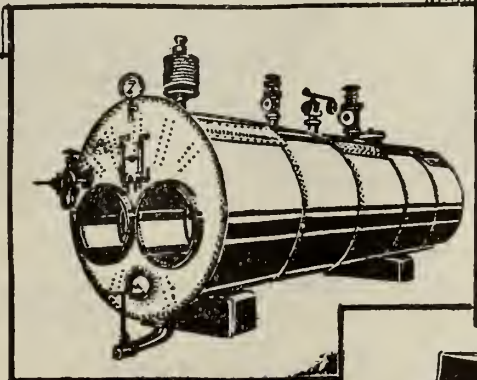

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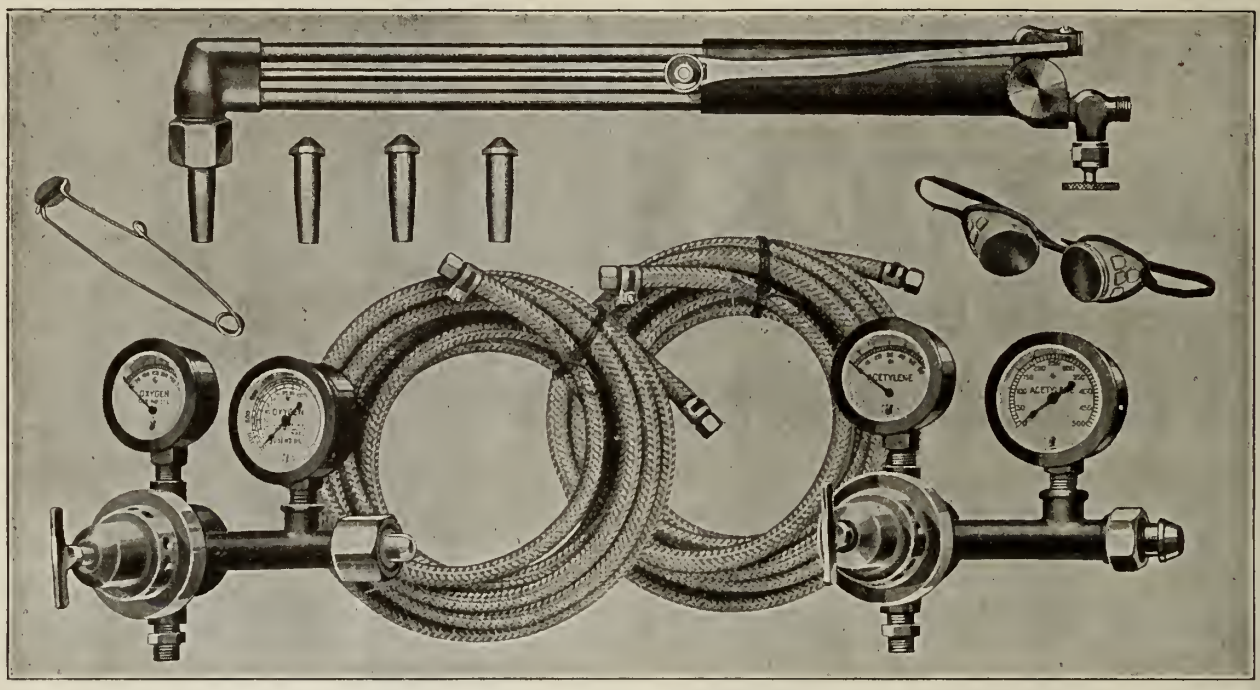
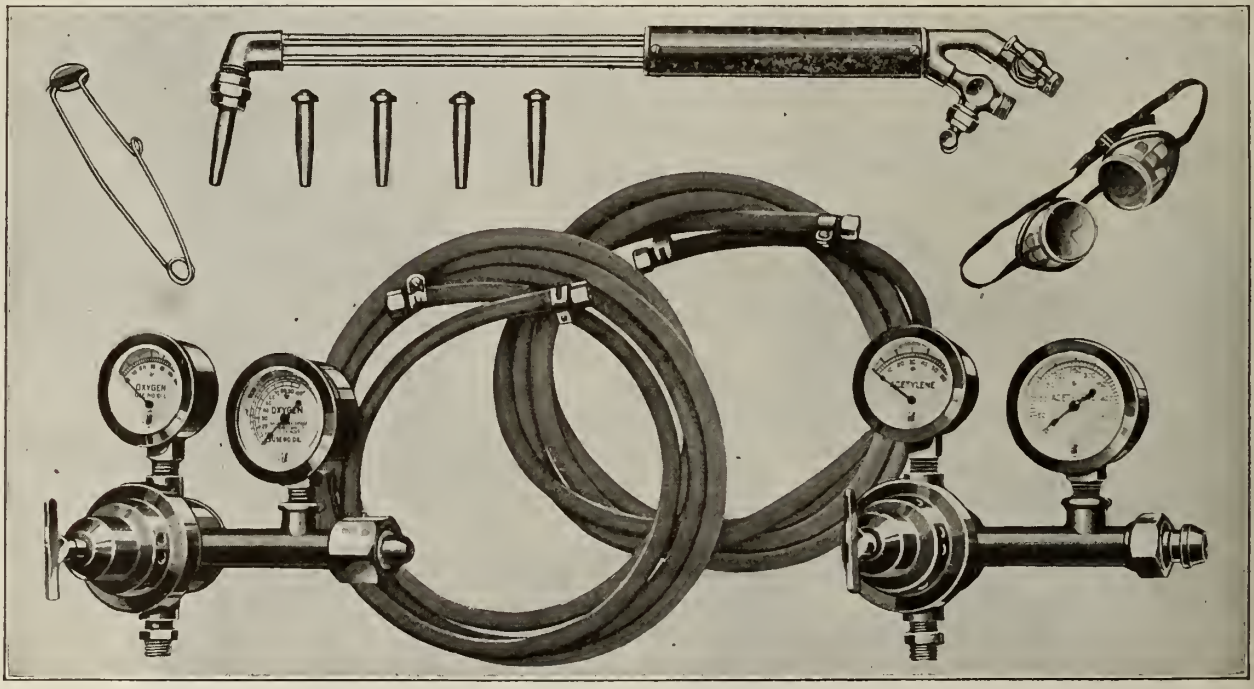
Rego Welding and Cutting Apparatus



No. 2 — Rego Cutting Apparatus — $127
Oxygen and Hydrogen



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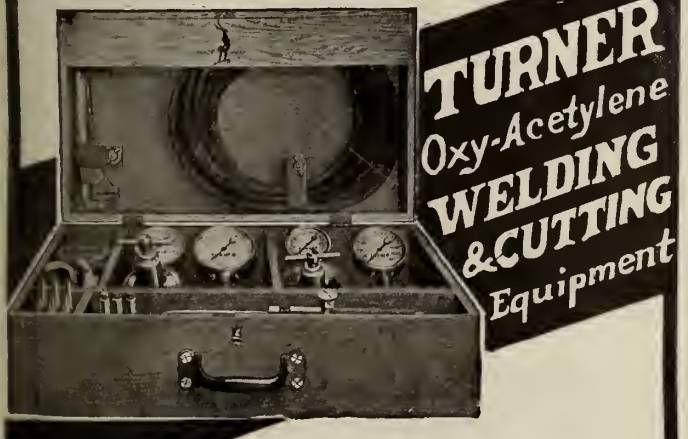

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ARMCO IRON is the standard welding wire for both electric arc and oxy-acetylene welding. It has unequalled welding qualities, due to chemical and physical uniformity; 99.84 per cent. pure iron content (minimum) guaranteed. Distributors in all industrial centres. 66

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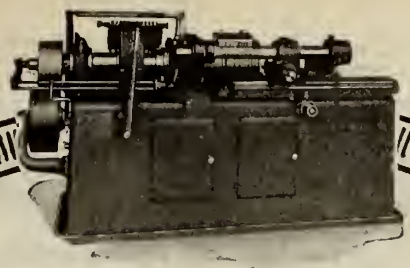

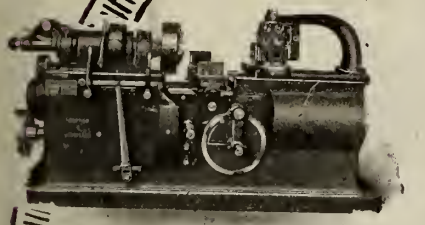

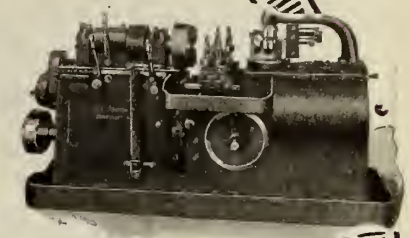

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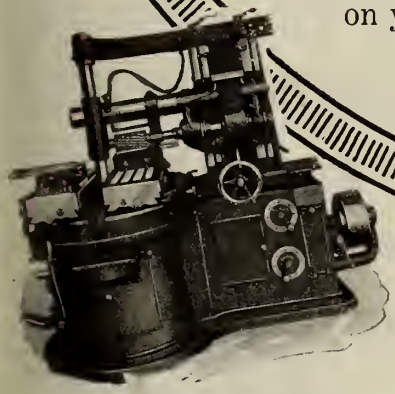

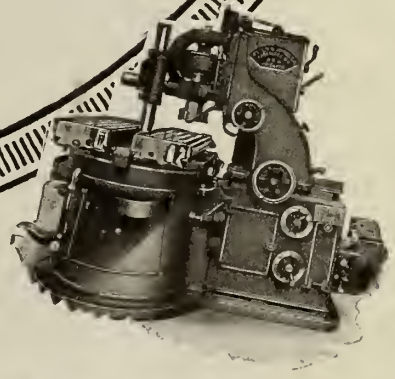

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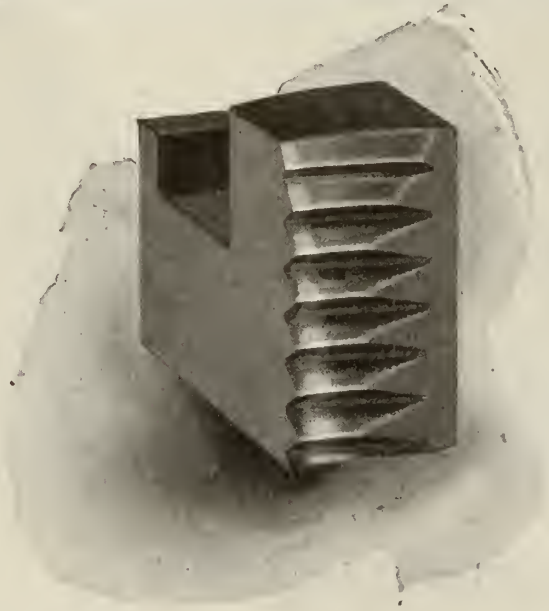

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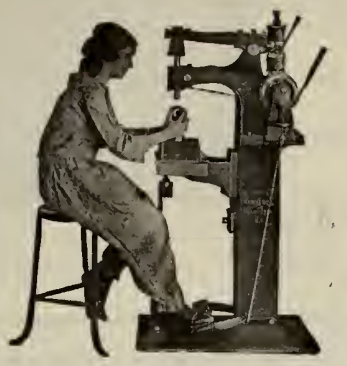

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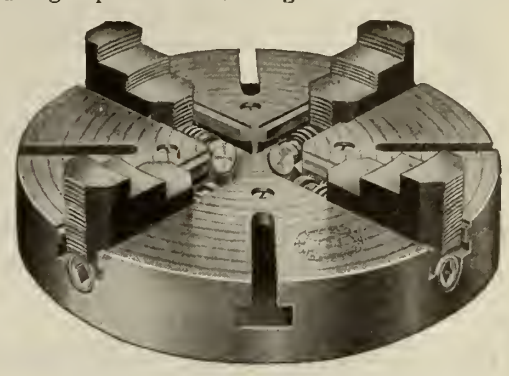

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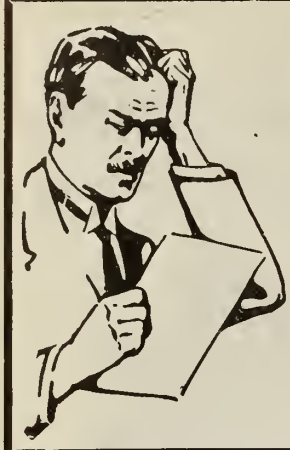

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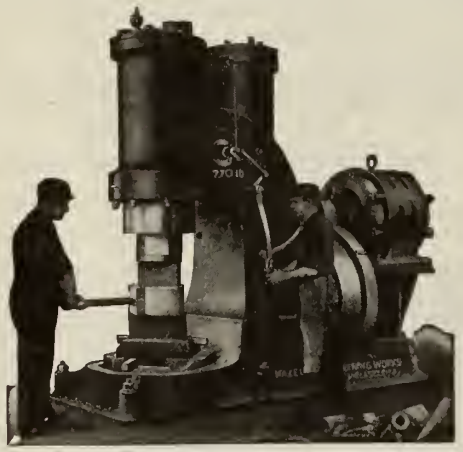

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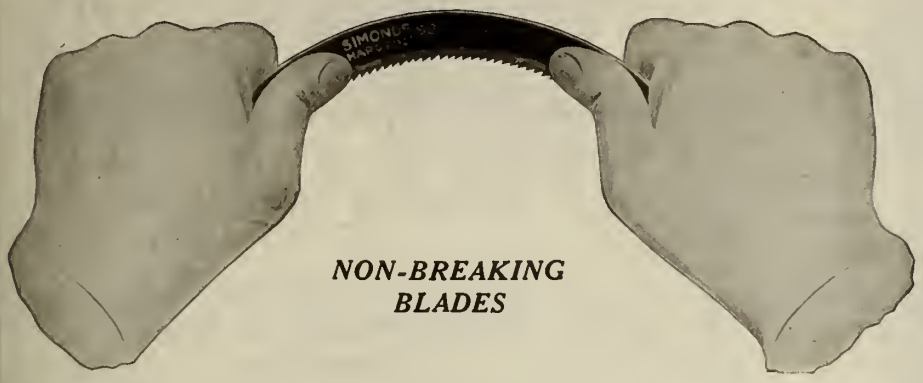

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Any Size or Length

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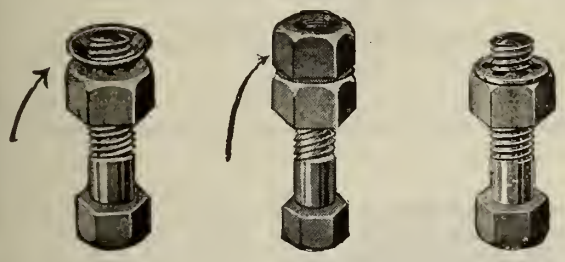
HOLD TITE NUT LOCK

See How Easily Applied



Knowing the size Bolt—use same size Nut Lock. Place over Bolt—as shown above.

Screw another Nut onto Nut Lock and Depress it — as shown above.

Remove Second Nut and Nut Lock will Look — as shown above.

The Hold Tite Nut Lock cannot come loose when it is compressed into the thread of the Bolt. Compressing will not destroy the thread.

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Hydraulic
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Presses

Made in Canada

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Industrial Bridges, Buildings, Towers, Smoke Flues and Stacks, Chutes, Coal Bins, Ore Bins, Tanks, Cranes, Engine Houses, Grain Elevators, Derricks.

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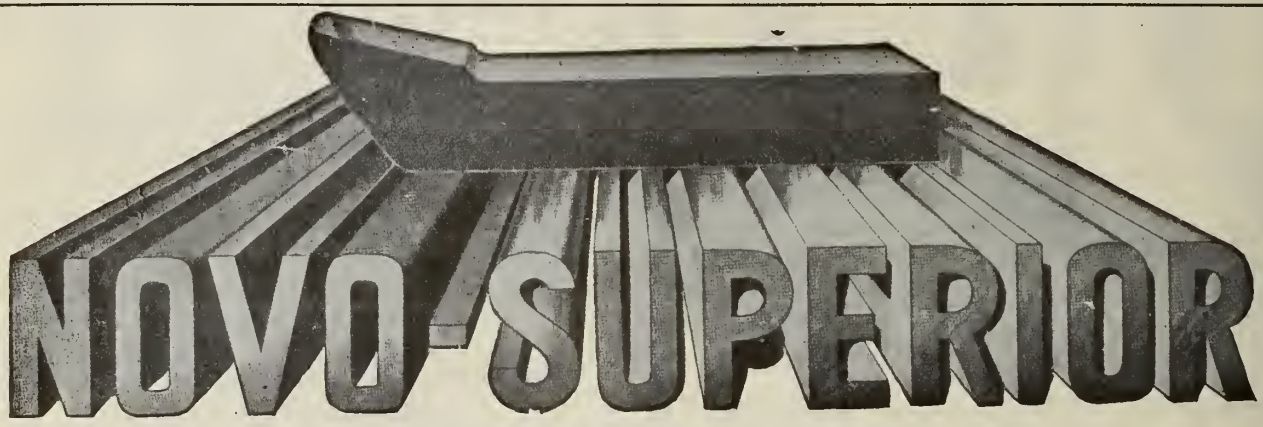

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Tool Steel for Every Purpose

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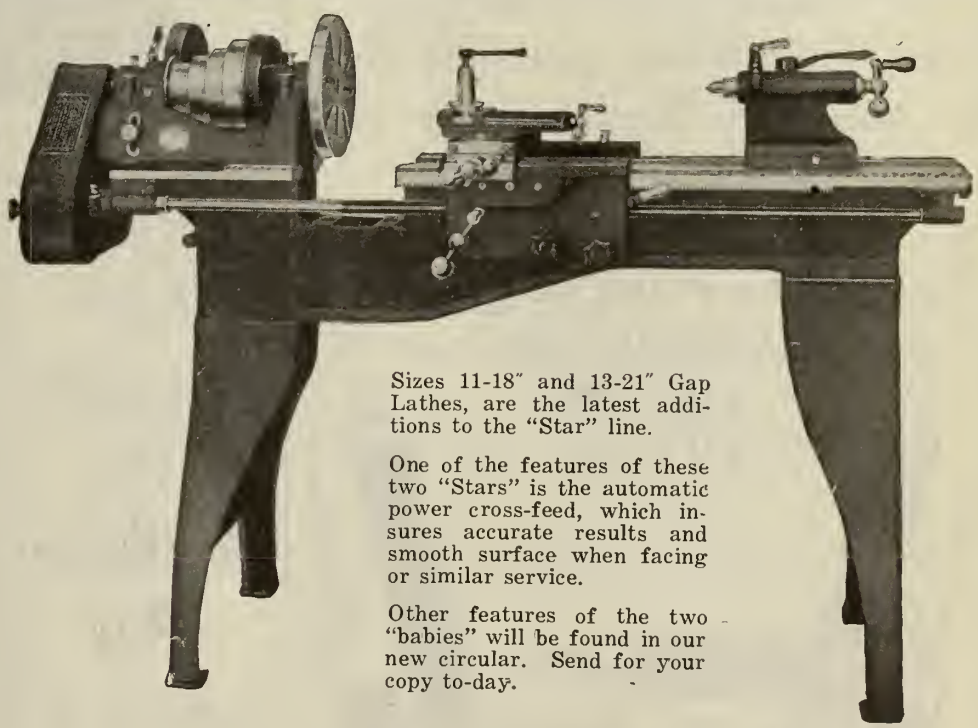
STAR LATHES



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One of the features of these two "Stars" is the automatic power cross-feed, which insures accurate results and smooth surface when facing or similar service.

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Don't let a workman use a file after it has begun to lose its edge.

Files that have lost their original keenness tire workmen and do poor work. They waste time, which costs more than new files.

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Steel from an exclusive formula, teeth accurately cut, and special hardening, are the secret.

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Matthews Letters and Figuers are hand made from carefully selected steel, heat treated for hardness, insuring long service under hard usage. They make deep clean-cut impressions that outlast the product.

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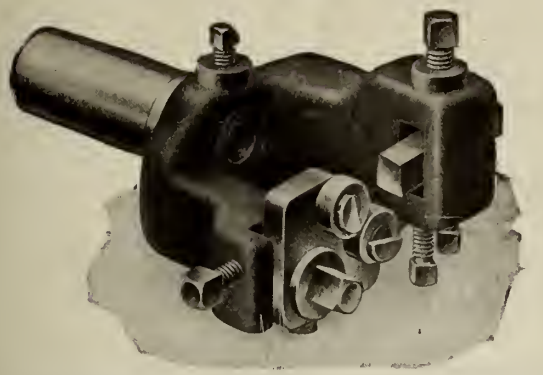

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Electrite

Electric furnaces, automatically regulated, the most modern methods, and the introduction of Uranium — make this a steel of truly remarkable cutting properties.
We know "Electrite" cannot be bettered — and stand ready to prove it to you.

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Squares 2" to 6"

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MADE TO ANY ANALYSIS

PROMPT SHIPMENT

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The Leading Chuck

Irrefutable evidence of the leadership of Jacobs Chucks is the fact that the people who know most about drilling —mechanics, foremen, superintendents and drill makers alike—prefer them by a large majority.

Equip your drills with them.

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A SELF-CONTAINED HYDRAULIC UNIT

EASTERN UNIVERSAL HYDRAULIC PRESS. Supplied in 20-35 and 50 ton capacities, full hydraulic depending on no springs or weight for return of ram, delivering pressure instantly at a speed of 1½ in. per second return of ram 3 in. per second.

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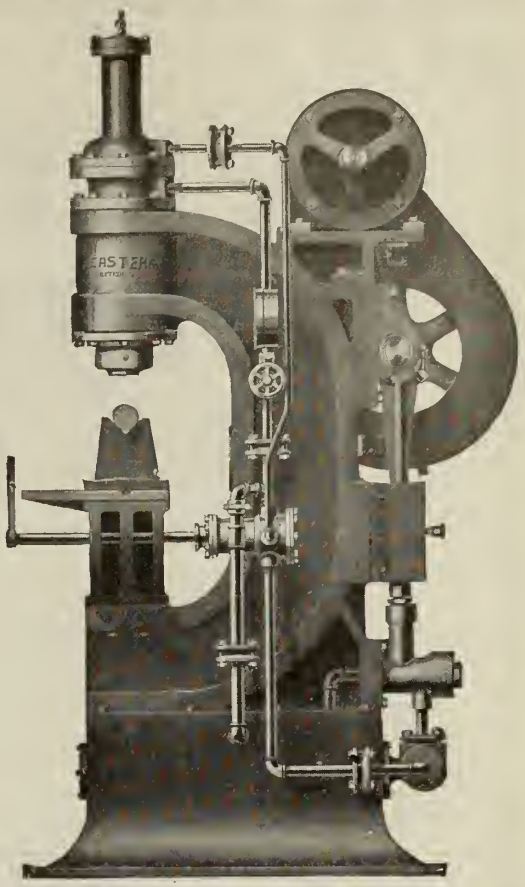
EASTERN UNIVERSAL PRESSES are tested before leaving our plant at 33 1/3% overload. They are furnished with rolling centres and are unexcelled for straightening of motor crank-shafts, heavy wheel shafts, broaching splines in drive plate, differential gears, and others. Straightening front axles and spindles.



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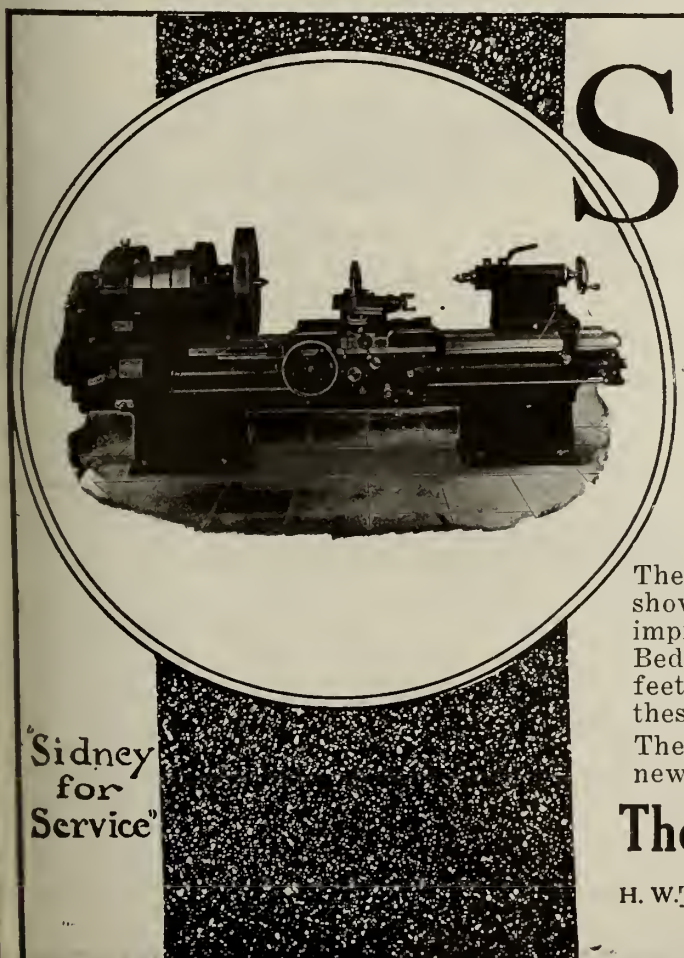

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SIDNEY

Heavy Duty Engine Lathes

Noted for Their Power and Rigidity

One of the outstanding features of the Sidney is the manner in which it takes deep cuts through tough metals. Clean cuts without chatter, without pause. The Sidney is so designed that rigidity is maintained under severe conditions, and, in normal service.

The 25-inch Heavy Duty Quick Change Sidney here shown is the last word in lathe construction. Every improvement will be found in this, the latest model. Bed lengths available are: 10, 12, 14, 16, 18 and 20 feet. 27-inch swing design can also be supplied in these lengths.

The specific details of the Sidney are given in our new Bulletin. Write for your copy to-day.

The Sidney Tool Co., Sidney, Ohio

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MONTREAL, QUEBEC

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A MESSAGE ON NORTON SERVICE

From Charles H Norton

"Grinding reduces labor costs"

There are few who seem to realize what the Norton machine organization has accomplished in its twenty years of effort.

Do you realize that twenty years ago, March 1 of this year, all cylindrical ground work cost more than turned and filed work?

That while the grinding was a refinement it was obtained at a cost in addition to the cost of turning.

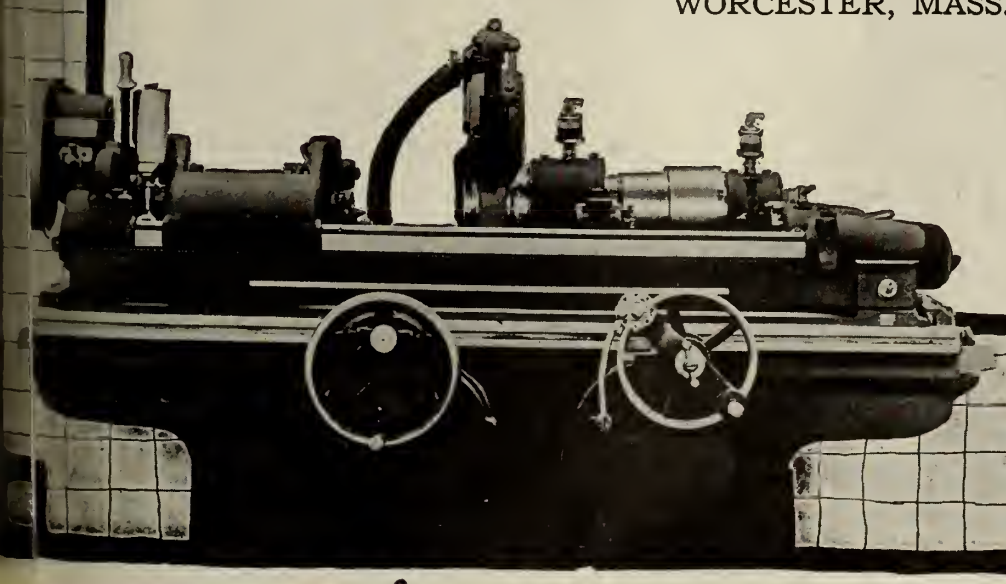
Do you realize that now when the proper study is given to the relation between the lathe and the grinding machine, refined cylindrical ground work is secured at a labor cost that is less than when work is turned in the lathe by the method used twenty years ago?

When we realize that 90% of the parts contained in every moving mechanism in the world are round and revolve upon a round axis, and when we understand that there are billions of these moving mechanisms using many more billions of round parts, we can comprehend something of the value to the world of the Norton service during these twenty years. It has been the Norton organization that has made possible the production of turned and ground work in less time than was required for the turning alone before the introduction of the Norton cylindrical grinding machines, and the Norton methods of turning and grinding.

CHARLES H. NORTON

NORTON COMPANY

WORCESTER, MASS., U. S. A.



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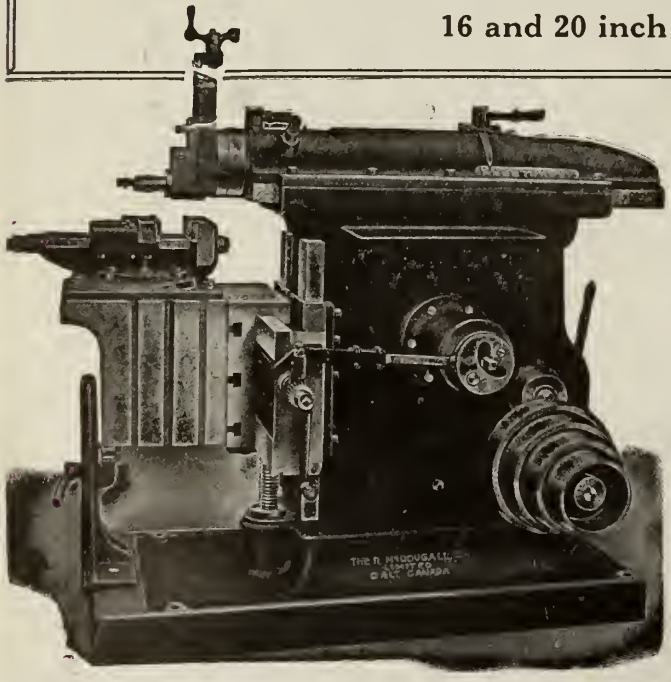

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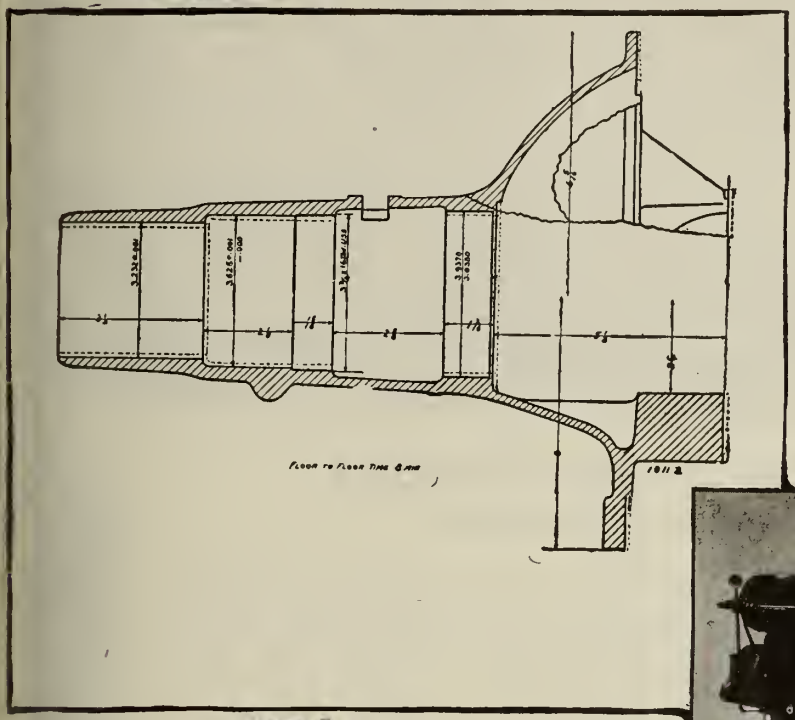

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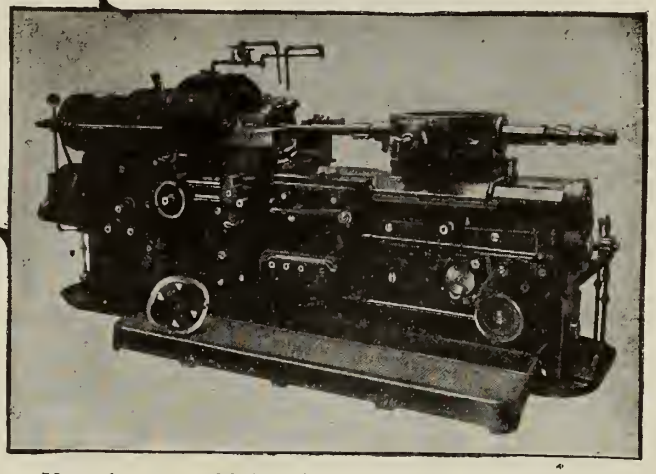

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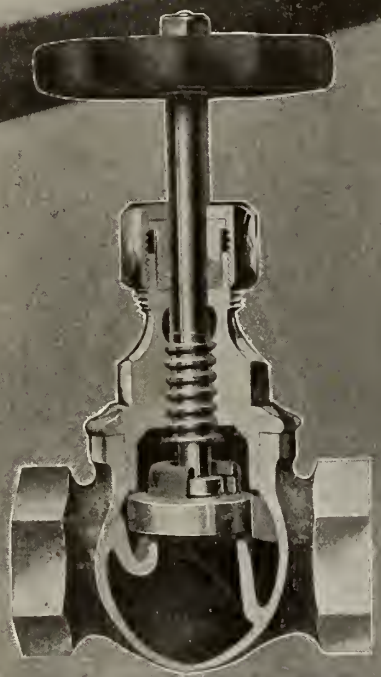

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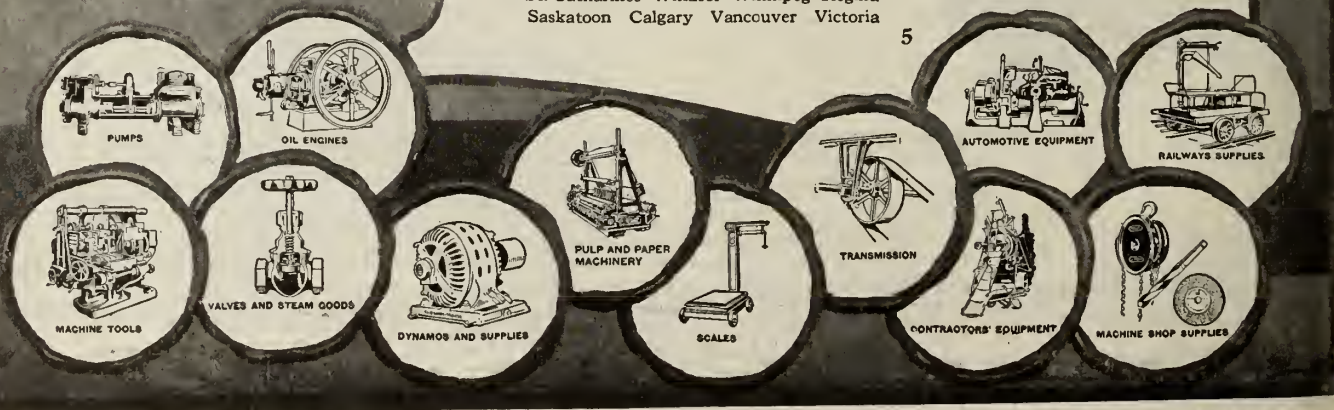

CANADIAN MACHINERY
AND
MANUFACTURING NEWS

Vol. XIII., No. 21 May 20, 1920

Discussion on American and British Pipe Threads*

Being an Extract From the Finding of the Committee of Manufacturers of Pipes, Valves and Fittings, Following a Conference Held in Paris, in Reference to the Adoption of an International Standard

By J. H. RODGERS

AT no other time in the world's history has there been a greater necessity or a more genuine desire on the part of manufacturers and engineers of the Allied countries for a better understanding of their mutual problems. A frank and liberal exchange of ideas will bring about closer international co-operation and secure greater uniformity in matters of standard practice. With this in view the following data has been compiled from the findings of the committee of Manufacturers on Standardization of Fittings and Valves, with the hope of contributing to the common knowledge and shedding additional light on certain phases of the subject which may have been somewhat obscure in the past.

While it is generally known that the usual practice has been the adoption of the American or the British standards of pipe threads, it will be interesting to many to learn that in 1914, at a conference held in Paris, an International Pipe Thread Standard was proposed, but that so far, it has not been applied commercially. To familiarize the readers with the outline of the various standards, the following brief summary has been given.

The American Standard:

Pipe sizes—⅛ inch to 30 inches, inclusive.

Profile of thread—60 degrees V thread, slightly truncated.

Taper male and female threads are established.

Taper of cone (1 in 16).

Straight threads are recognized only for certain special applications.

Threaded plug and ring gauges are established.

Tolerances are established.

Dimensions are expressed in inches and millimeters.

The British Standard:

Pipe sizes—⅛ inch to 18 inches.

Profile of thread—55 degrees thread, rounded Whitworth.

Taper and straight male and female threads are established.

Taper of cone (1 in 16).

Straight threads are recognized for general use.

Threaded plug and unthreaded ring gauges are established.

Tolerances are established.

Dimensions are expressed in inches.

The Proposed International Standard:

Pipe sizes—⅛ inch to 20 inches, inclusive (3 to 500 mm.).

Profile of thread—55 degrees, rounded (Whitworth).

Taper and straight male threads are established—Two tapers are recognized (1 in 16) and (1 in 32).

Straight male threads are recognized for general use.

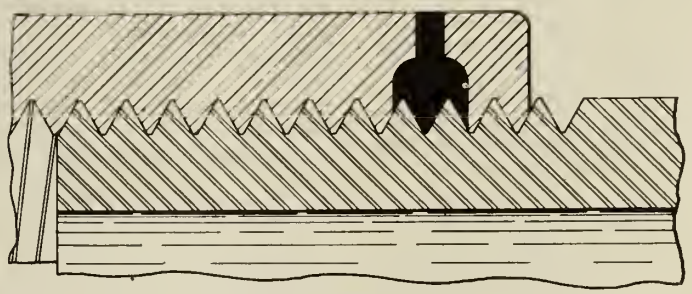

FIG. 17—STRAIGHT THREADS WITH LOCKNUT.

Gauges are not established.

Tolerances are established.

Dimensions are expressed in millimeters.

General Remarks on Pipe Practice

In America and Canada the general use of the straight male and female threads for pipe joints was discarded many years ago. This was forced upon the manufacturers by the urgent demand for interchangeability, and this condition is much easier attainable with product with a taper thread. By interchangeability is meant that ready method of making joints with pipe cut by one manufacturer, with valves and fittings made by another manufacturer, and with threads cut by the steamfitter, with dies made by still another manufacturer. The taper male and female threads for pipe joints is more firmly established on this continent than elsewhere. Some of the methods used throughout the world may be stated as follows:

Taper male and female threads.

Taper male and straight female threads.

Greater taper on female than on male.

Straight threads on male and female

*Second of two articles bearing on pipe thread standards, the first appeared in the Feb. 19th issue.

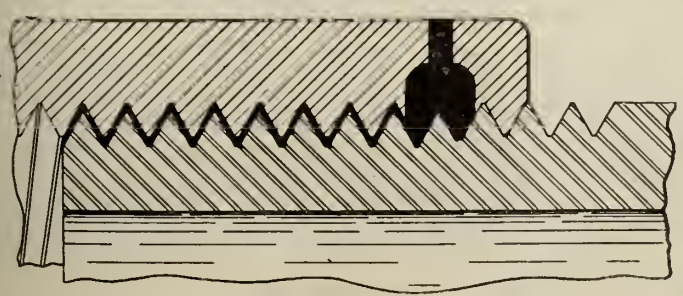

FIG. 18—STRAIGHT THREADS WITH PACKING AND LOCKNUT.

joints with packing and locknut—Fig. 17.

Straight threads, with packing between male and female threads as well as under locknut—Fig. 18.

Various Standards in Use

Fig. 17 illustrates a joint made with a straight male and female thread, which requires packing to make a tight joint, and a locknut to retain the packing in position. No permanent metal to metal joint is made. This type of connection is used extensively in Europe. It will readily be seen that the efficiency of this joint is dependent very largely, on the packing and the locknut. Owing to the long thread engagement and the possible imperfections in the pitch, the possibility of making interchangeable product is greatly increased. Should the male thread be cut slightly undersize it is also necessary to use packing between the thread, as shown in Fig. 18. Where joints are subjected to considerable vibration and heat, the effectiveness of the connection is soon destroyed. This joint is still used to a small extent in the United States, but usually where the temperature and the pressure are comparatively low.

With straight female and taper male threads, or where the taper of the female is greater than on the male, the chief objection is that the actual effective contact only comes on a small portion of the thread length. Considerable use of this style of joint is the practice in Europe, but on this continent it is practically limited to wrought iron or wrought steel fittings, where the female section with a straight thread will yield sufficiently to adjust itself to the taper male when the oint is properly screwed together.

The ideal joint is where the two threads are given the same taper, as it gives a metal to metal contact throughout the entire length of thread, assists in filling all irregularities, allows reasonable variations in the diameters without destroying the interchangeability, and holds up under excessive pressure. In comparing a taper thread joint with a straight one, the efficiency of a drill socket might be cited, where the taper shanks of twist drills will adapt themselves to any make of drill press, while the same result would be virtually impossible with straight shank drills. In former days a steamfitter felt that he was shouldering a very heavy responsibility when called upon to put up piping to withstand a steam pressure of from 200 to 300 lbs., but with the Briggs standard as adopted in the United States and Canada, the highest pressure offer no greater difficulty than the ordinary low pressure installations.

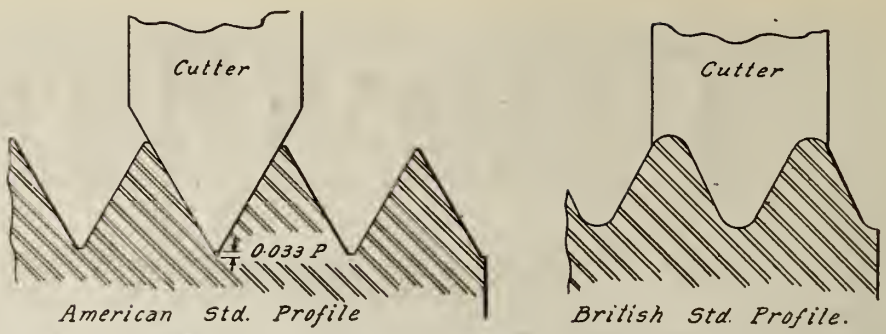

FIG. 21—PROFILE OF AMERICAN AND BRITISH THREADS WITH CUTTERS.

In considering the merits of any pipe thread standard, it must be borne in mind that the ease of screwing pipe into fittings to make tight joints is the prime consideration. Users must be able to buy pipe, fittings or valves, indiscriminately and make whatever connections are considered satisfactory; therefore, any standard to be efficient must fulfill these requirements. The American standard is the only existing standard that has consistently met these demands for a long period of years. Its success has been due to a combination to desirable features, which are outlines herewith.

Profile of Threads

As shown in the previous article on this subject, the profile of the American standard thread was illustrated in Fig. 1. The flat or truncated portion of the thread is only slight, even on the coarsest pitch of eight threads per inch, where the flat measures about .004 in. The purpose of the truncation is merely to break the crest and the root of the sharp V, and thus facilitate the fitting of the threads. In commercial work, the pipe is generally threaded with dies which may be more or less worn, so that a perfectly theoretically cut thread is almost impossible. The first evidence of wear on a tap is the dulling or wearing down of the tops of the teeth, with the result that the female threads cut with a worn tap will have a rounded root, but the crest will remain nearly the correct profile, for the reason that the wear is greatest at the crest where the greatest work is done, than on the sides or the root. The same condition practically applies to dies for cutting the male threads. At A Fig. 19 is shown male and female threads that have been cut with dull tools. When the wear is not excessive, an almost perfect fit can be obtained with this type of thread, owing to the sharp crest forcing its way into the root of the thread and providing a metal to metal contact throughout the entire length of the thread engagement. The American thread affords greater opportunities for compensation for inaccuracies. Slight errors in the pitch of thread is easily taken up by this thread.

Where only one of the threads is cut with a dull or worn tool, the breaking down of the crest is only necessary on the opposite thread. Illustrations of this condition are shown at C and B in Fig. 19.

The profile of the British Standard pipe thread, as well as the proposed International thread, is shown at D Fig. 20, and has an inclined angle of 55 degrees, rounded at crest and root, and the taper is at right angle to the surface of

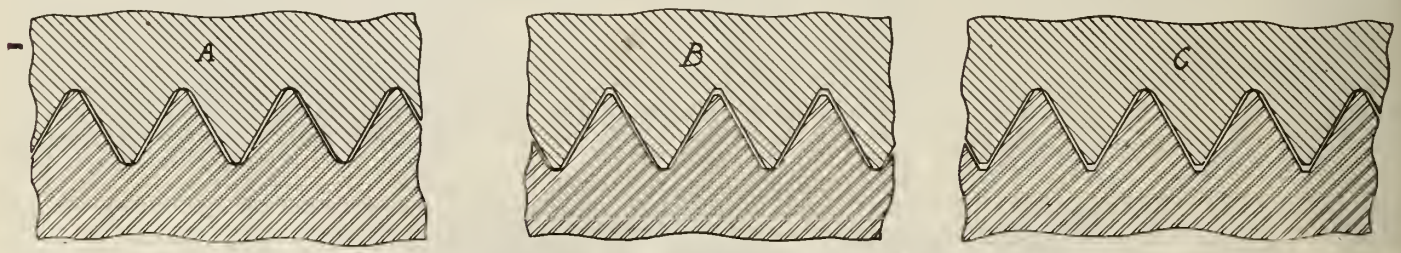

FIG. 19—UNITED STATES THREADS CUT WITH WORN TOOLS.

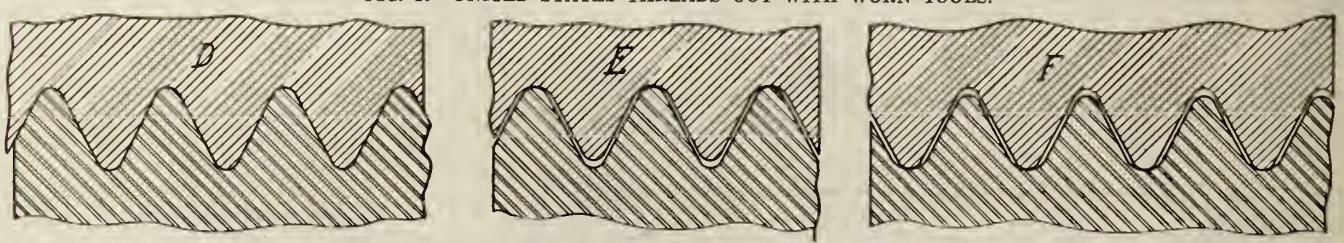

FIG. 20—BRITISH THREADS CUT WITH PERFECT AND WORN TOOLS.

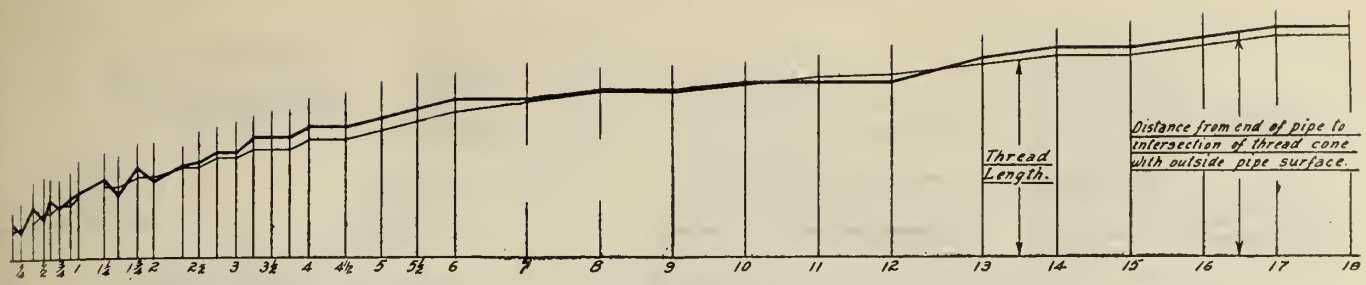

FIG. 22—COMPARISON OF BRITISH AND AMERICAN THREADS.

the cone. It might be well to state here that with perfectly cut threads, one contour of thread has no distinctive advantage over another, and any one will make a joint equally effective, but as perfectly machined pipe threads are impossible in commercial manufacture, the suitability of the various profiles to working conditions is the prime consideration. Owing to the inevitable wear of the cutting tools, it is obvious that the rounded crests of the British threads will not conform so readily to inaccuracies in the roots as the sharper crests of the American standard profile, so that the commercial made joints in all probability is only made on the rounded crests and roots. It is doubtful if the flanks will come into intimate contact. When realizing that the prime object of a pipe thread is to make a pressure tight joint under commercial conditions, the advantages of the American standard over that of the British is clearly evident. The result of worn tools when working on the British threads is illustrated in E and F in Fig. 20.

The rounded crests and roots in the British threads introduce complications in the manufacture of the different tools and gauges that make the interchangeable factor a serious problem. This is amply illustrated in Fig. 21, which shows the respective cutters for both the American and the British practice. The one tool will answer for a wide range of threads on the American thread, but in the British system the cutting tools and the gauges are limited to the one particular pitch for which it is used. When the latter has to be reground to operation requires very accurate attention, while the straight sides of the American thread offers little difficulty.

While the American thread is cut at right angles to the axis of the thread and the British thread is cut at right angle to the surface of the cone, there is little advantage that can be given to one over the other, but the manufacture of the taps and the dies are easier to make when the threads are cut at right angles to the axis of the thread.

Length of Threads

Fig. 22 shows the respective proportions of a 2 inch British and a 2 inch American thread, giving the relative lengths of perfect and imperfect threads, and also the effective thread length in each case. On every pipe size the American standard length of thread includes the two imperfect threads as indicated. The effective length of the American standard thread is expressed by the formula $(0.8G + 6.8)P$, where G equals the outside diameter of the pipe and P equals the pitch. The British standard length of thread is expressed by the formula (D ⅛ inch), where D equals the nominal bore of the pipe. The length of engagement in both cases is determined by the distance of the gauging point from the end of the pipe.

In comparing the advantages of one thread length over another, and deciding on the most suitable length, it is necessary to take into consideration not only the theoretical lengths mentioned above, but also the variations from these lengths permitted by the established tolerances. The thread must be long enough to give sufficient engagement under the extremes permitted by the tolerances. Too long a thread is objectionable as the additional imperfections must later be crushed in making a tight joint. In the American standard the tolerance is limited to one thread plus or minus from the gauge size, but in the British standard the tolerance established is expressed in terms of distance which bear no constant relation to the pitch of the thread.

In considering the effective length of the threads it will be noted that the American standard is based on the outside diameter of the pipe and the pitch of the thread, while the British is based on the nominal bore of the pipe only. As the outside of the pipe is the determining factor of a pipe thread it would seem to be more suitable basis from which to compute the thread length. However, the formula is of secondary importance, providing the length is suitable for practical application. By referring to Table 1, it will be noted that the number of effective threads on American standard pipe increases uniformly, being 7.1 on the ⅛ inch size and 30.8 on the 30 inch size. On the British thread the increase is irregular, a smaller size frequently having a greater number than a larger size. The same is true of the proposed International standard. This in itself is of no great importance, but it shows that the American practice is more consistent.

In order to make the diameter of the thread as large as possible with relation to the outside diameter of the pipe, thereby maintaining the maximum thickness of the pipe, the American standard utilizes the two threads with imperfect crests as effective threads. By referring to Fig. 22-A, it will be noted that the cone formed by the tops of the threads intersect the outside surface of the pipe between the end of the pipe and the end of the effective thread. The distance of this intersection from the end of the effective thread is a constant amount on all sizes, being equal to two threads.

By referring to Fig. 23, it will be noted

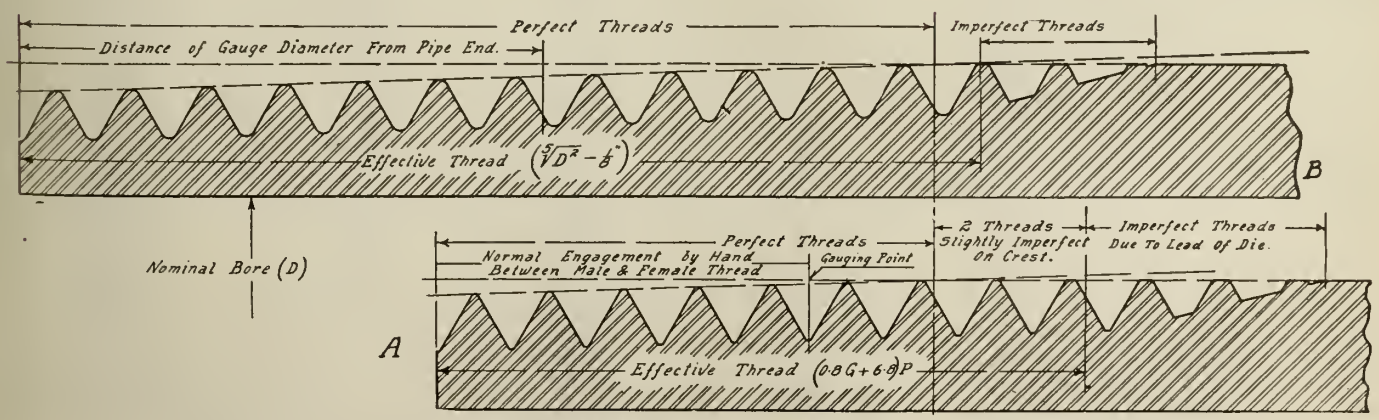

FIG. 23—BRITISH THREAD CHART.

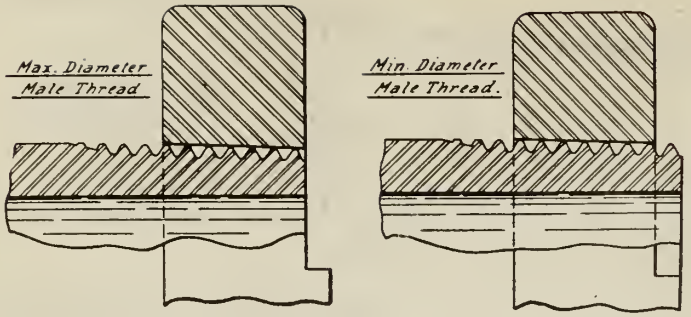

FIG. 24—BRITISH STANDARD RING GAUGE.

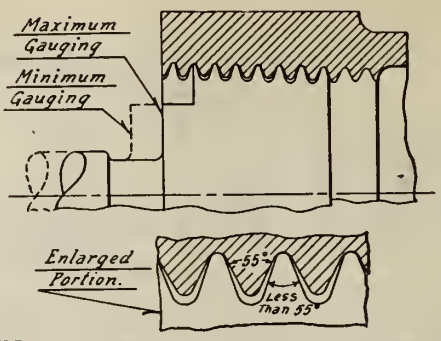

FIG. 25—BRITISH STANDARD PLUG GAUGE.

that there is no constant relation in the British standard between the length of the effective thread and the intersection of the thread cone with the outside diameter of the pipe. On sizes ¼, ½, ¾, 1½, 2, 11, and 12, the intersection comes between the end of the pipe and the end of the effective thread, and a portion of the thread is, therefore, slightly imperfect on the crests, but the number of such threads bears no constant relation to the pitch. On the remaining sizes, the intersection comes beyond the end of the effective thread, and there are no threads with flat crests. This again indicates that the American standard is more carefully studied out, and leads to the consideration of an important matter, a comparison of the practical advantage of one thread length over another.

It can be seen from Fig. 22 and also from Table 1 that the American thread is shorter on all sizes than either the British or the proposed International threads. On some sizes the difference is slight but quite pronounced on the majority of sizes. From this it is obvious that the longer the thread the greater amount of metal that will have to be removed from the outside of the pipe when cutting taper threads. Another advantage of the shorter thread is the saving in time required to cut the thread, and as the increased length is detrimental rather than beneficial the increased time required to cut the longer thread is an item of considerable importance.

Gauging

The method of gauging on the British standard is shown in Figs. 24 and 25, the plug gauge for the female thread being cut at a lesser angle than the work so that the crest of the gauge threads bear on the root of the threads in the fitting. The ring gauge for gauging the pipe or outside threads is a taper bore that fits over the crests of the thread, the tolerance being indicated by the notched portion of the smaller end of the gauge.

Another serious objection to too long a thread engagement occurs in designing valves and fittings. Referring to Fig. 26 it will be evident that the valves or fitting must be long enough to avoid interference at the inner end of the thread. In considering the pitch of threads, it should be remembered that successful application in service and in manufacture is of prime importance; furthermore, the number of different pitches for the entire range of pipe sizes should be the smallest number consistent with the ratio of pitch to diameter.

For maximum efficiency in any system of interchangeability it is imperative that the gauging be done on those surfaces that will be least affected by the wear of the cutting tool. Practice has demonstrated that the sides of the threads remain practically unchanged when male and female threads are forced together. Therefore, it is essential to gauge at this point only. No gauging should be done at crest or root, as these may alter when making the joints. The working plug gauge should enter the fitting by hand the same distance as the pipe itself enters, and the working ring gauge should screw on the pipe the same distance as the fitting screws on by hand. The distance the pipe enters the fitting is the most vital feature, as the remaining thread adjusts itself when properly screwed up. In other words, the gauges should be a replica of that

TABLE 1

SIZE	NUMBER OF EFFECTIVE THREADS ON PIPE		
	American	British	International
	TURNS		
⅛	7.10	10.50	11.00
3/16	.....	.....	7.45
¼	7.25	8.30	8.15
⅜	7.35	9.50	9.20
½	7.45	8.75	8.00
⅝	.....	8.75	8.80
¾	7.65	10.50	9.65
⅞	.....	10.50	10.50
1	7.85	9.65	9.55
1⅛	.....	.....	9.55
1¼	8.15	11.00	10.20
1½	8.35	11.00	10.40
1¾	.....	12.40	11.90
2	8.70	12.40	12.55
2¼	.....	13.75	13.20
2⅜	.....	.....	13.40
2 7/16	.....	.....	13.65
2½	9.10	13.75	13.85
2¾	.....	15.10	14.50
3	9.60	15.10	15.15
3¼	.....	16.50	15.80
3½	10.00	16.50	16.45
3¾	.....	16.50	17.10
4	10.40	17.90	17.75
4½	10.80	17.90	18.60
5	11.25	19.25	19.50
5½	.....	20.60	20.35
6	12.10	22.00	21.20
7	12.90	21.25	17.00
8	13.70	22.50	17.95
9	14.50	22.50	18.90
10	15.40	23.75	19.50
11	16.20	20.00	20.15
12	17.00	20.00	20.80
13	.....	21.00	21.40
14	18.00	22.00	22.05
15	18.80	22.00	22.70
16	19.60	23.00	23.30
17	20.40	24.00	23.95
18	21.20	24.00	24.55
20	22.80	.....	25.80
22	24.40	.....	.....
24	26.00	.....	.....
26	27.60	.....	.....
28	29.20	.....	.....
30	30.80	.....	.....

FIG. 27—COMPARTIVE LENGTHS OF EFFECTIVE THREADS.

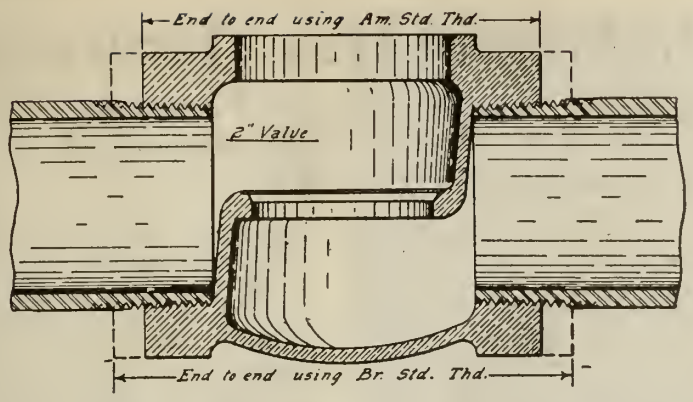

FIG. 26—COMPARATIVE THREAD LENGTHS OF FITTINGS.

portion of the joint which is made up by hand.

Summary

The ultimate test of any standard is its successful application in commercial manufacture and use for a long period of years. The American standard has met this test in every respect. Its success cannot be attributed to any particular feature, but is due rather to the aggregate of its desirable features. The profile of the thread, pitch, length of thread, system of gauging, each contributes a share, and these, combined with the fact that the standard as a whole is readily adaptable to commercial application, has made it highly successful in every sense of the word. From the standpoint of manufacture, it lends itself most admirably to large quantity production, and an interchangeable product is more easily produced than with any other pipe standard in existence.

INTERESTING WELDING JOB

The "Acetylene Journal" tells an interesting story of the welding together of two pieces of metal presenting a broken surface of 330 square inches. This occurred at the Trenton, N.J., shops of the Pennsylvania Railroad.

Through the lack of care of a yard employee engaged in cutting up old metal, a piece of 1¼ in. by 4 in. steel was fed into a shearing machine in such a way that a bolt in the metal broke off the shear blade at the heel of the knife. This was caused by the twisting strain presented when the bolt was caught between the shear blades. The broken face was 33 in. in height, 13 in. in thickness at the bottom and 7 in. at the top. An examination of the broken parts showed the metal to be of the highest quality of cast iron, there being no flaws or sand holes, showing that the break was due entirely to misuse. The shear has capacity for cutting 3½ in. round bars, 3¼ in. flat bars, or 10 in. by 1½ in. flat bars, and is as large as cutting machines of this type are usually made.

Immediate repair became a very urgent problem as it was impossible to order and secure a new machine under several weeks, if not months, and delay in replacement meant much delay in the making of billets and forgings for engine work, inasmuch as this shear is used almost daily in cutting metal for the large furnace from which billets are secured.

A great deal of work has been done with oxy-acetylene equipment at Trenton, but nothing to compare in size with the case here presented. The question of welding together broken pieces of so large a surface was submitted to an expert, who expressed the opinion that the two parts could be welded perfectly.

"Conscientious objectors" and scoffers were all there with their arguments against trying it, not realizing that even if a failure resulted we would be no worse off than with a broken shear, except for the expense entailed in the attempt. The matter of repairing was finally decided, and permission was given to do the work.

The broken parts were taken to the machine shop and the metal was planed away at an angle of 45 deg. from both sides of each piece, on one side to 65 per cent. of the thickness and to 35 per cent. on the other, so that when the two parts were brought together, lying on their sides, an edge only about ¼ in. thick remained. This was left as an aid in setting the parts for preheating and welding, and for the purpose of preserving the exact length of the shear blade. This work required two days, after which time the parts were ready for preheating.

The broken parts were laid flat, set accurately, and firmly secured. A firebrick furnace was built around them and a charcoal fire started. After eight hours of preheating the temperature was at the proper point to commence welding.

The deeper cutting, the 65 per cent. side, was welded first. Oxweld cast iron alloy rods of ¼ in. and ⅜ in. diameter were fused in from the bottom up and outward from the middle of the cutting. Ferro flux was used in this work, being constantly added to insure fusion of the metal.

After it had been filled and slightly reinforced to prevent fracture in handling the casting was turned over and the other side welded up in the same manner. It will be noted from the illustrations that the cavity to be filled was of an astonishing size.

Six welders were assigned to the work and were worked in relays of two each, using four Oxweld outfits with No. 15 welding heads. The extra number of men was necessary because of the intense heat generated, not only by the torches but by such a large mass of iron on a large charcoal fire. In fact, the heat was so great that those using the torches protected their faces with asbestos masks, and it was frequently necessary to dip their gloved hands into water to cool them. Compressed air also was used to blow the hot air away from the men at work.

The men engaged in the work were enthusiastic as to its success, and, knowing they were engaged in a most extraordinary undertaking, were exceedingly careful to see that nothing untoward should happen to endanger the success of their efforts, nor that any lack of attention should militate against the desired end.

There were used in the repair of this shear:

Oxweld cast iron alloy rod	445 lb.
Oxweld ferro flux	12 lb.
Acetylene	6,116 ft.
Oxygen	7,640 cu. ft.
Labor at 68c, in both pre-heating and welding	203 hours
Charcoal	100 bushels
Coke	20 bushels

The total cost of making the repair was about $400. The cost of a new shear blade is variously estimated at from $1,500 to $1,700, so that the saving by welding approximated $1,200, to say nothing of the loss by being deprived of the use of this machine.

The shear has been fully tested and is doing business as usual. It appears to be as good as new.

It is quite possible, quotes the "Scientific American," that cellulose nitrate lacquers will find application in peace times for certain specific purposes where quick-drying, hard, and elastic films are required. They may be admixed with pigments to produce colored coatings which dry to a flat, washable surface. When mixed with aluminum powder or zinc powder, quick drying hard primers for metal are formed. These primers may be used satisfactorily as the base for many metal finishes. As substitutes for shellac on some types of work they should also prove of value. These paints may be applied by spray, brush, or dipping, drying almost immediately to a moisture-resisting, flexible film. Baking at a low temperature is permissible. Cellulose nitrate lacquers act as excellent primers for certain types of cement floors that are to be painted. Through their use waterproofing greases or other materials in the cement are insulated from action on subsequently applied enamels. Cellulose lacquers or enamels are not as durable as those made with oil or varnish.

Captain Allan McIntyre of Parkhill, a veteran seaman who had sailed the Great Lakes for more than half a century, died in St. Joseph's Hospital at London, aged 87 years.

Talk on Modern Methods of Heat Treatment

No Doubt Practical, as Well as Technical Men, Are Following This Article With Interest—In This, the Concluding Portion, We Go Still Further Into the Heat Treatment Art

NEXT in order comes the selection of suitable boxes or pots in which pack the work for carburizing. Whenever the quantity of the work will allow for it the boxes should be designed especially for the work at hand. They should allow for no less than ⅜ in. of carburizer between each piece and walls of box, and two inches or more, depending upon the depth of box, between work and lid, for the convenient handling of them when packed and when hot, and for the efficient charging of furnace. Whenever it is practical I prefer the use of the circular chimney type of pot. With this type there is less chance of crowding the work in packing and in the charging of the furnace and the centre of pot being in the form of a chimney together with liberal feet under pot allows for the free circulation of the gases down, in and around, underneath and up through the pot, all of which go to make up a uniformly carburized product as well as cutting down the time and cost of the operation. There are articles of course that require a square or rectangular or a solid round pot. In Fig. 2 can be seen a few different types.

Next comes the question of suitable material for the packing boxes. Given in order of their superiority, according to an experience of about ten years, the various materials are: ordinary grey cast iron, white cast iron, cast steel and the alloy of nickel chromium called Ni-Chrome for short.

For nearly all purposes grey cast iron is the least satisfactory and in the long run is the most expensive. The special mixtures in white cast iron and cast steel are much superior to grey cast iron and are on about a par with each other with reference to their cost per service hour, but they scale badly and hold their shape only a comparatively short time. The value of nickel chrome for carburizing boxes is best illustrated in Fig. 3.

The two pots in the centre of Fig. 3 are of Ni-Chrome, the other four of .20-.30 Carbon Steel. The two pots in the centre were the very first of Ni-Chrome used by us and to prove the merits of this material it was decided to run a test by comparing one of them with four new cast steel pots under the same conditions. It was thought it might be a good thing to hold the one Ni-Chrome pot out so that we could compare a new pot with one that had been run. Accordingly one Ni-Chrome (this is at the left centre in Fig. 3) and the four cast steel (two at either end in Fig. 3) were run at the same temperature for the same time, never one without the other four, always in the same furnace, until the cast steel pots gave out. At that time the other Ni-Chrome pot was placed in service and we continued to use the one which had been run with the steel pots. We held the cast steel pots which failed in this run as a curiosity and up to the time the photograph was taken, the Ni-Chrome pot on the left had seen 1,300 hours service and the one on the right 650 hours. Fig. 4 gives another view of the pots in Fig. 3. While this is not the best which we have obtained with Ni-Chrome, it was the only example which I could actually show you and is presented for what it is worth. I might make reference to comparisons made on Ni-Chrome and cast steel jigs or crates as seen in Fig. 5. The cost per service hour compares favorably with that of cast steel and on account of the resistance to the action of furnace gases and the extraordinary physical properties which nickel chrome possesses when heated to moderately high temperatures the pots can be cast with much thinner sections than those of steel or cast iron, thereby affecting a saving in time and fuel.

Much has been said about furnaces, their design, the advantages of one type over another, their economy in point of fuel consumption, cost of maintenance, etc., but whether they be under fired, side-fired, or over-fired, whether they have one type of burner or another, whether they operate on gas or oil with low or high pressure air makes little difference unless they are constructed so as to provide plenty of room between the pots themselves and between the pots and the walls and the roof of furnace to allow for the circulation of the gases uniformly throughout and for proper ventilation of the spent gases.

Just as good results can be obtained by a good man on a poorly constructed furnace as can be obtained with an up-to-the-minute furnace operated by a man who does not know the right sort of a heat when he sees one. (This is just another way of pointing out the value of good men on the job.) The boxes must be placed in such a position in the furnace that they are exposed to the heat on all sides, top, and around bottom. They should not be placed too near the sides or vents of furnace, as this would cause one or both of two things; overheating at that one place or cutting off the circulation.

The position of the thermo-couple in carburizing is an all important one. If the time for carburizing is to be taken as "total time," that is, from the time the pots are placed in until they are taken out, then the thermo-couple should be located at that point where the pots would be apt to get the hottest if the furnace were fired somewhat hard. It should not be placed too near the pots as their mean temperature would influence the pyrometer reading to too great an extent.

We are no doubt all familiar with the practice of using test rods for determining the time at which the proper penetration has been obtained. These are usually any size up to ½ in. rod, depending upon the depth of case desired and bent over on the end to accommodate pulling them out with a poker. They

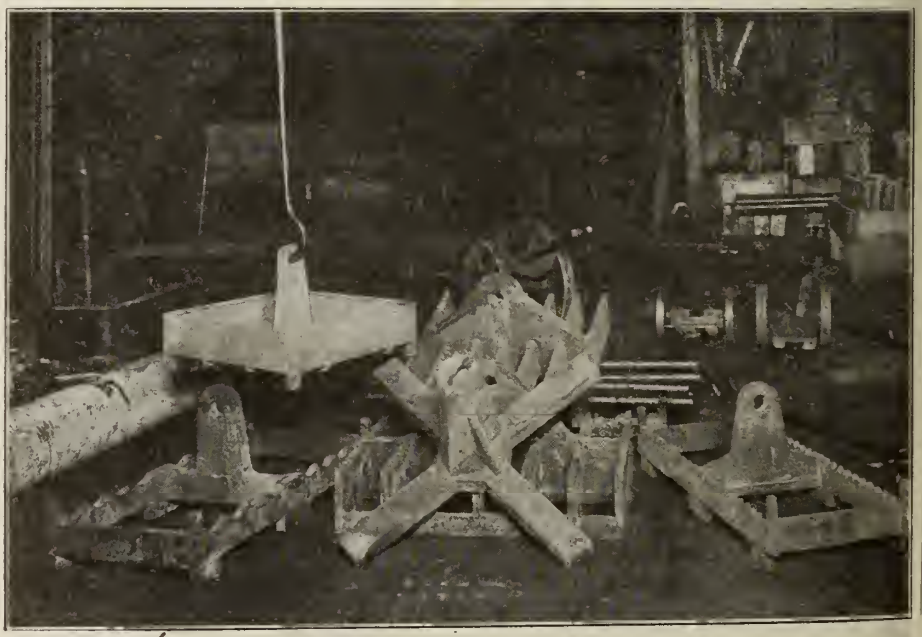

FIG. 8.

are packed down in the pot with the work, with the hooked end protruding up through the luting of pot and at intervals, after the pots have been in the furnace a sufficient length of time to heat through, they are pulled from the pot and quenched, then broken to determine the depth of case. This method is all right where the pots are covered with clay or cast iron borings, but does not work out so well where the covers for pots are of the same material as the pots unless drilling holes in the covers is resorted to.

A good method which has been followed for years is to pack the pyrometer thermo-couple down in the centre of one of the pots as shown in Fig. 6. This is accomplished by packing a piece of ordinary 1½ in. wrought iron pipe in the pot right along with the work. The pipe should be long enough to show about 4 in. above the pot when lid is on. A hole can be drilled in a few of the covers of each style pot to accommodate this and if not used on a pot with thermo-couple the hole can be plastered shut with clay. When the pots are placed in furnace the thermo-couple in its protection tube is put down through a hole in the roof of furnace into the 1½ in. pipe in one of the pots. Down, over and around the thermo-couple is placed a piece of 4 in. or 5 in. wrought iron pipe. This should be long enough to rest on cover of pot around the piece of 1½ in. pipe and show about 5 in. to 6 in. above furnace. The space around thermo-couple protection tube inside the larger pipe is then filled with cast iron borings and jarred down into the smaller pipe in pot. The temperature then indicated, after thermo-couple has been connected, is the actual temperature of the work. When this method is employed another thermo-couple should be used to indicate or record the furnace temperature. If the second couple is not used there is a chance of overheating the outer portion of the pots, especially if the furnace operator depends too much on the pyrometer and does not observe the temperature of the outside of the pots.

The carburizing temperature and time and whether the articles are to be left cool in pots or quenched directly from the pots depends entirely on the article, the steel it is made from and the depth of case desired.

The best practice in my estimation is not to exceed 1650 deg. F. on any carburizing work. With the higher temperatures when a fairly deep case is obtained it is practically impossible to dissolve the excess of carbon when it is desired to leave the articles cool in the boxes and the consequent brittleness often leads to more trouble and expense than that saved in the carburizing by the increased temperatures. For articles made from straight carbon or chrome vanadium steels have found that 1,600 to 1,650 deg. F. is a good working range and on chrome nickel steels 1,550 to 1,600 deg. F.

Some pieces made from simple straight carbon steel such as nuts, drilling jig bushings, pilots, balancing arbors, crank pins or the like can be quenched directly from the carburizing pots in running fresh water or brine. A type of dumping tank effectively used for the hardening of nuts and pieces where running fresh water is available is shown in Fig. 7.

FIG. 9

Other pieces such as punches for trimmer presses, drilling jigs, thin nuts, bushings, etc., which must be kept fairly true are best quenched entirely in oil directly from the carburizing pot.

For machine parts where the maximum of toughness and hardness must be combined a better method is to leave the pieces cool in the carburizing pot, reheat to a temperature as high as that used in carburizing, quench in oil and reheat again to a lower temperature high enough only to refine the case and quench in oil or water.

I have had no experience with the "gas carburizing" method and therefore do not feel qualified to discuss it other than to say that I have seen the process in operation and believe that there is a field for it which has up to this time been undeveloped.

The "liquid bath" method of carburizing is used mostly for those parts which require only a superficial hardness. The hardness is obtained by immersion in the liquid bath at temperatures usually between 1100 to 1500 deg. F. for anywhere from 5 minutes to an hour and quenching in either oil, water or brine.

Various Forms of Liquid Variety

There are various forms of processes of the "liquid" variety, some of which I presume the most of us have had experience with. The one most extensively used is without a doubt the "cyanide" process.

By this proces the liquid bath is made up of sodium chloride (salt), sodium carbonate (soda ash) and either yellow prussiate of potash, potassium cyanide or sodium cyanide is added to the melt to give the bath it's case hardening properties. Of the three forms of cyanide the sodium is the most used for this purpose.

The baths can be made up in different ways. One can purchase the salt and soda ash locally, of which the base is made up, and purchase the sodium cyanide of high cyanogen content separately, which is used to add the case-hardening properties; or the sodium cyanide can be obtained already mixed and fused with salt and soda ash in the proper proportions.

In addition to being used as a case-hardening bath the cyanide bath is used for reheating parts for hardening which have been carburized or made from tool steel which, on account of their character, would go out of shape if heated in a lead bath or muffle furnace. In this bath the parts are hung suspended either by their own weight on wires or in a basket. The opinion seems to be that when the work when cold, or considerably under the quenching temperature, is placed in the liquid bath, the salt immediately surrounding the articles solidifies and remains so until the temperature of the article has increased to beyond the freezing point of the solution, thereby retarding the rate of heating. The same thing, only the opposite phase, and more pronounced, occurs when quenching. The thin film of solution which adheres to the pieces heated in it retards the cooling effect of the quenching medium just long enough especially in those pieces with very thin sections, to prevent undue strains being set up in them.

It has the effect I know of preventing every possible chance of oxidizing the work in heating and when taking work from the heating to the quenching bath, as the work quenched from it is cleaner and more uniformly hard than that obtained by any other method.

Another and more recently-developed process called "The Shimer case-hardening process," is one which I wish to bring to your attention.

This process was invented by Porter W. Shimer in his laboratory at Easton, Pa., and was first developed commercially at our plant in co-operation with Mr. Shimer and under my supervision

In this process calcium chloride and sodium chloride are used as a base, and when in a molten state calcium cyanamid is immersed in same to add the case-hardening properties. The calcium cyanamid in the form of lumps is immersed in the liquid melt of calcium chloride and salt in a basket or suitable perforated container. It does not melt, the case-hardening properties being extracted from the surface of the lumps, and usually about 5 per cent. of the total weight of the bath in calcium cyanamid suspended in the bath lasts about 24 hours, at the end of which time it is removed and replaced with new material. For our work we have found that the pieces of cyanamid can, with advantage, be used of the size of an egg or even as large as a man's first. We are informed by Mr. Shimer that he gets the maximum results in his work under other conditions by grading the cyanamid in quality and size of pieces, especially adapted and adjusted to different kinds of work and rates of production. For intensive use he used pieces much smaller than our present practice, the rate of action between the cyanamid and the bath being proportional to the surface of the cyanamid exposed. Just as the experienced man can tell when the case-hardening properties of a cyanide bath are becoming exhausted, so can the properties of the Shimer bath be determined. The properties of the bath can be judged by the activity of the bursting into flame of little gas bubbles which rise to the surface. The greater the number of these little flames and the more violent the bubbling of the bath from the evolution of these gas bubbles the stronger the bath. When the bath is being run at a temeprature between 1,400 and 1,500 deg. Fahr. and the action of these bubbles subsides, it is pretty good indication that the case-hardening properties are leaving the bath and it is then that the old calcium cyanamid should be removed and replaced with new. If the pieces taken from the bath are of fair size they can be broken again, thereby exposing new surfaces of the material, and can be used over again the same as new calcium cynamid.

The commercial applications of this process are practically the same as those of the cyanide bath with the exception that parts quenched in water or brine from it are somewhat more susceptible to rusting. This rusting, however, can be very easily counteracted by a thorough washing in a soda ash solution.

There are decided advantages in its favor and it does not, like the cyanide bath, give off poisonous and obnoxious gases; the men handling it need have no fear of becoming poisoned, and it is materially more economical.

We have used it exclusively since 1916 in the place of cyanide on all classes of work as a case-hardening bath as well as for heating purposes only, and I am certain, judging from our experience with it that the process has come to stay.

The process is covered by patents, and I understand that Mr. Shimer is about ready to launch it commercially. Anyone, therefore, who is interested in learning more about it, or who contemplates giving it a test, should communicate with him.

The heat treatment usually consists of one or two quenches in either, usually applied to bar stock or to forgings, and at times, when the parts are exceptionally large, after rough machining.

The heat treatment usually consists of one or two quenches in either oil or water from temperatures between 1,350 and 1,650 deg. Fahr., depending on the article and the physical properties desired, and a drawing back, or, as some prefer to call it, "an annealing," to somewhere under the critical temperature.

These steels with their subsequent heat treatment are used in parts where great elasticity combined with ductility are the requirements to resist shock and repeated stresses.

Following are given results of a few tensile tests showing the characteristic properties of steel in this class:

Type "AAA" chrome vanadium steel.
Carbon, .28/.33; mang., .65/.85; chrome .75/.90; van., .15/.20.
No. 1 stock as received from the mill.
Elastic limit 93,826.
Tensile strength, 126,735.
Per cent. of elongation, 21.09.
Per cent. of reduction, 61.22.

No. 2 same as No. 1, heated to 1,625 deg. Fahr. in muffle furnace, quenching in oil and reheated in muffle furnace to 1,075 deg. F., leaving cool in atmosphere.
Elastic limit, 127,750.
Tensile strength, 139,200.
Per cent. of elongation, 17.19.
Per cent. reduction, 61.00.

Chrome nickel steel—
.30/.40 carbon; .5 chrome; 3.5 nickel.
No. 3 stock as received from the mill.
Elastic limit, 62,330.
Tensile strength, 103,380.
Per cent. of elongation, 20.90.
Per cent. of reduction, 55.0.

No. 4, same as No. 3, heated thoroughly in muffle furnace to 1,450 deg. Fahr. and quenched in oil.
Elastic limit, 211,893.
Tensile strength, 232,342.
Per cent. of elongation, 4.88.
Per cent. of reduction, 24.25.

No. 5, same as No. 3, heated thoroughly in muffle furnace to 1,450 deg., Fahr., quenched in oil, reheated thoroughly in muffle furnace at 1,150 deg., Fahr., buried in mica until cold.
Elastic limit, 116,840.
Tensile strength, 127,950.
Per cent. of elongation, 14.84.
Per cent. of reduction, 57.6.

In those plants where the quantity of any class of work is great enough, this class can be best handled in automatic continuous heating furnaces and quenching apparatus, but where the work is of a variety with not enough of any one class of work to warrant an installation of the kind mentioned, it is a different problem.

A method of handling material such as the last mentioned consists of loading the work on jigs or trays as shown in Fig. 8, using furnaces built on a level with the floor and handling the loaded jigs to and from the furnaces and quenching tanks with a truck as shown in Fig. 9. The jigs are raised in and out of the quenching tanks with electric cranes on a trolley. Some judgment must be used, however, in the loading of jigs. If the work is piled too high without sufficient spaces between, uneven heating and cooling will be the result. By using a fork in place of a prong the truck shown in Fig. 9 can be used for handling large annealing and carburizing boxes.

We discussed some of the methods of heating for hardening in the fore part of the paper and they are again brought to our attention in the reheating for hardening of parts which have been carburized. Suffice it to say that the same things apply in this work as in the hardening of parts made from tool steel.

The Hump Method

A method of heat-treating which is steadily gaining favor with steel treaters handling parts which must be held to shape in hardening is the "Hump" electric furnace method.

By this method the articles to be treated are heated in an electric furnace

FIG. 10

in close proximity to the tip of a thermo-couple and quenched from a temperature governed by the "Hump" (or critical point), in the heating curve as shown on a recorder.

The furnaces are vertical, cylindrical in shape and of the wire-wound type. The thermo-couple protrudes up through the bottom of furnace and is connected by lead wires to a potentiometer recorder. A top made of special insulating material, which can easily be handled, seals the furnace when in operation so that it is practically free from an oxidizing atmosphere.

The principle involved might best be defined by quoting a certain man who said that: "What we are actually doing is making a transformation point of determination of every piece we harden.

All of us have no doubt taken a piece of steel, which we wanted to determine the critical point of, drilled a hole not quite all the way through it, inserted the tip of a thermo-couple in the hole, and after placing the piece in the furnace rising slowly in temperature watched for the point on our recorder or indicator where the temperature, which had been gradually rising, was momentarily arrested. That was the point we knew the steel had to be heated through to enable us to harden it. Exactly the same thing occurs when hardening by the "Hump" method, with the exception that all of the work cannot have holes drilled in it in which to place the thermo-couple. For different classes of work various ways of making thermo-couples can be resorted to without much trouble. For small parts where it is convenient to rest the work lightly upon or against the thermo-couple a hair-pin type with the wires bent and welded in the shape of a hair-pin works to the best advantage, while with fairly heavy work the ordinary twisted and welded couple is satisfactory.

The closer the work is placed to the tip of the thermo-couple and the more the thermo-couple is affected by the temperature of the work, the more nearly is the curve as shown on the recorder the true heating curve of the work being heated. In other words, we know that as any change in the E. M. F. generated by the thermo-couple would immediately be recorded by the potentiometer in terms of degrees of heat, and as any change in the temperature of the thermo-couple would change the E. M. F., generated by it, those changes in the temperature of the work being heated which had any influence over the temperature of the thermo-couple would be immediately recorded by the potentiometer. The extent to which the temperature of the thermo-couple is influenced by changes in the temperature of the work being heated is in proportion to the area of that part of the thermo-couple that is in contact with and affected by the work or that part which, being away from the work, is affected by the heat radiated from the walls of furnace. If the character of the work would permit it and it were possible to place it so that the tip of the thermo-couple was protected from contact with the heat radiated from the walls of the furnace (such for instance as placing a plug-gauge with a hole drilled through the centre of it down over the tip of the thermo-couple) the thermo-couple would be affected only by changes in the temperature of the work and the curve drawn by recorder would be the true heating curve of the work. A curve of this description is shown in Fig. 10.

We know that steel cannot be hardened under its critical point and that the higher above the critical point the temperature is from which it is quenched the greater the strains are which are set up in quenching. We also know that fast and uneven heating result in the warping and cracking of many articles. Then, too, I doubt whether there ever has been a hardener who has not had the experience of, at one time, successfully hardning delicate tools without warping or cracking them and then at another time in the attempt to harden the very same kind of tools have the corners "run off" or find that they had gone out of shape.

By the "Hump" method the particular temperatures, in so far as degrees of heat are concerned, at which the pieces are quenched, is of little consequence. "It is the point in or the number of degrees above the critical temperature," as shown by the break in the heating curve that indicates when the work should be quenched.

The operation consists of first heating the furnace to about the working temperature. The current is then thrown off the furnace by means of a switch, and the work is placed in the furnace, as mentioned previously, in close touch with the thermo-couple. The current is left off until the work and the furnace have "equalized," or in other words attained the same temperature. At this point the current is switched on and by means of the rheostat adjusted to suit the work. This may be 10 amperes or 15 amperes, depending upon the charge. By observing the temperature of the furnace walls and the work from time to time on new work the furnace can be regulated so that it is not too far in advance of the work. When the critical temperature is reached a deflection in the curve as drawn by recorder will occur, and from experience with other work one can judge how far above that point the work should be heated for quenching.

The furnace can be regulated to heat at practically any rate and with some judgment on the part of those operating it there is little chanace of heating unevenly.

By practice in determining the way they should be placed in the furnace, the speed with which they should be heated and the distance above the critical point they should be heated to, articles can be hardened with little or no distortion and with very little chance of their breaking.

We have hardened taps, reamers, cutters, punching dies, shear blades and gauges by this method entirely in salt brine with practically no distortion and without failure from hardening strains.

A Record is Worth While

Keeping a complete record of the parts hardened, such as the kind of steel, the shape and size of the articles, the shop number, the current used, the method of quenching, the hardness obtained, and the distortion which took place on the recorder sheet is of great help in the duplication of results and in planning the procedure to be followed in hardening future work of a different character.

The method is particularly adaptable

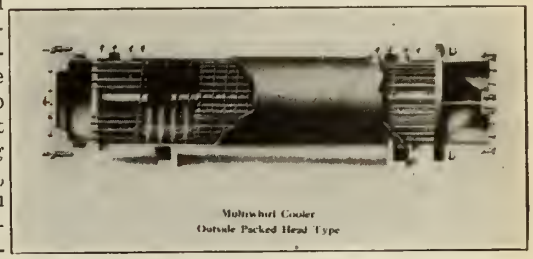

FIG. 12.

to productive work of a character where a minimum of distortion is allowed. As I have tried to point out, this method, through the manner in which the rate of heating can be controlled and the way in which the quenching temperature is determined, allows for the exact duplication of results.

If results were obtained to-day with a certain time temperature curve as shown on the recorder, anyone could rest assured that the same results could be obtained at any time in the future with the same heating curve providing the articles were the same, that they were made from the same steel and were placed in the furnace in the same manner.

For productice work it is best practice to have suitable jigs made to conveniently handle as many pieces as practical in the furnace at one time. Several jigs for each class of work facilitates the loading of some of the jigs while others are in the furnace and the quenching bath. Immediately one charge is removed from the furnace and quenched another should be placed in the furnace, so as to make it a continuous performance.

In addition to showing the heating curves of every charge the recorder sheet can be used as a production chart providing the number of pieces loaded on each jig are checked. In my opinion this is the only method of heat treatment where the work can be safely placed on a piecework basis without going to the expense of employing considerable additional supervision.

Adequate quenching facilities should be part of the equipment of every heat-treating plant.

To insure uniformity in quenching, whether the medium is oil or brine, there should be plenty of it and some means of circulating or agitating it and maintaining it at a constant temperature.

A method used in the past on oil consisted in running water through jackets surrounding each individual quenching tank and agitating the oil with compress-air. This method has it disadvantages. When air is used in oil that has become heated, it drives off the volatile matter in the oil and causes what is termed "fractional distillation." I have under-

stood that when it is desired in some cases to thicken oil, compressed air is used for oxidizing or thickening it, and it can readily be appreciated why an oxidizing agent should not be used in quenching oil. In addition to the injurious effect compressed air has on oil, particularly at high temperatures, the condensation from the air lines might be great enough to cause the "boiling over" of the oil when it was rapidly heated up to above 212 deg. Fahr. Then, too, thinking of smaller work, the tendency must be considered toward non-uniform water is suspended, and the effect of cold air coming in contact with the work. By this practice the volume of oil in the tanks is kept at the proper level by the occasional addition of new oil to the old. This is poor practice as there comes a time when the new oil, being such a small proportion of the whole, is swallowed up by the old and has no effect at all on the viscosity of the bath as a whole. By this method also the water is not used to the best advantage.

Efficient Oil Quenching System

In my opinion the most efficient oil quenching system, in point of uniformity in quenching and economy of operation, and one being used by many of the larger heat-treating plants, is one of which the oil is pumped from an underground tank through a cooler to the quenching tanks and left run from there through an overflow back to the underground tank by gravity. The surplus carried in underground tank should be large enough to take care of the quenching until the whole lot of oil becomes too viscous for use, when it should be discarded and replaced with new oil. The underground tank should be of ample capacity (about the same quantity carried in underground tank as in all of the quenching tanks should be ample) and placed deep enough to allow for the draining of lines. The best type of intercooler known for this work is the "Multiwhirl" cooler as shown in Fig. 12. The cooler should be placed between the underground tank and pump. If the pump is placed between the tank and cooler and the oil becomes fairly hot a great deal of trouble is usually experienced with the pump bearing and packing.

A system of the character just mentioned serves as a means of maintaining the entire volume of oil in quenching tanks at a uniform temperature, agitating same in tanks (the cold oil would be forced in at bottom of tank and the hot oil would run off top through overflow) and taking care of the volume of oil in one tank until it was worthless.

While there has been much said and written about pyrometry, I thought it might be well, before closing the paper, to present a few of my views on the all-important subject.

Pyrometers are at best only tools in the hands of the heat treater.

They can be compared to the tool-maker's micrometers or gauges. The tool maker depends on his gauges only to guide him in the finishing of a tool. He does not rely on them to produce the finish that makes the tool saleable or fit for service, as they serve only to indicate the size of the article, and he uses his head and eyes in administering the finishing touches.

And the tool-maker's gauges are of little practical value unless they are rugged enough so that he need not be afraid to handle them, and they must be accurate to the point where he can rely on what they tell him.

Just the same is true in the case of the heat-treater's pyrometers. They serve only as a guide to him in informing him that at that point in the furnace where the thermo-couple tip is located the temperature is as indicated or recorded. It does not tell him that the entire charge in the furnace is heated thoroughly and uniformly at that temperature, but that only the tip of the thermo-couple is heated at that temperature. Nor does it tell him what the nature of the atmosphere in his furnace happens to be.

The same as in the case of the tool maker, the heat treater must use his head and his eyes to determine if the work in the furnace is heated uniformly at same temperature as the tip of the thermo-couple and to determine the nature of the atmosphere in the furnace.

But the guides should be worthy of being called such and should be thoroughly dependable in so far as it is possible to obtain them. The very best is none too good.

The instruments themselves should be sufficiently robust and constructed so as to stand up under shop conditions such as dusty, smoky and damp atmospheres; their accuracy should not be affected by vibrations such as are found at the average plant where there is moving machinery and heavy hammers or by atmospheric temperature changes; and since it is impossible to obtain any instrument which never needs any adjustments, they should be of a character which would allow for these adjustments on the job.

The thermo-couples should be of a character which would withstand ordinary shop handling, and whether they are made up on the job or purchased from the manufacturer of the system they should be interchangeable.

The method of controlling or compensating for the cold and temperature should be a practical one.

To be useful to the point where the heat treater can depend on the temperature indicated or recorded as being the exact temperature of the tip of the thermo-couple, the pyrometer system (or the guides as we have called them) must be accurate.

The accuracy and the constancy of any pyrometer system is governed largely by the systematic checking and calibrating of it, and of course by the manner in which this is accomplished. Too much importance cannot be attached to the selection of the individuals to perform this work.

A capable man can obtain greater accuracy with an inferior installation than an inexperienced man could obtain with the best, but the greatest accuracy is to be obtained with the best of both.

Time does not permit me to go into the calibration of pyrometers other than to say that it is the constancy, or the sameness, or the uniformness, with which the calibrations in the laboratory and checks in the shop are carried out that are most instrumental in helping to make up a uniformly heat-treated product

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In a paper read before the National Academy of Sciences, Major-General George Squier, Chief Signal Officer of the United States Army, stated that an invention now perfected would shortly do away with expensive undersea cables and enable messages, both telegraphic and vocal, to be transmitted with the aid of bare wires laid under the sea or buried in the earth. Messages would be transmitted by wireless and the naked wire used merely as a guide.

In some interesting experiments on belt driving discussed in the "Sibley Journal of Engineering," Mr. W. N. Sawdon mentions that the carrying capacity of the pulleys was low and that as soon as the slip exceeded about 2 per cent. it was impossible to keep the belt on the pulleys. It was found that the pulleys were comparatively rough and still bore the tool marks, although they had been smoothed down to some extent with emery or sandpaper. The pulleys were then dressed down with emery cloth and oil until all traces of the tool marks were removed. In this condition it was found that the slip for small loads was materially increased, but the belt could be kept on the pulleys without difficulty with slips as high as 10 per cent., and the carrying capacity of the pulleys was greatly increased.

INTERESTING FACTS TO BE FOUND IN THIS WEEK'S ADVERTISING SECTION

How to secure larger output.

How I can learn more about the Engineering business.

All about a stirring and stabilizing process.

How to make a good buy in books.

How to properly straighten wire.

All about a moving picture release.

How to put efficiency into a shop.

That it does not pay to be prejudiced.

How to handle any material.

How to correct inaccuracies in new or used tools.

Why a certain gentleman came to Toronto.

How you can combine a punch and shear.

Why it does not pay to have a machine standing idle.

Can You Widen Your Planer to Advantage?

Here is How One Firm Widened Their 24-inch Planer, Three Inches on Each Side, to Accommodate Larger Work—The Construction and Details of Lining Up Are Given

By DONALD A. HAMPSON

IT IS the experience of nearly all shops that their planer or planers are found to be too narrow. Though originally selected of a width ample for the work, the expansion of business and the unexpected jobs that appear almost always run wider than the distance between the uprights; rarely are these jobs too high or too long for the machine, and herein lies the outstanding feature of the open side planer.

Ours was a typical case. We were making a line of cast iron table tops and surface plates that were from 2 to 6 inches in thickness and of large and small sizes. The large sizes were from 36 to 40 inches in width, the small from 20 to 24 inches, and the length in both cases was roughly double the width. There were three planers in the shop, one a 24 inch, taking care of the small sizes very nicely, and one, a 41 inch doing the same for the large sizes, aside from the fact that it had a 14-foot table which consumed a good deal of power to move and there were conditions which prevented us from ordinarily running two plates on the machine at one time.

Changes in the trade we served created a demand for plates 26, 28, and 30 inches in width to the partial exclusion of the other sizes. It was not as convenient to run these on the large planer, the latter consumed too much power anv way, and the price of a new 30 inch planer was out of proportion with the return from the work.

After a careful inspection it was decided to widen the 24 inch machine three inches on a side. The cross rail was long enough to feed 36 inches, so there was no difficulty there, merely a case of resetting the studs on the back for the clamps. The bed was of sufficient width for our work without any objectionable overhang. The first shaft (the pulley shaft) and the second one were long enough to permit resetting the pulleys and gears approximately half an inch at each end, which was all that was needed to clear the housings in their new position. These minor items being disposed of, it left but the moving of the housings and the top cross piece.

Fig. 1 shows the construction. Each upright was held to the bed by four 1 inch through bolts tightly fitted in reamed holes. Also the bottom edge of the castings rested on a machined ledge on the bed. Our method of widening was to make two spacing block castings to go on in place of the uprights, one of these being shown as B in Fig. 2. These blocks were planed to rest on the same ledge on the bed, then they had a downward extension carried outward to provide another ledge in the same horizontal plane on which the uprights were finally rested New bolts were made up but left a shade large for the final fitting.

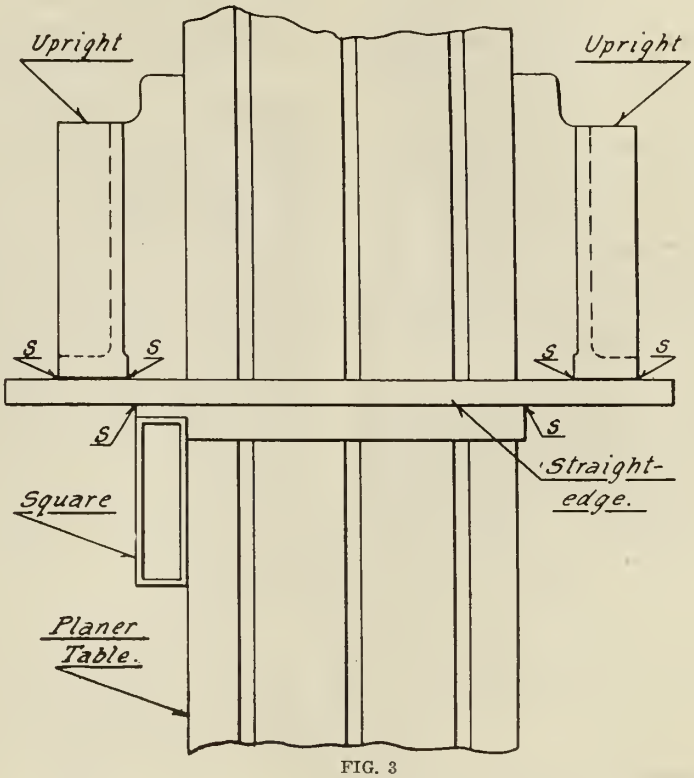
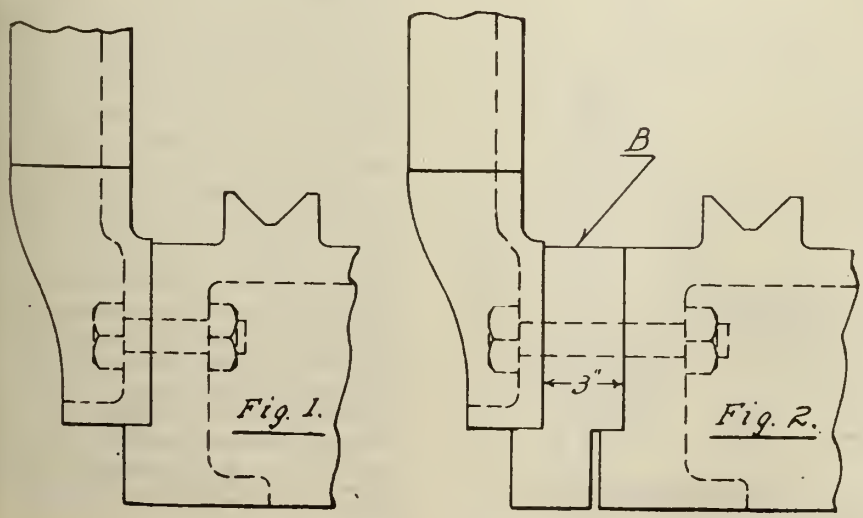


FIG. 3



FIGS. 1 AND 2.

Before the machine was taken down the bed was carefully levelled up and securely fastened in the levelled position. Then the top face of the table was gone over with a flat tool and the sides given a light, true cut. These precautions were taken to give us accurate faces from which to align our new work as well as to improve the condition of the table. Checking the faces of the housings, we found them square both ways with the table as trued up.

In assembling the upright housings, the two end holes were first reamed, while the castings were held tight by ⅞ in. bolts in the other holes. The accuracy of the setting as this reaming progressed was checked as shown in Figs. 3 and 4. We had some new tools including a 24 in. Starrett square and a 36 in. straight-edge; these were of great

value in the work, for without good tools the accuracy could only be assumed.

Fig. 3 shows how the straight-edge is placed across the face of the uprights, where the truth of the front faces is readily ascertained by tissue paper slips "S" and "S." Then the square is placed with the butt against the trued side of the table and its blade tested against the lined-up straight-edge, using other slips of thin paper. When these slips are all tight there is no question as to the housings being squared with the travel of the bed. The check on this and on the accuracy of the square, too, is to reverse the square, placing the butt against the other face of the table.

This lines the uprights at the bottom. At the top, the straight-edge alone is used. The square cannot be used here but if it has been used at the bottom and the straight-edge holds all four slips of paper at the top, the work is being done with all reasonable accuracy.

Checking the uprights the other way is shown at Fig. 4. Tissue paper feelers are again used. If any discrepancy is discovered, it is corrected before finishing the reaming.

With the end holes reamed and the bolts finished to fit, the centre ones may be directly reamed and fitted. This leaves but the assembling of the cross rail and the top piece. The former needs no comment. The latter being short three inches on each end, a spacing block was inserted, this being micrometered the same as the block against the bed below.

The elevating screws were left in their original place, which necessitated but one minor change—that of putting holes through the spacers and moving up the bevels to mesh. This design might be open to criticism, in that it leaves the screws within the space between the housings. However, it is possible to run work 8 inches in height under the lower ends of the screws. And if there does appear a higher job the rail is first elevated to the proper height, when the screws are backed out of their nuts, leaving the rail fastened, as always, by the clamps. Then, too, a high job is apt to be a narrow job and in a majority of cases will pass between the screws.

This widening costs less than $100 for labor and material, figuring the labor at $1 an hour, though the work was all done by the shop force, who were of course not paid that much. We secured a larger planer at a minimum of expense. It was wide enough to take in our new work and plenty powerful enough without being a big consumer of power, yet the change had not effected the ease with which a small planer is handled.

RECUTTING WORN FILES

By W. S. Standiford

In these days of efficiency methods and high prices, everything is being done by the managers of machine shops, automotive plants and other factories to keep the operating costs as low as possible. The utilization of articles that were formerly regarded as wasted, once they were used up, is receiving the attention of various manufacturers who are saving large amounts of money yearly by reclaiming used lubricating oils, dirty waste thrown away by workmen, and other articles, the railroads being the leaders in this respect, they having the matter worked out with the greatest efficiency.

The writer has found out during his travels over the United States and Canada, that the average machine shop (which uses up large quantities of files in a year's time) foreman does not seem to know that worn files can be recut, and allows them to be thrown away in the scrap heap. In spite of the extensive use of machinery there is some work which has to be done with a file, there being no substitute for the latter in some lines of work for finishing articles. The file as a cutting tool is used so extensively that it will pay to re-cut them, which work can be done by the man who sweeps out the shop, it taking only a few minutes of his time, if too many are not allowed to accumulate at one time. Two dozen can be conveniently handled by the shopman without interfering with his other work.

The acid mixture is cheap and don't cost much, in fact, many mills and factories have a supply of acid on hand, it being used, mostly, to remove the scale from iron and steel—called pickling. In the formula given the proportions of sulphuric acid and water are so arranged as to do the re-cutting in from 10 to 12 hours' time. All that the shopman has to do is to clean the files and put them into the acid solution before leaving the shop at night, and in the morning they will be done. First clean the files with a "file card" and then put them into a solution composed of four ounces of washing soda and one quart of hot water—having the latter as hot as can be comfortably borne, and scrubbing them with a brush. This removes any oil on them. Then rinse them thoroughly so that no soda solution will remain, and transfer the files to the acid-cutting fluid, which is made up of four ounces of sulphuric acid and one quart of water, pouring the acid into the water slowly and stirring with a stick.

Do not reverse this proceeding or the acid will fly up in the face. Too great care cannot be taken when any person is handling acids. Mix the acid solution in an earthen or a glass vessel, making up enough of the fluid to cover the files. Let the latter remain 10 or 12 hours and the job is done. Rinse them in water thoroughly to remove all traces of the acid, dry and oil them well and put away in stock room until they are wanted for use.

In some localities the water is alkaline and more acid will have to be used to counteract it. Distilled water will obviate the necessity of using more acid in using alkaline water. A good way to test water for alkalinity is to dip a piece of red litmus paper (which can be bought at any drug store for a few cents) in the water, for five minutes. If it turns blue when first put in, the water is strongly alkaline, but if it takes five or more minutes to turn it blue the water is only slightly so. This test is one of the most sensitive ones that chemists possess, and will enable the workman to regulate the amount of acid needed for file re-cutting. Blue litmus paper turns red when dipped into acid, so a ready means exists for testing the strength of acid file-cutting solutions.

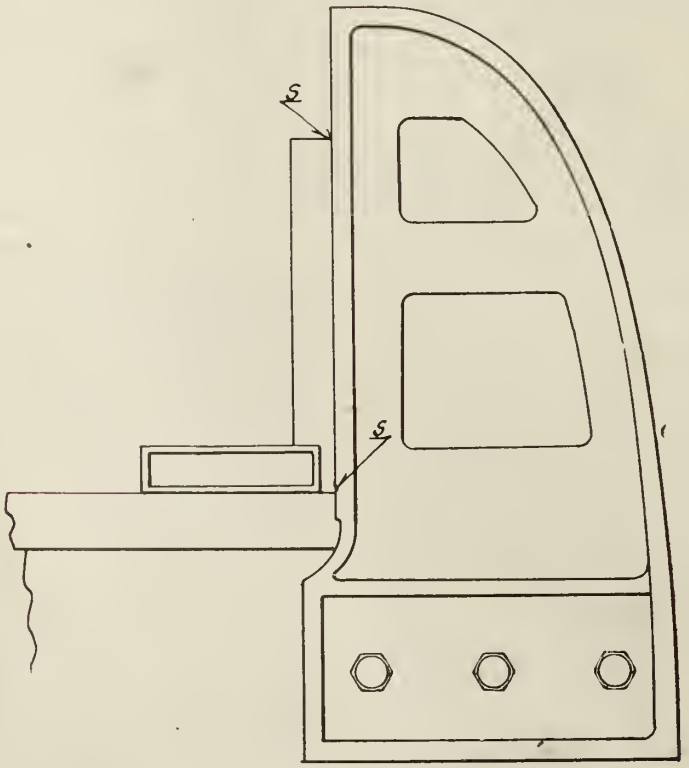


FIG. 4

WELDING AND CUTTING

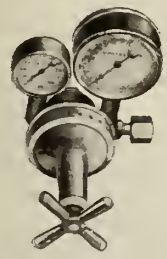
Lessons of the A.B.C. of Good Welding

This is the Fourth Lesson by an Authority on the Subject—The Remainder of the Series Will Follow

By W. B. PERDUE*

ONE of the principal reasons for the success of the graduates of efficient welding schools is that they are trained "trouble shooters" and know the "why" of their apparatus from the tip of the torch all the way back to the generator or gas cylinders.

The successful instructor keeps both mind and muscles of the student busy. This is not difficult, since there are so many new and interesting things to be



learned that even those students who have held positions as foremen in large welding shops are always eager for the next lecture.

While training his muscles to execute a neat "ripple" the student has ample time to master the intricacies of regulator and torch construction and thus become versed in "trouble shooting" and acquire the knowledge that will enable him to select equipment from the standpoint of merit and its adaptability to his own particular requirements.

Nothing is more important than the selection of good regulators, made for welding work. A recent canvass of 137 welding shops showed that only 28 were equipped with welding regulators, the others being equipped with small regulators intended by the manufacturers for lead and carbon-burning outfits.

Salesmen, unfamiliar with the requirements of the user, are often responsible for the delivery of equipment entirely unsuited to the purposes for which purchased. The prosperity and full development of the welding industry depends primarily upon the ability of the operator to select equipment that will meet his needs and to preserve same in efficient working order.

There is nothing occult or difficult about welding. Theory, practice, and common sense are the essential factors to which must be added the business initiative essential to success in any calling.

The purpose of the welding regulator is to furnish gas to the hose lines at reduced and unvarying pressures. The regulator is an instrument of precision that requires careful handling. Accorded proper treatment it will give long and efficient service.

Welding Regulators—How Distinguished

Regulators for lead and carbon burning, soda water outfits, etc., are not required to deliver gases in the volume required for welding. Therefore, to lessen expense of construction they are made with 2 or 2½ inch diaphragms. When used for welding, the rapid vibration of the diaphragm of the small regulator soon cuts out the composition seat (7), injures the nozzle (8) and in time buckles or cracks the diaphragm (14). The diameter of the diaphragm on all standard makes of welding regulators is 3 or more inches.

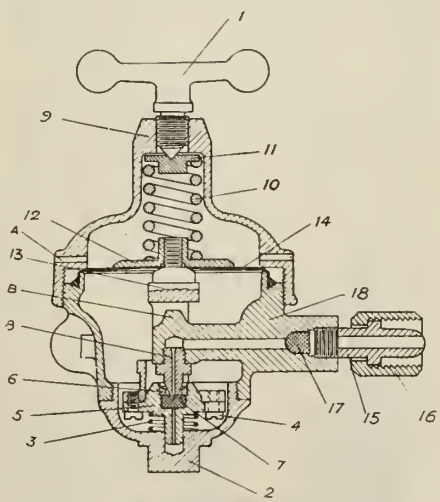


FIG. 15—VIEW SHOWING SECTION OF PERFECTYPE REGULATOR.

Nomenclature of Regulator Parts

1. Pressure adjusting key.
2. Back cap.
3. Compensating spring.
4. Centre piece screws.
5. Back centre piece.
6. Seat-retaining plug.
7. Seat.
8. Nozzle.
9. Front cap.
10. Pressure spring.
11. Spring button.
12. Diaphragm plate.
13. Front centre piece.
14. Diaphragm.
15. Cylinder connection.
16. Cylinder nut.
17. Wire cloth screen.
18. Regulator body.

Principle of Operation

The illustration shows the outline of the "Perfectype" welding regulator. With the exception of the safety vents A, and the safety button B, which prevents the buckling of the diaphragm by application of excess pressure on the pressure adjusting key, it is similar to any other regulator.

Gas enters the regulator from the cylinder through the cylinder connection 15 and the nozzle 8. Pressure applied by means of the pressure adjusting key 1 is communicated to the front centre piece 13 and to the back centre piece 5, in which the seat 7 is secured. Forcing the seat away from the nozzle permits the gas to fill the body of the regulator from when it passes through a connection not shown to the hose's connecting with the torch.

When there is sufficient pressure, the force of the gas pressing against the diaphragm 14 equalizes that of the pressure spring 10 and allows the compensating spring 3 to force the back centre piece and seat against the nozzle to prevent increase of pressure. Gas being drawn from the regulator the pressure spring overcomes the pressure of gas against the diaphragm and repeats the above process. With proper spring adjustment and large diaphragm surface, these opposing forces are so nicely balanced as to cause the regulator to operate without any noticeable change in pressure.

Regulators for heavy cutting are similar to those for welding, the principal difference being the use of stiffer springs to give greater pressure. Here, large diaphragm surface is even more important than in welding, since the flow of gas is much greater. For extremely heavy cutting a large "Jumbo" regula-

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ter, with at least a 4-inch diaphragm is absolutely essential to economy and efficiency. Better still, use several large regulators connecting the hoses leading therefrom to a "Y" from which the single hose leads which supplies the torch. Where oxygen is being used at the rate of from 100 to 250 feet per minute on heavy cutting work it is poor policy to attempt to economize by means of cheap equipment. Speed is the essential factor —any equipment which increases speed reduces the cost of the job.

Oxygen regulators for welding are adjusted by the manufacturer to deliver oxygen at pressures varying from a few ounces to 75 pounds pressure. They will answer all ordinary requirements for cutting work. Where heavy cutting is contemplated a regulator that will deliver higher pressures can be furnished.

Acetylene regulators are similar in construction to oxygen regulators, but are not set to deliver gas at high pressures. The gauges on acetylene regulators are of lower calibration than the pressure carried in oxygen cylinders, and would not withstand such high pressure.

Regulators Not Interchangeable

To prevent their being used interchangeably the cylinder connection stems are sweated in. The connections to the cylinders in which the different gases are supplied are furnished with different threadings. A careless operator cannot attach a regulator to a cylinder other than that for which it is intended.

Precautions Necessary When Attaching Regulators to Cylinders

Remove the pressure-regulating screw (1) and do not replace until the pressure from the cylinder has been turned on. Before attaching regulator the cylinder valve should be opened slightly to blow out any dust or dirt that may be present, and left slightly cracked to permit the pressure to enter the regulator gently when attached. As soon as the full cylinder pressure registers, the cylinder valve should be opened wide (jammed open) to prevent leakage.

What Happens if Pressure-Regulating Screw is Not Released Before Turning on Cylinder Pressure

The cylinder seat (7) will be held away from the nozzle (8) by the pressure on the spring (10). The inrushing gas from the cylinder will force the diaphragm violently outward. The impact of the seat against the nozzle may injure either or both. This causes the regulator to leak or "creep." The pressure within keeps rising, sometimes only a few pounds, more often until it menaces the working pressure gauge or diaphragm. For this reason needle valves should never be used as regulator outlets. A slight leak with a closed needle valve outlet may cause serious trouble. This is lessened by the elasticity of the hose lines. The resiliency of the pressure within the hose often causes a creeping regulator to "find itself" and become securely seated.

Remove the parts in numerical order to 7. If the nozzle is injured it must also be removed and replaced. If the seat is merely dented it may be turned over and replaced. If this has already been done and a new seat is not available, measure its thickness carefully, using a micrometer if possible, and then smooth the surface by means of a fine, clean file. Punch a shim from sheet brass of paper to give the original thickness of seat. Place this in back centre piece beneath the seat and screw retaining plug in firmly.

Replace all parts in reverse order, being careful that none are omitted, then attach regulator to cylinder and turn on pressure. No gas should escape from outlet until pressure is applied to pressure-adjusting key. If the regulator does not respond with pressure at the first half-turn of the pressure-adjusting key the shim inserted is too thick. Many a regulator, in otherwise good condition, has been ruined by carelessly placing thick shims beneath the seat.

If gauges have been removed from regulator to make this repair it will be necessary to use a little shellac as a filler on the threads by which they are attached to the body of the regulator. Use nothing else as a substitute. It might cause trouble.

Gauges Vary With Temperature

To a certain extent the pressure within the oxygen cylinder increases as the temperature rises, and decreases as the temperature falls. The difference indicated by the reading of the gauges at the time of commencing and finishing a repair is sufficiently accurate to be used as a basis for the computation of costs. This cannot be done with the acetylene gauge, which varies to a much greater extent as the temperature changes. A good flow meter gives a fairly accurate idea of the acetylene consumption, but even this is only an estimation. The contents of an acetylene cylinder can be accurately determined only by weight, there being exactly 14½ cubic feet of acetylene to the pound.

In estimating costs it is safe to assume that the quantities of acetylene and oxygen consumed are equal.

If clamps are not available or do not prevent leakage, it may be necessary to fasten connections to hose with wire. First attach the nut to the torch and give the tail-piece a light coating of shellac. Then push the tail-piece into the hose, but not hard enough to cause the hose fabric to bind against the nut. Take two turns of non-corrosive wire around the hose. Hold the ends taut and roll the hose back and forth. With the wire still taut twist the hose until one full turn is given the ends of the wire. Twist the ends together by means of pliers, bend the end slightly and hammer down out of the way.

The cylinders in which acetylene is supplied are painted black. To prevent danger from interchange of hose, that used for acetylene should be black and that used for oxygen red. Hose should be strong, light, flexible, and of the proper bore to give the necessary flow of gas without reduction of pressure.

Hose connections should be made by means of special nuts and stems supplied for that purpose. It often happens that the use of a tail-piece with a small bore causes a very decided loss of pressure between the regulator and the hose. It is for this reason that the author insists that welders should be taught to make the proper adjustment of torches without reference to pressure tables.

Welding Does Not Impair Vision

No other light can be compared to that of acetylene for lighting dwellings. The brilliancy of the welding cone, however, is such as to require goggles of special protective glass. No injury to the eyes will result from welding if the goggles selected are fitted with proper lenses of a shade that it not too dark. The lenses which protect the eyes from the glare and the ultra violet rays of the flame should have renewable front cover glasses which may be discarded when they become fouled with specks of oxide. These cover glasses should be of ground, not blown glass. Operators who ordinarily require glasses should have their prescriptions ground into the colored lenses of the safety goggles used for welding.

Connecting New Equipment to Acetylene Cylinder

Observe that no flame or fire is sufficiently near to ignite the acetylene. Blow dust from cylinder connection and wipe out with cloth or waste. Attach the regulator and open cylinder valve. Make sure (by sense of smell) that there is no leakage at any point and that no gas is escaping from outlet of regulator. To locate leaks use soap and water with a cloth or brush.

Connecting and Cleaning Acetylene Hose

Attach acetylene hose to and insert the pressure-regulating screw in the regulator. Turn screw to the right until pressure of five pounds shows on working pressure gauge. This will blow out the dust which is always present in a new hose. Release pressure by turning screw to the left until flow of gas is stopped.

Connecting Acetylene Hose to Torch

With the needle valves of the torch closed, connect the acetylene hose to connection on torch marked "acetylene," and having selected a tip of the size desired, turn on the pressure at the regulator. Some torches require a very delicate adjustment at the regulator for each size of tip, others are built to work with all tips at ordinary generator pressure of 12 pounds. Allow a little gas to flow through the torch to expel the air, then light it. More pressure is required to force gas through restricted orifices than where all openings are of large area. We are concerned with volume of gases, not pressures. The volume of acetylene passing through the torch should be sufficient to cause the acetylene flame (before turning on the oxygen) to burn without giving off smoke. For ordinary welding work the pressure should be between 5 and 12 pounds. Lower pressures do not force the gases into a

Continued on page 64

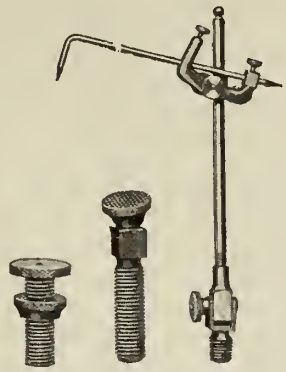
DEVELOPMENTS IN SHOP EQUIPMENT

ROBERTS UNIT JACKS

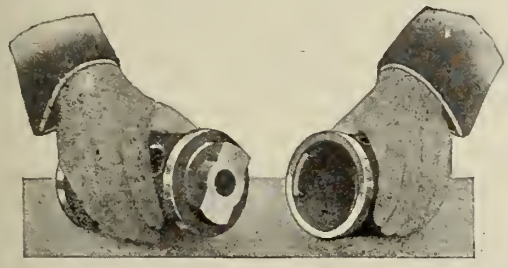
The Roberts Mfg. Co., New Haven, Conn., handle a line of unit jacks and bolt couplers which should interest the mechanic in general. These jacks can be set to any height instantly by means of separate and interchangeable units. One merely builds up the proper number of units required and adjusts their rack jack. Lock joints connect each unit and are locked in place by means of a simple turn.

A surface gauge connection is also made, which can be clearly seen in the illustrations.

Readers can no doubt obtain all necessary details from a study of the various illustrations and will readily understand the advantages of such a system, especially for machine set-up work. All these jacks are made of first quality malleable iron, and will stand the strain placed on them in supporting work These shop aids, as we might term them, are ideal for use on planers, vertical millers, horiontal mills, radial drills, boring mills, slotters, shapers, or in fact any machine upon which work has to be strapped in place. The erecting department will also find them of splendid service.



FROM LEFT TO RIGHT WE HAVE A TOOL-SETTING STAND, A LEVELING JACK, AND A SURFACE GAUGE CONNECTION.



THIS ILLUSTRATES THE LOCK JOINT. A SINGLE TURN FIRMLY LOCKS THE UNITS.

SOME EXTENSION UNITS AND RACK JACK.

This concern will also turn out what is known as an instant bolt coupler. By referring to the illustration showing work jacketed up and clamped, one can see a coupling in actual use.

This attachment is claimed to save the time and cost of making special bolts for special jobs. With the aid of coupler any length of bolt can be had by coupling up bolts you already have. Better still use studs for greater economy, for each bolt retains its own nut. These couplers are also made of malleable iron, and are designed to withstand high strains.

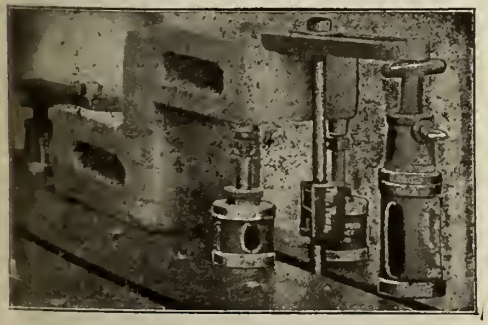
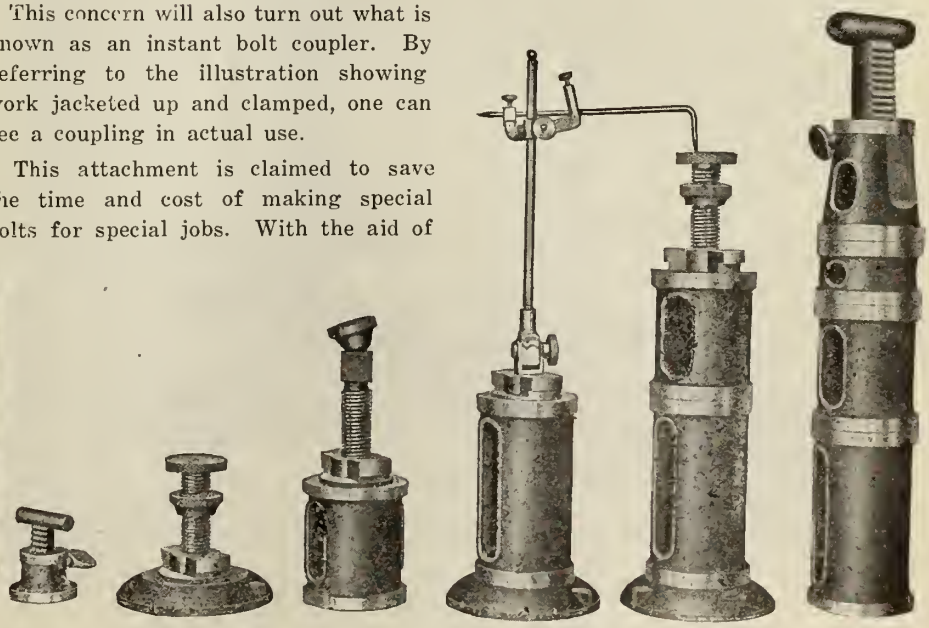


ILLUSTRATION SHOWING BOLT COUPLER AND JACKS IN USE.



HERE ARE THE UNITS. THEY CAN BE BUILT UP TO SUIT THE JOB.

The L'Air Liquide Society announce that their plant at London, Ont., is now in operation, and producing at full capacity. This is the seventh plant in Canada to be completed, and at present there are two others in course of erection, one of which will be in operation within a month of two. This news will, no doubt, be of interest to those requiring oxygen for use in their plants.

HORIZONTAL DRILL

The Milwaukee Crane and Manufacturing Co., Milwaukee, Wis., have plared on the market what is known as their Horizontal Drill No. 25. This machine is designed to cover a wide range of drilling and boring, and is especially useful in completing in one operation bulky and awkward work.

The spindle is of high carbon steel and accurately finished; the front bearing is 2½ in. diameter by 7½ in. long; middle bearing 2⅜ in. diameter by 6 in. long, and the driving end is 2¼ in. diameter with two beveled keyways. The front end is fitted with a ball thrust bearing and No. 5 Morse taper hole, arranged with special cross key and nuts for drawing up and releasing boring bars or tools and the spindle torque is not transmitted through the tang of the drill socket or boring bar when the work is heavy.

Spindle drill is of semi-steel, 4⅜ in. diameter, with heavy rack teeth cut for 24 in. feed, arranged to automatically cut out the drive when the spindle reaches the extreme in or out run of the feed range. Danger of stripping the feed mechanism by over-running when the feed is worked near the extremes of the run is thus eliminated.

The spindle is geared for standard speeds of 20 to 400 per minute, which may be increased or reduced when special service is to be met. With a 4 to 1 motor speed range and 16-point controller, 32 different speeds are obtainable with a sinkle back-gear ratio of about 5 to 1.

All gears are of steel, wide face, and carefully cut, run in oil and are supported on both sides by large bronze bearings arranged for ample and continuous lubrication. Power is transmitted through a maximum of only four reductions of spur gears to secure minimum boring speed and maximum torque, instead of the usual 8 or 9 pairs, thus permitting most of the motor power to reach the cutting tool without being used up by friction losses.

Spindle Feeds and Gearing

The standard spindle feeds provided are 9, 14, 20, 30, 50, and 70 thousandths per revolution. The feed is cut in or out by means of a trip lever and quick return or advance secured by means of the hand wheel on the quill-pinion shaft. Gears for change of feed are of steel and phosphor bronze, of wider face and heavier pitch than usually employed, and run in oil-tight case for constant lubrication. The quill drive worm wheel is of bronze, entirely covered, and the worm is of hard steel, running in oil.

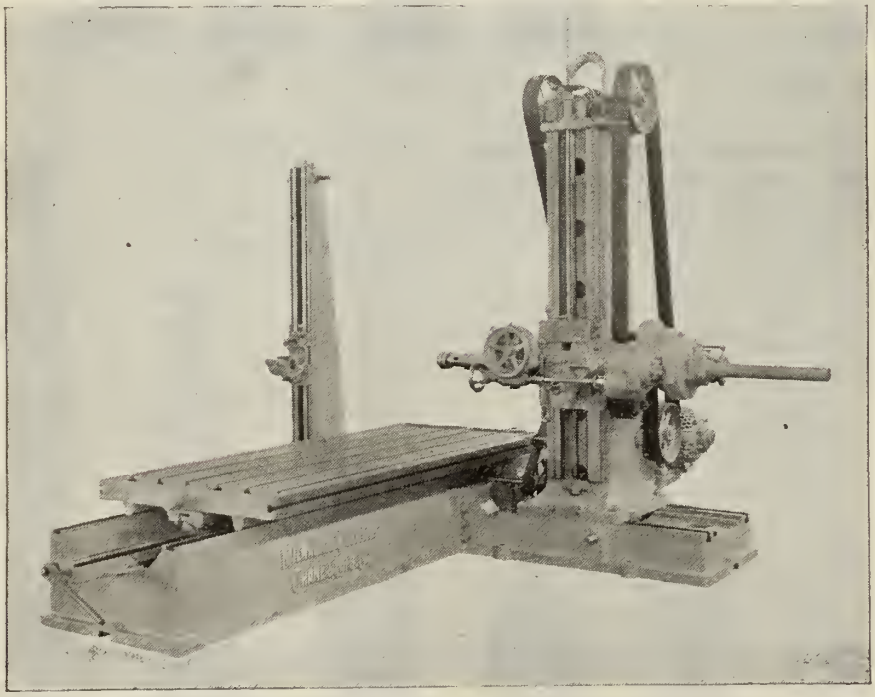
The carriage elevating and lowering mechanism is operated by power or hand and the driving gear is provided with a limiting torque clutch to secure safety to the mechanism in case the carriage is clamped too hard to the column when the power drive is thrown into gear. The hand adjustment is used only to secure final setting of the carriage. A steel scale on the face of the column indicates the distance from the top of the table to the centre of the spindle and a corresponding scale is carried by the outboard column.

The drill column is mounted on a side extension of the bed and is movable to or from the table to suit the size of the work and reduce the overhang of the spindle. This is an important advantage in many cases where end milling and facing is necessary and secures more accurate spotting of the drill than is possible with a long overhang.

The standard table furnished with this machine is 4 ft. wide and 9 ft. long and slides on a heavy, planed, cast iron bed 15 ft. long. The table is operated by a heavy screw operated by power and capable of easy and accurate adjustment by hand from both sides of the work. Suitable tee slots are provided for clamping the work or fixtures and the front edge of the table is tee slotted for bolting on special indexing plates or fixtures for accurately locating shaft bearings or other holes in duplicate work. Tables longer or shorter than the standard length can be furnished to meet special requirements.

The drill is operated by 3½ to 5 horse power, 4 to 1 variable speed motor. The starting, stopping and reversing lever is placed on the spindle carriage within convenient reach of the operator and the maximum floor space required, 14 ft. 6 in. x 17 ft. 10 in.

These drills are made in four sizes, Nos. 25, 30, 35 and 40, each size increasing in capacity and the No. 40 having a capacity of 72 in. elevation to table, and a column movement on base of 30 inches. Further information can be had from the manufacturers.



GENERAL VIEW OF THE MACHINE.

In a recent explosion of a 6-inch copper steam pipe at Carlisle, England, the findings of the official enquiry were as follows:

"The metal used being too brittle the explosion naturally followed. The analysis showed that the copper contained .027 per cent. of arsenic and .13 per cent. of oxygen. Tensile tests gave results varying from 12.4 tons to 14 tons per square inch, with elongations of from 25 to 33½ per cent."

A plate-bending roll which has recently been made in America is claimed by the makers to be one of the largest ever turned. It is 35 ft. 6 in. by 3 in. in the body, 40 feet 8 inches overall, and weighs 60 tons. The ingot from which it was forged weighed 119 tons, and was 67 inches in diameter.

One Way to Do It is to Put Your Good Ideas in This Paper

Hamilton, February 28th.

Editor, MACHINERY,

Dear Sir,—I wish to express a little thanks for the way Mr. Ernest helped at least one reader of CANADIAN MACHINERY by the small but practical subject: "How to Bore a Tapered Hole." I am sure such bright machine shop kinks as this are welcomed by all ambitious readers, and I, for one, hope to see more of them.

Wishing you all success,

Yours truly,

Hamilton Reader.

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The Lesson For Canada

CANADIAN industry is being tied in knots because American railroads are tied in knots by the outlaw strikes in that country.

And Canadian industry is going to continue being tied in knots until this country wakes up to the fact that it is a long, dreary distance from being self-contained.

United States is becoming the stamping ground for agitators whose jaws work harder than their brains, and who would starve to death if they had to take their dirty hands out of the pockets of their fellows.

These men put a big crimp in the steel industry of United States last year, and that crimp passed right over into Canada.

These same men are throwing monkey wrenches into the railroad wheels now—on the other side of the line again. Railroad yards are clogged—traffic has become rusty—transportation companies don't transport.

And in Canada right now firms are wiring, writing and making personal trips to the strike-tied belt in United States.

We are paying a tremendous price for having year after year found it easier to reach across and get finished or semi-finished steel or iron than to get down to business and turn it out at home.

Transportation experts have laughed at the idea of bringing coal from the East or West into this coalless belt in the centre of industrial Canada.

And right now we have the spectacle of our finest steel industries, users of coal that must come from United States fields, being crippled to the point of banked furnaces and silent rollers—because the agitator has done his work, and because we have not seriously tried to annihilate distance in bringing our own ore and coal together in Canada.

Right now Canada stands facing empty markets at home and all over the world. There is so much business booked that it cannot be written off for months. It is not fictitious, nor imaginary. It is real, positive and legitimate.

And with all this in view the industries of Canada, for the lack of coal, steel and iron, have to stand aside and watch the opportunity go begging.

We have taken it for granted long enough that the great workshop of Canada—Ontario—was too far away from the coal fields of the West or the East. We have looked over the transportation figures and said "It's out of the question."

The punishment that Canadian industry has received on account of the outbreaks of strikes in United States should make our national comment read, "It must be done."

Surely our industrial head has been bumped on the pavement enough times in the last couple of years to cause us to wake up.

Otherwise we may feel around some bright morning, only to find that our feet have been frozen overnight.

Couldn't Earn $2.80 a Day

HOW things hop! Could you go out to-day and hire a moulder for $2.80 a day? You might not be able to hire one at any price, but certainly $2.80 would never get a hearing.

A moulder had answered an ad. of a firm in an Eastern Ontario town. He was making $2.50 a day, and was willing to leave for $2.80. He so informed the wise man from the East, and here is what he received in return.

The letter is dated June 3, 1909:—

Dear Sir,—

Your favor of the 1st to hand. The two places are already filled in my moulding shop for which I was advertising.

The applications which I have received are rather amusing. Moulders now-a-days do not know what to ask in wages. I do not believe it is possible for you to earn $2.80 a day. If any one could I would pay it, but I know that no moulder under me has ever done that yet. Nor come near it. Our moulders have steady work, every day the year round.

The sequel to the whole thing is that only a few weeks ago the same shop was advertising for moulders again, the wording this time reading "Highest Wages Paid."

Chance For the Skilled Man

ACCORDING to officials whose business it is to keep in touch with the situation, the fuel situation in Ontario, as far as power is concerned, is decidedly bad now.

Every ton of coal should be made to do, as near as possible, the duty of a ton. Steam plants, even at their best, are some distance removed from 100 per cent. efficiency.

The shortage of coal—and it is not apt to be remedied very soon—calls for the elimination of the tinker and the guesser in every department of the business that is touched by the production or transmission of power.

Industry calls for men who know—know how to get the best results from the fuel used—how to get results in transmission—how to eliminate as much friction as possible.

Increasing costs call for the same thing.

There's a great chance now for the man who wants to take himself by his own shoe-strings and pull himself out of the rut.

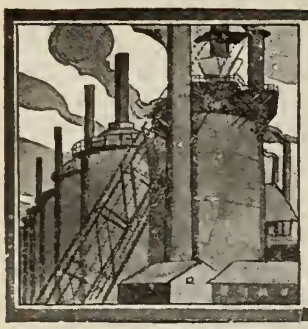
He may have to burn the midnight oil to do it—or he may have to burn the midnight oil if he doesn't, trying to figure out how to make ends meet.

Industry has not become simply a case of automatic production. You may get this idea at times.

The man who is going to succeed is not the man who contents himself with looking after the machine.

The man who succeeds is the one who is keeping a few paces ahead of the machine.

The night classes, the technical papers and books are still the real stepping stones to men who want to get into that desirable class that are called in after the average man has failed to give results.



MARKET DEVELOPMENTS

U. S. Railroad Strike Effects Are Felt Here

Many Canadian Concerns Depend on Shipments Coming Through From United States Mills—Premium Prices Are Still Much in Evidence in the Market—British Firms Are Getting Shipment Through Quickly

THE extent to which conditions in United States transportation systems are interfering with the steel, iron and machinery business in Canada is becoming more evident daily. The supply of coal is vitally necessary to the steel industry, and that is running dangerously low. One firm that needs 2,000 tons per day is getting about three or four hundred tons. There is a tremendous tonnage on the books of the steel mills and of the jobbers in Canada, but the big business is to make it or get it for shipment to the consumer.

Old Country representatives are reporting better service from their home offices in the way of deliveries, and some goods are reported as arriving in three weeks from the placing of the order.

Premium prices are still to the front. Toronto interests wanted plate within a short time, and had to pay 4.75 per pound at the mill. When extras for size, freight, duty, war tax and exchange were added to the price, as well as yardage and profit, it had to sell at 8.25 per pound. The U.S. manufacturer is getting the same material, if he is on the books of the Steel Corporation, at 2.65 per pound.

Another firm, anxious about boiler tubes that had been on the way for weeks, was informed by the mills that there were some 50,000 tons piled in the yards, and that the order wanted was probably in that pile. When that pile gets moved the Canadian customer will get his supplies, and there is not much indication of the movement taking place under present conditions.

New York machine tool market reports a falling off in inquiry that is quite noticeable. One explanation is that there is a very well-defined feeling that there must be an end to rising costs and increasing prices, and until there is some signs of a definite move downward in many essentials, buyers will persist in staying out of the market.

Steel mills and large melters have largely withdrawn from the scrap market in Canada, with the result that prices are flat and demand very small.

MONTREAL REPORTS BETTER DELIVERIES OF BRITISH TOOLS

Special to CANADIAN MACHINERY.

MONTREAL, May 20.—There are rumors in the air that steel prices may be easier in the near future, but it is difficult to state any good reason for such assumption, as conditions are not such as would lead one to believe that pressure has been relieved in any direction. The situation here is relatively the same as it has been for several months and dealers are still satisfied that receipt of materials will remain uncertain for some little time yet. The demand is still heavy and the inability to get steel material through for fixed deliveries continues to be a prominent feature of the present market. Roads in the States are in an unsettled state and traffic is still more or less congested, a condition that influences all industries that depend on transportation for requirements of raw materials and semi-finished products. Dealers state that occasionally they will get a little heavier shipment than usual, but are unable to place any in the warehouse owing to the urgent needs of consumers. The scarcity in sheets is probably the most pronounced, and tube users are continually asking for more supplies. It is thought that the situation will become easier from now on. Labor unrest is less evident, although it is still far from a condition where production is maintained at maximum. Dealers are invariably satisfied at the low state of stocks as the uncertainty leaves them nothing to worry over should prices decline.

Metals Slightly Easier

The metal situation shows a general tendency to weaken, as the reduced demand has created a temporary oversupply. Transportation difficulties have delayed deliveries but the general price tone is easier. Local dealers report a quiet week with a downward trend to prices. Tin is quite active with quotations easier, 70 cents being a drop of 2 cents on the week. Antimony has declined and is now quoted at 14 cents per pound.

British Trade Increasing

There is an increasing tendency on the part of dealers here to favor British-made machine tools when the delivery on American tools is a matter of several months. This is particularly true in the case of supplies, and in some instances a user of small tools has been given better satisfaction in the way of delivery when getting goods from England. A case in point was the receipt of a quantity of drills in less than three weeks from the time the order was given to the time the goods were delivered to the customer. It is thought that the release of tonnage control will be still more favorable to trade from Great Britain. The condition is still prevalent where old tools are made to fill the place of new ones when the latter are not to be had. Dealers are doing a good business in used machinery, although it is much harder to locate general purpose equipment as the bulk of this has long since been absorbed.

Non-Ferrous Scraps Weakening

It is stated that the consumption of scrap has fallen off as a result of the curtailment of furnace and mill operations, due to the inability to obtain sufficient supplies for normal operations. Whatever the reason, the present market is comparatively dull and trading is quiet. Local foundries are regular buyers, particularly of machinery scrap, but the supply is stil below the full require-

ments of the trade. Quotations on this class of material are high but listed prices are a fair average of what the dealers are paying. Non-ferrous lines are not very active and the market is weakening.

PAY THE PRICE TO GET THE MATERIAL

Premium Figures Dominate the Situation—Shipments of Some Machine Tools are Better

TORONTO.—In these columns a week ago, the observation was made that several of the steel warehouses had noticed a decided falling-off in inquiries. Some were inclined to think it was the forerunner of a quieter period, but most of the dealers are prepared to change their minds this week. Demand is strong, and there is insistent pressure for material from firms that are hard put to get enough to keep going.

Machine tool dealers are finding the embargo as big a problem as they have faced for a long time. Their usual shipping schedule is a fairly protracted affair at best—at least it has been for the past three or four years—and now that schedule is at the mercy of the railroads and their employees.

The fuel situation is a big topic of conversation in the machine tool market. The dealers apparently hear much of it from many of the customers, and it has much to do with the installation of new equipment. If a firm finds that power is not going to be available, the chances are that it will stay out of the market until some better condition is in sight.

The orders that are coming into the market here now are mostly from the smaller buyer, or from firms wanting to round out present installations.

The tie-up in the States in the way of transportation works out in queer ways at times. For instance, one dealer here who sells automatic lines, reports that he has had several machines sent across in advance of their promised schedule by several weeks. The reason was that there appeared to be no chance of getting them to their proper destination, a United States point, and it was found possibly to ship to Canada, so the Canadian buyer got the shipment.

Old country machine tool houses, now represented in Canada, report that their shipments are coming along better now, and they will be able to make deliveries in good season. They report good returns for the time they have been open in the Canadian territory, and find no trouble in placing all the machines they can get shipped.

Prices Continue Upward

A limited tonnage of plate (3-16) was taken in at one of the Toronto warehouses this week. The reason for the limited tonnage was the price, not the demand.

The buyer took on a tonnage for which he had to pay 4.75 base at the American mills. Delivery is to be made very shortly on this. How does this figure out by the time it goes out from the Canadian warehouse? Well, add ten per cent. for size, making 5.22; 35 cents duty which is at the rate of $7 per ton; 40 cents war tax; 33 cents freight charges, and 50 cents exchange. That brings the price of the plate to around 6.80. Then put on the cost of placing it in the warehouse, and add the profit of the dealer and the plate is selling at 8.25 cents per pound.

The Steel Corporation price has been all along, and still is 2.65, although it is not possible to get orders placed now, the mills being clogged with business that has been on the books for a long time.

Shipments to Canadian users are disappointingly meagre when compared to the absolute needs of the case. One firm in Hamilton has three or four hundred tons of flats and hexagons piled at the mills across the lines, and there they stay. They cannot be moved a foot.

There is no improvement in sheets. The Canadian mill is not sending many out now, on account of the shortage of coal. No. 28 are selling in the warehouse as 9.50 per pound, while 10 gauge is 9 cents.

Boiler tubes are coming in slowly. A few cars have arrived after long-drawn-out trip. One Toronto dealer in an effort to get some action on a shipment wired and wrote the mills. The reply was from one of the officials, and he stated that there were 35,000 tons piled at one side of the mill waiting a chance to get out, and probably his shipment was in the lot. That is as near as he could come to giving anything in the line of information as to where the Canadian shipment was. There is always an accumulation of orders against any shipment that may come. Big buyers come in many times, and ask that their orders be accepted at the warehouses. They know they cannot get attention right away, but they are willing to have their orders booked in the hope that the warehouses will be able to get better treatment from the mills than they can hope for.

A Dead Scrap Market

Dealers claim that the market is heading toward lower levels, although they were willing to let the price list stand for the present.

"Many of the big buyers in Canada are out of the market, especially in the steel business," was the explanation given to this paper, "and as a result the removal of the demand has caused the price tendency to point down." There is no change or let-up in the embargo situation, and any trading that is being done must be confined to this country. Very little exporting is being done.

POINTS IN WEEK'S MARKETING NOTES

New York reports a very quiet machine tool market and intimates that the feeling there is that there must be an end to rising prices and costs.

—

Steel mills are not able to get their finished material away from the mills as the switchmen's strike has seriously interfered with traffic. Passenger trains alone are operating on schedule.

—

Coal is not coming across the border in anything like needed amounts. Steel firms, for instance, that need 2,000 tons per day are trying to keep coking plants in operation on 300 or 400 tons per day.

—

Toronto jobbers had to pay 4.75 base for plate at U.S. mills for fair delivery. When all charges are paid it will be offered to the Canadian trade around 8.25 per pound.

—

The steel companies and large melters have largely gone out of the scrap metal market, with the result that prices are flat. Embargoes keep trading confined to Canada.

—

British importers report that they are getting much better service from their firms in the matter of deliveries.

—

Shipments of steel coming to Canada are being seriously interfered with. Some companies have not had a pound come in for as long as five days.

FALLING-OFF IN NEW YORK MARKET

Has Been Very Noticeable—Railroad Problem Has Caused a Serious Situation

Special to CANADIAN MACHINERY.

NEW YORK, May 20.—The falling off in machine tool business in the past two weeks has been rapid. The past week has been one of the quietest experienced in the Eastern markets in many months. The slump is largely attributed to the railroad situation. It is becoming more clearly recognized that railroad transportation will be the "neck of the bottle" industrially for some time to come. Statements of railroad executives to Government officials in Washington point out that the crisis in transportation is due not only to insufficient labor but also to insufficiency of freight cars. The roads are asking for funds to build 100,000 freight cars, but even if the money is speedily granted it will be many months before there will be any marked relief in that direction. Meanwhile traffic is becoming hopelessly confused. Should there be improvement in car supply and a more plentiful supply of labor to move trains there would im-

mediately be immense offerings of freight, which has been piled up for weeks in warehouses and factories, and the result would be greater congestion. The solution offered by the railroads is action by the Interstate Commerce Commission restoring the priority arrangement which existed in war times. In this way priority would be given to essential products such as coal, food, etc., while other less needed articles would be carried only as the railroads were able to supply the cars.

A full appreciation of the railroad situation, together with a growing belief that a halt must be called on rising prices of all commodities, are no doubt at the bottom of the falling off in demand for machine tools. The same lack of buying exists in iron and steel and some other products, so that the present condition is not confined to any one industry.

Some sellers say that users of machine tools are of the opinion that the next change in prices will be downward. There are no positive indications at this writing of price declines; in fact the trend has been the other way right up to within the past two or three weeks. However, it may be said that there will be more conservatism henceforth in price advances on tools as well as on other articles.

The only inquiry of importance in the East is one issued by the Chesapeake and Ohio Railroad, calling for more than forty machines for plate shop, pipe shop and machine shop. Singularly, the principal business now pending and expected in the East is railroad business. The Norfolk and Western Railroad has not yet placed orders against its recent list of about seventy machines. Other roads, notably the Pennsylvania, Erie and Lackawanna are expected to come into the market shortly. Certainly if the roads are to get their rolling stock into shape to handle the freight traffic they must re-equip their shops, some of which have had practically no new tools since before the war.

PITTSBURG DISTRICT BADLY TIED UP BY STRIKE OF RAILROAD SWITCHMEN

Special to CANADIAN MACHINERY.

PITTSBURGH, May 20.—The rail strike has affected the iron and steel industry in a complicated manner. The strike itself has been waning, though very slowly, partly by the return of strikers and partly by the advent of new men, some of them volunteers, on temporary service. The full effect of this is not felt by the iron and steel industry for the reason that empty cars have been growing scarcer. From the beginning of the strike the effort has naturally been to load cars. The coal mines, coke works and steel mills gathered up all the cars they possibly could secure, many of them not being furnished by the railroads in the regular manner, but being simply gathered up by a plant sending out its own locomotives and picking up cars where they could be found. Main line tracks were idle in some cases, on account of the strike, and it was possible to do altogether unusual things in the matter of gathering up cars. Once the cars were loaded, however, they frequently did not get far. Some are still on plant sidings, while others have gone to railroad sidings and still others have gone to classification yards. It was said early in the strike that the railroad managements would make a particular point to avoid congesting their yards, but whatever the theory or intention the actual result has been different. Many yards are badly congested. Even in the case of the solid trainload movement, which has been employed so much, the solid trainload is merely one going out. There are few solid trainloads of empties being moved back. Of course there is no system or order. A trainload of coke from the Connellsville region is accompanied by a representative of the blast furnace, and the "personally conducted" train gets through, not infrequently by the distribution of bribes to the men working on the railroads, but similar efforts are not made to get the trainload of empties back.

The result of all this is an increasing scarcity of cars, which militates against freer shipments being made even though the avenues through which shipment could be made have been clearing.

The effect of these trends has been felt in some of the markets, most noticeably in the case of Connellsville coke. When the rail strike started, there were plenty of coke ovens and men, and a fair number of cars, while there were very few directions in which coke could be shipped. The market for spot furnace coke had been $11 to $12, and it weakened to $10.50 or possibly $10, as there were more sellers than there were buyers to whom shipments could be gotten through. Then the rails got more open, whereby more buyers could bid for coke, while the supply of cars decreased if it changed at all. The pressure turned to the other side. Coke became firm at $12, then within a few days got up to $13.50 minimum, next day to $14 and a day later to $15. Seeing no end to the advance some furnacemen withdrew from the market, preferring to bank rather than pay such fancy prices, as even $12 in its time had been considered a fancy price, and the market at this writing is about $15. It may be mentioned that foundry coke did not move similarly. Some brokers got as high as $14, but several old-line producers refused to go above $12, considering this the highest price that could possibly be regarded as fair, but they have been able to sell, and only in a limited way at that, to regular customers.

Steel Production

The monthly report of the American Iron and Steel Institute shows that in April the 30 companies that contribute to the monthly report made 2,638,305 gross tons of steel ingots, against 3,299,049 tons in March. These 30 companies produced 84.03 per cent. of the total output in 1918, and computing from this, and allowing for the number of working days the rate of steel ingot production by the whole industry in April is seen to have been about 37,550,000 gross tons per annum, against a rate of about 45,200,000 tons per annum in March, the March rate having been the highest attained since October, 1918. The decrease from March to April in the rate was one-sixth, precisely the same rate of decrease as was shown in pig iron, referred to in this report of a week ago. As the strike only began April 1 at Chicago, and did not affect Ohio and Western Pennsylvania points until Monday, April 12, while later in the month conditions in the Chicago district improved, the curtailment in production when the strike was at its worst was more than one-sixth from the March rate. It is doubtful whether production at the present time is greater than the average rate of April.

Shipments Poor

By this time, however, the trade has become much more interested in shipments or rather in receipts, than in production. Much more pig iron and steel is being made than is being shipped and much more is being shipped than is reaching destinations. Consumers are hard hit, not only by steel shortage, but also by shortage of coal and other necessities. Pittsburgh district coal, which was ranging from $4.00 to $4.50 per net ton at mine before the rail strike, has sold in the last few days at $7.00, and it may of course go still higher, as there are few cars and many anxious bidders.

The consumption of steel is certainly reduced very materially, although the precise amount cannot be estimated. Meanwhile steel is accumulating in mill warehouses and yards, and en route, the same being true of pig iron. These accumulations will doubtless have an effect upon the markets when the rail strike is ended, or rather when there is a free movement again, for ending the rail strike instantly would not entirely restore the movement of material, because there is so much congestion of loaded cars, and shipments with any freedom would not be possible until the loaded cars were delivered and unloaded and the empties gotten back.

Market Lethargic

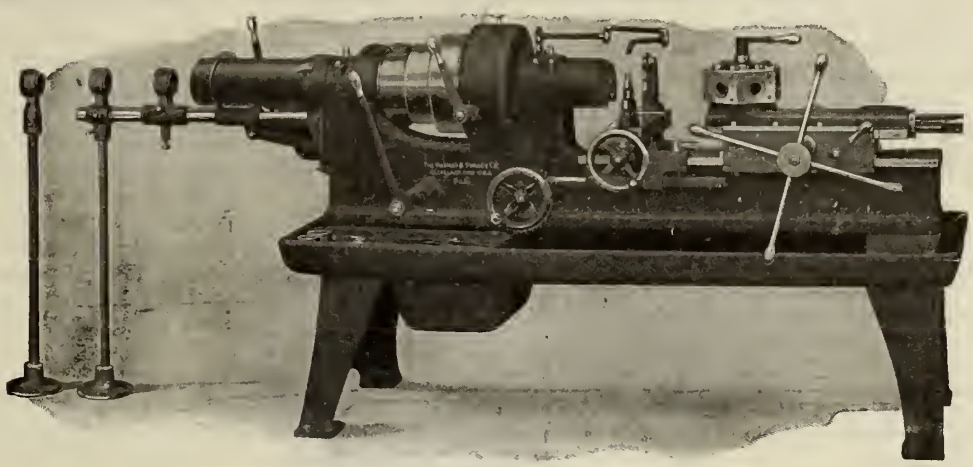
The whole market is lethargic. Consumers have no occasion to buy prompt deliveries, for as a rule the delivery on a new purchase would be no better than delivery on an old purchase. As to forward deliveries, there is no interest.

In pig iron, the quotable market is strong, and in foundry pig there is a quotable advance of $1 a ton, to $44, valley, Bessemer remaining at $42.50, and basic at $43, but the foundry iron market is made simply by small prompt lots. What pig iron would bring for

Warner & Swansey Screw Machines

For large output and close limits—If you are figuring on screw machine work you can depend on W. & S. machines being right for the job.

We can supply you from stock immediately.



The A. R. Williams Machinery Company, Limited

ST. JOHN, N.B.
WINNIPEG, VANCOUVER

If It's Machinery—"Write Williams"

64 Front Street West
TORONTO

second half delivery, if forced on the market, can only be conjectured.

As to steel prices, the prices for the earliest deliveries are declining, as the mills making such deliveries had little tonnage on books and must force sales. Mills booked for from two to four months, and having lower prices, though still say $10 to $20 a ton above the Steel Corporation or Industrial Board prices, have not reduced prices, but do not need to at this time. The Steel Corporation continues its prices. The corporation's unfilled obligations at the end of April amounted to 10,359,747 tons, showing 467,672 tons increase during April, against increases of 389,994 tons in March and 216,640 tons during February. Actual bookings in April, however, were lighter, as the greater increase in unfilled obligations in that month was due to decreased shipments, April shipments amounting to about 60 per cent. of capacity, against shipments in March at about 96 per cent. Bookings may be estimated at 124 per cent. of capacity in March and 94 per cent. of capacity in April. When the bookings of the low seller decreased it may readily be concluded that the bookings of the higher sellers, the independents, decreased still more.

SERIOUS MATTER FOR THIS COUNTRY WITH COAL SHUT OFF

CANADIANS, who have returned this week from points in the steel belt of United States, bring back reports of congested yards, of freight trains that do not carry freight and of shipments that have fallen by the wayside. The switchmen's strike is as effective as it ever was, and the results are such as to interfere seriously with the securing of basic materials by Canadian mills.

The amount of coal passing over the border during the last three months is away down when compared to any ordinary period of similar duration. Steel mills in Canada, in some cases, depend entirely on United States fields for coal for coking purposes. The fact that the mines belong to them does not help matters if they cannot get the product of the mines in here.

Several blast furnaces have been down for some days, if not weeks, and finishing departments are getting along as best they can without any regular movement of material from the furnace to them. The big danger is that if things do not improve quickly some of the by-product coking plants will go down, and closing these off is a serious business, as coking, once started, is of necessity a continuous process.

There is a lot of business on the books of the steel companies in this country, and it is all good, legitimate business, placed there by people who want steel products for manufacturing or building. The pity of the thing is that, more and more, due to labor troubles carried on on the other side of the line, Canadian industry is being crippled and retarded, just at a time when it is in great shape to go ahead by leaps and bounds.

One Canadian steel man, who came back to-day, told CANADIAN MACHINERY: "The switchmen's strike is on just as effectively to-day as it ever was. Production in Pittsburgh I would place around 40 per cent., while the same figure would hold good in Youngstown as well."

HOW ONE AMERICAN FIRM HAS ADOPTED A FIFTY-FIFTY PLAN

The Willys-Overland Company's "50-50 Profit Sharing Plan" in connection with its factories in the United States goes further into the realm of profit sharing than has been attempted in the great majority of these experiments. The distribution between capital and labor is made on an equal basis after capital has been justly rewarded, and provision made for the depreciation, etc. An amount equivalent to 3 per cent. of permanent capital is set aside for depreciation; 1 per cent. applies to a contingency or "Rainy Day Fund." The just return to invested or permanent capital is estimated at 7½ per cent. Payment of these amounts is made from the income of the year and the residue is shared equally between capital and the workers. This plan was tried as an experiment and has been in operation for a year and a half. It will be continued each year after 1920 if it proves satisfactory. The company believes that with the consistent co-operation of its employees the "50-50 plan" will work out successfully. The firm does not assume any additional legal obligations, nor do the employees sacrifice or imperil any of their rights. The fact is emphasized that the plan shall in no wise affect either the rights of the company or the rights of its employees. It is a purely voluntary arrangement on the part of the company and its employees. Every worker, who has been in the employ of the company for a period of ten months becomes a profit sharer.

The employee's record of conditions service is not affected by absence on account of sickness or injury. Absence from work for two consecutive days or three times in thirty days without report, automatically removes an employee's name from the continuous service record.

To take charge of this work a 50-50 division was organized, composed of ten members, five of these selected from the factory, who submitted best written suggestions on profit sharing plans. These ten members hold office for one year and their successors are elected annually.

Profits are distributed on the basis of salary and no wage is considered in excess of $5,000 per annum. Length of service is also rewarded. Five distributions of profit are made each year. The first four are based on a conservative book inventory and the fifth on the regular annual inventory.

NO COAL BOATS

Formerly a Large Amount of Coal Has Come Up This Way

MONTREAL.—This season not a ton of coal will be brought to Montreal in the Black Diamond ships by the water route from Louisburg to Montreal.

When asked when the first shipment of coal was likely to be unloaded in port from Nova Scotia or Cape Breton, a Dominion Coal Company official said:

"No coal boats are coming to Montreal this year."

The reasons given were firstly the great demand made for the coal on the spot by big industries like the Steel Corporation, whose consumption has increased tremendously.

This factor has become aggravated by under production in the mines. The high cost of bunkering in Britain, which compels British vessels to fill their bunkers at Sydney instead, is also an important factor in the present drastic changes.

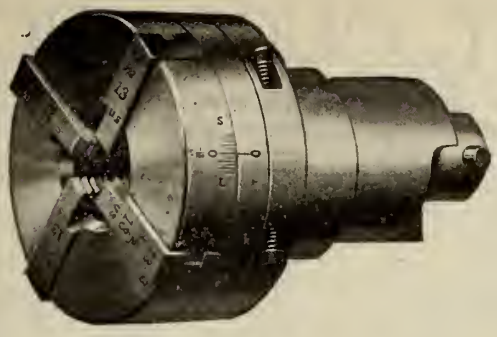
PLENTY OF POWER

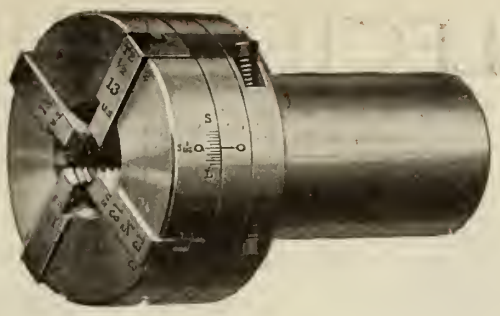
Report Says That Trent Valley Resources Capable of Great Things

PETERBORO.—At a meeting of the Engineering Institute Mr. Sisson presented a verbal report on behalf of the committee appointed to investigate the power situation in the Trent Valley. It contains some interesting figures on the supply of power and was coupled with the suggestion of Mr. Sisson that, although there were at present sources of power for double the present population of Peterborough, yet a year from now the city might have to look for new sources of additional power, which will unquestionably be forthcoming.

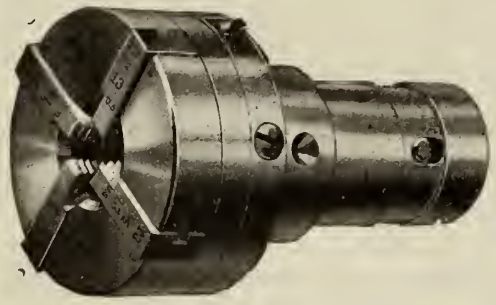
He stated that in the Trent Valley there was power available to the amount of 70,000 h. p., of which, up to the present, only 28,000 had been developed. In connection with this latter figure, Mr. Sisson pointed out that his figures referred to the power actually produced and not to the total capacity of the installations and machinery.

Quebec.—A most successful launching of the "Canadian Hunter" took place from the Davie Shipyards, when a large number of interested spectators watched the vessel glide into the water. The "Canadian Hunter" has a length of 331 feet, breadth 46 feet 6 inches, a depth moulded of 25 feet 6 inches, and a speed of 12 knots. Her deadweight is 5,100 tons.





Geometric Solid Adjustable Die Heads



When one uses the word "ONLY," he needs to be sure of what he is talking about. With confidence we use the word in saying that a Geometric Solid Adjustable Die Head, fitted with a set of milled dies, is the only solid die head that will back off without stripping the thread.

Geometric Solid Adjustable Die Heads may be fitted with either a releasing shank, plain shank, or with special shank for the Gridley Automatics. The releasing shank permits the head to disengage from the shank upon completion of the thread. The plain shank fits the head for use on the turret of a lathe or on a live spindle, such as a drill press.

Apart from the fact that it is not equipped with the self-opening feature or the roughing and finishing attachment, the Geometric Solid Adjustable Die Head is the same in principle and construction and will do equally as accurate work as the other styles of Geometric Die Heads.

Whatever the requirements, there is a type of Geometric Die Head bsst adapted to the work.

THE GEOMETRIC TOOL COMPANY
NEW HAVEN CONNECTICUT

Canadian Agents: William & Wilson, Ltd., Montreal; The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg, and St. John, N.B.; The Canadian Fairbanks-Morse Co., Ltd., Manitoba, Saskatchewan, Alberta.

If interested, tear out this page and keep with letters to be answered.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$42 40
Lake Superior, charcoal, Chicago	57 00
Standard low phos., Philadelphia	50 00
Bessemer, Pittsburgh	43 00
Basic, Valley furnace	42 90
Toronto price:—	
Silicon, 2.25% to 2.75%	52 00
No. 2 Foundry, 1.75 to 2.25%	50 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 50
Steel bars, base, Toronto	5 50
Iron bars, base, Montreal	5 50
Steel bars, base, Montreal	5 50
Reinforcing bars, base	5 00
Steel hoops	7 00
Norway iron	11 00
Tire steel	5 75
Spring steel	10 00
Band steel, No. 10 gauge and 3-16 in. base	6 00
Chequered floor plate, 3-16 in.	9 40
Chequered floor plate, ¼ in.	9 00
Staybolt iron	9 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	4 00
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 90
Small shapes under 3"	3 62

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points	C.L.	L.C.L.
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

	Gross. Montreal	Toronto
Lake copper	$25 00	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	72 00	75 00
Spelter	12 00	12 25
Lead	11 50	12 00
Antimony	14 50	14 00
Aluminum	34 00	35 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$ 7 25	$ 7 25
Plates, ¼ up	6 50	6 50

PIPE—WROUGHT

Price List No. 44—April, 1920.

STANDARD BUTTWELD S/C

	Steel Black	Steel Galv.	Gen. Wrot. Iron Black	Gen. Wrot. Iron Galv.
⅛ in.	$6 50	$ 8 50	....	....
¼ in.	5 13	7 26	$ 5 43	$ 7 56
⅜ in.	5 13	7 26	5 43	7 56
½ in.	6 84	8 42	7 27	8 84
¾ in.	8 45	10 58	9 03	11 16
1 in.	12 50	15 64	13 35	16 49
1¼ in.	16 91	21 16	18 06	22 31
1½ in.	20 21	25 30	21 59	26 68
2 in.	27 20	34 04	29 05	35 89
2½ in.	43 00	53 82	....	....
3 in.	56 23	70 38	....	....
3½ in.	71 30	88 32	....	....
4 in.	84 48	104 64	....	....

STANDARD LAPWELD S/C

	Steel Black	Steel G lv.	Gen. Wrot. Iron Black	Gen. Wrot. Iron Galv.
2 in.	$30 90	$37 74	$34 60	$41 44
2½ in.	45 34	56 16	51 19	62 01
3 in.	59 29	73 44	66 94	81 09
3½ in.	73 14	90 16	82 34	99 36
4 in.	86 66	106 82	97 56	117 72
4½ in.	0 98	1 23	1 24	1 49
5 in.	1 15	1 44	1 44	1 73
6½ in.	1 49	1 86	1 87	2 25
7 in.	1 94	2 43	2 42	2 90
8-L in.	2 04	2 55	2 54	3 05
8 in.	2 35	2 94	2 92	3 51
9 in.	2 81	3 52	3 50	4 21
10-L in.	2 61	3 26	3 25	3 90
10 in.	3 36	4 20	4 18	5 03

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.

4½" and larger 50%.

4" and under, running thread, 30%.

Standard couplings, 4-in. and under, 30%

Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds. Montreal	Toronto
Copper, light	$15 00	$14 00
Copper, crucible	18 00	18 00
Copper, heavy	18 00	18 00
Copper wire	18 00	18 00
No. 1 machine composition	16 00	17 00
New brass cuttings	11 00	11 75
Red brass cuttings	14 00	15 75
Yellow brass turnings	8 50	9 50
Light brass	6 50	7 00
Medium brass	8 00	7 75
Scrap zinc	6 50	6 00
Heavy lead	7 00	7 75
Tea lead	4 50	5 00
Aluminum	19 00	20 00
	Per Ton	Gross
Heavy melting steel	18 00	18 00
Boiler plate	15 50	15 00
Axles (wrought iron)	22 00	20 00
Rails (scrap)	18 00	18 00
Malleable scrap	25 00	25 00
No. 1 machine east iron	32 00	33 00
Pipe, wrought	12 00	12 00
Car wheel	26 00	26 00
Steel axles	22 00	20 00
Mach. shop turnings	11 00	11 00
Stove plate	26 50	25 00
Cast boring	12 00	12 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜-in. and less	10
Carriage bolts, 7-16 and up	Net
Coach and lag screws	25
Stove bolts	55
Wrought washers	45
Elevator bolts	Net
Machine bolts, 7/16 and over	Net
Machine bolts, ⅜-in. and less	15
Blank bolts	Net
Bolt ends	Net
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square, blank	add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 50
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent.
Set screws	25 and 5
Sq. and hex. hd. cap screws	22½
Rd. and fil. hd. cap screws	plus 17½
Flat but. hd. cap screws	plus 30
Fin. and semi-fin. nuts up to 1-in.	20
Fin. and Semi-fin. nuts, over 1 in., up to 1½-in.	10
Fin. and Semi-fin. nuts over 1½ in., up to 2-in.	Net
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$60 00
Open-hearth billets	60 00
O.H. sheet bars	76 00
Forging billets	56 00-75 00
Wire rods	52 00-70 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 70
Cut nails	5 85
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 35½
British Manila rope	0 28
New Zealand hemp	0 28
Transmission rope, Manila	0 47
Cotton rope, ¼-in. and up	0 88

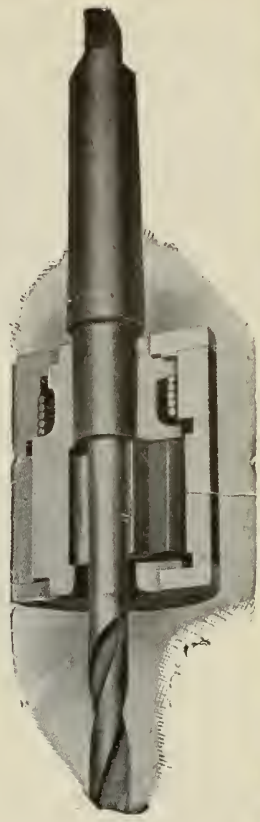
POLISHED DRILL ROD

Discount off list, Montreal and Toronto net

When You Need Dependable Tools See Aikenhead's

Wahlstrom Automatic Drill Chuck

Holds Tools With or Without Tangs



Do you repair or discard your broken tang tools? This expense is unnecessary and an absolute waste for Wahlstrom Automatic Drill Chucks will hold tools whether they have tangs or not—the jaws grip on the sides of the shank—not by the tangs.

The percentage of reduction in your tool up-keep cost is governed entirely by the number of Wahlstrom chucks operating in your plant. They pay for themselves.

The operator can make any change of tools without stopping the spindle and simply by grasping the loose shell of the chuck. Figure out the labor saving alone in your plant in drilling jobs.

Made in a number of sizes to take straight or taper shank tools.

Write for the Wahlstrom Booklet

When you want tools—remember **Aikenhead's** Tools—their reliability under severe strains, standard quality and modern design, assure maximum service at minimum upkeep cost. Immediate shipments on all orders. Let us know your requirements.

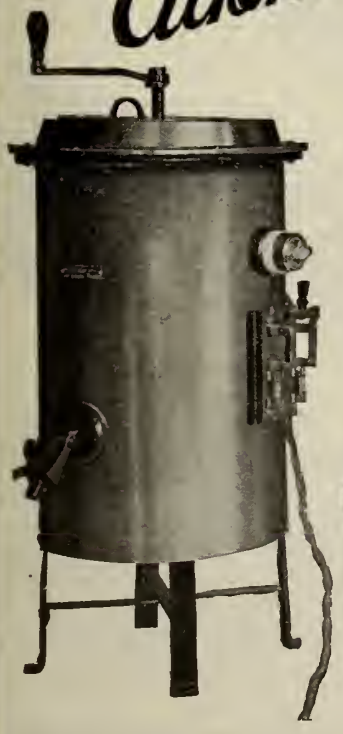
Aikenhead Hardware Limited

17 Temperance St., TORONTO

Aikenhead's

International Glue Heaters

Operate without the use of water



The International Electric Glue Heater, another of the well known Aikenhead specialties, is designed to operate on dry heat without the use of water and is built in a variety of sizes which make it adaptable to all classes of shops large and small.

There can be no burn-outs from evaporation of the bath as no water is used. Uniform temperature is maintained at all times through the "fireless" cooker principle, a feature that will be appreciated by all practical glue men. It prevents the forming of a skin skum and dirt on the glue. The 1 quart heater consumes only one cents worth of current per day and the 13 quart consumes less than the ordinary electric flat iron.

Write for full information.

Aikenhead Hardware Limited

17 Temperance St., TORONTO

If interested, tear out this page and keep with letters to be answered.

MISCELLANEOUS

Solder, strictly	$ 0 40
Solder, guaranteed	0 43
Babbitt metals	18 to 70
Soldering coppers, lb.	0 62
Lead wool, per lb.	0 16
Putty, 100-lb. drums	8 30
White lead, pure, cwt.	20 00
Red dry lead, 100-lb. kegs, per cwt.	16 50
Glue, English	0 40
Tarred slater's paper, roll	1 30
Gasoline, per gal., bulk	0 35
Benzine, per gal., bulk	0 35
Pure turp., single bbls., gal.	3 60
Linseed oil, raw, single bbls.	3 00
Linseed oil, boiled, single bbls.	3 03
Sandpaper, B. & A.	List plus 43
Emery cloth	List plus 37½
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin, "D," per lb.	0 14
Borax crystal and granular	0 14
Wood alcohol, per gal.	2 70
Whiting, plain, per 100 lbs.	2 75

CARBON DRILLS AND REAMERS

S.S. drills, wire sizes	32½
Can. carbon cutters, plus	20
Standard drills, all sizes	32½
S-fluted drills, plus	10
Jobbers' and letter sizes	32½
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	net
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus 20 to	40
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At warehouse]

Rounds and squares	$7 base
Hexagons and flats	$7.75 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	60	75
Class B	27	37
Class C	18	27

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 8 50	$ 9 50
Sheets, black, No. 10	8 50	9 00
Canada plates, dull, 52 sheets	8 50	10 00
Can. plates, all bright	8 60	9 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	11 00	....
Fleur-de-Lis, 28 B.W.G.	10 50	....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28.	....	....
Premier, No. 28, U.S.	11 50	10 50
Premier, 10¾-oz.	11 50	10 90
Zinc sheets	16 50	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅝ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	29 50
1¾ in.	31 50	30 00
2 in.	30 00	30 00
2¼ in.	35 00	29 00
2½ in.	42 00	37 00
3 in.	50 00	48 00
3¼ in.	.. ..	48 50
3½ in.	63 00	51 50
4 in.	85 00	65 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	..
Royalite, per gal., bulk	24½
Palacine	27½
Machine oil, per gal.	43½
Black oil, per gal.	18½
Cylinder oil, Capital	82
Cylinder oil, Acme	70
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	$2 60
Union thread cutting oil, antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil, bbls., net	13½

BELTING—No 1 OAK TANNED

Extra heavy, single and double	10%
Standard	10%
Cut leather lacing, No. 1	2 75
Leather in side	2 40

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 60
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	09
Pumice, ground	06
Emery glue	30
Tripoli composition	09
Crocus composition	12
Emery composition	10
Rouge, silver	60
Rouge, powder, nickel	45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE

XXX Extra	24	Atlas	20
Peerless	22½	X Empire	19½
Grand	22½	Ideal	19
Superior	22½	X Press	17½
X L C R	21		

Colored

Lion	17	Popular	13
Standard	15	Keen	11
No. 1	15		

Wool Packing

Arrow	35	Anvil	22
Axle	28	Anchor	17

Washed Wipers

Select White	20	Dark colored	09
Mixed colored	10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades... 15%

ANODES

Nickel	.58 to .65
Copper	.38 to .45
Tin	.70 to .70
Zinc	.18 to .18

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6 x 4 base	45 00	44 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 75	$14 50
Sheets, 3½ lbs. sq. ft.	10 50	14 00
Sheets, 4 to 6 lbs. sq. ft.	10 25	13 50

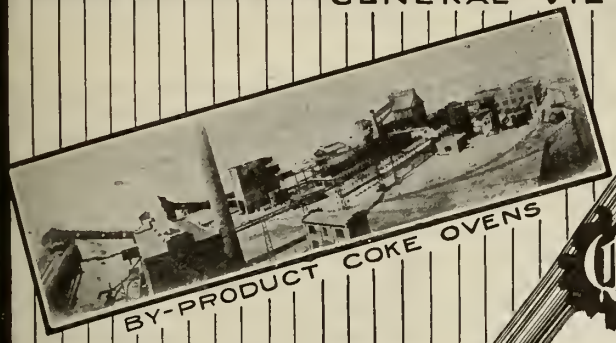
Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

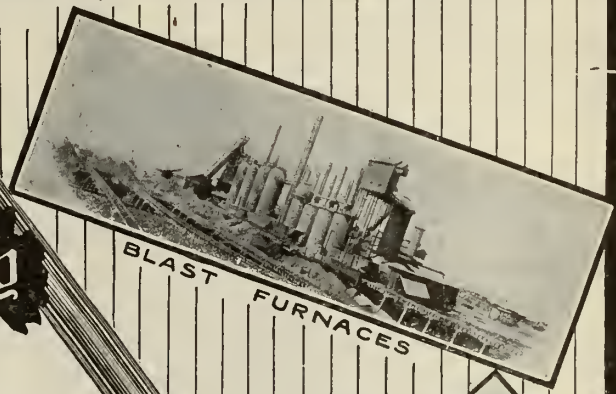
Acid, boracic	$ .23
Acid, hydrochloric	.03¼
Acid, nitric	.10
Acid, sulphuric	.03¼
Ammonia, aqua	.15
Ammonium, carbonate	.20
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.14
Copper, carbonate, ammy	.41
Copper, sulphate	.16
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.08
Nickel carbonate	.32
Nickel sulphate	.19
Potassium sulphide (substitute)	.42
Silver chloride (per oz.)	1.25
Silver nitrate (per oz.)	1.20
Sodium bisulphate	.11
Sodium carbonate crystals	.06
Sodium cyanide, 127-130%	.38
Sodium hyposulphite per 100 lbs	8.00
Sodium phosphate	.18
Tin chloride	1.00
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated

GENERAL VIEW HAMILTON WORKS
HAMILTON



BY-PRODUCT COKE OVENS



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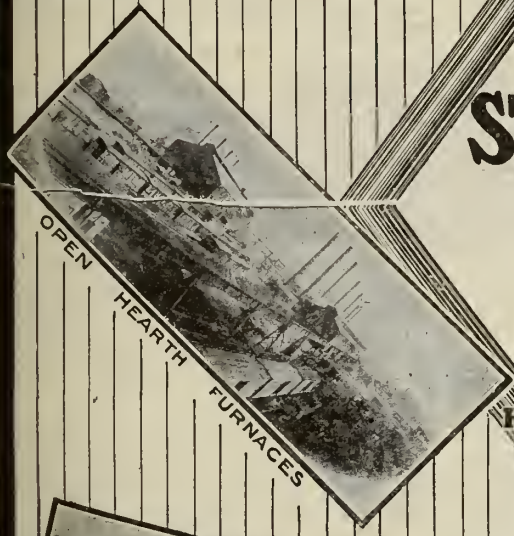
Service



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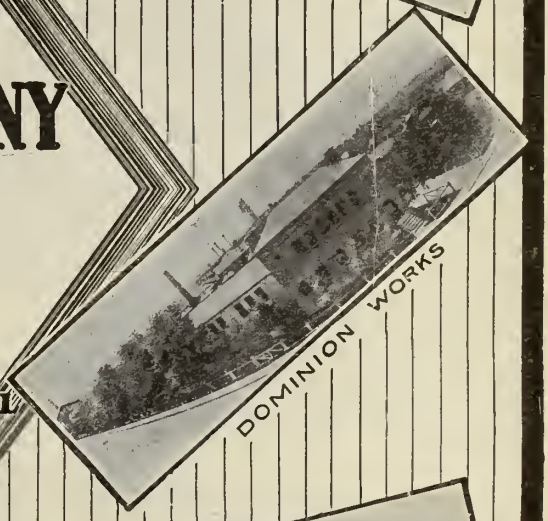
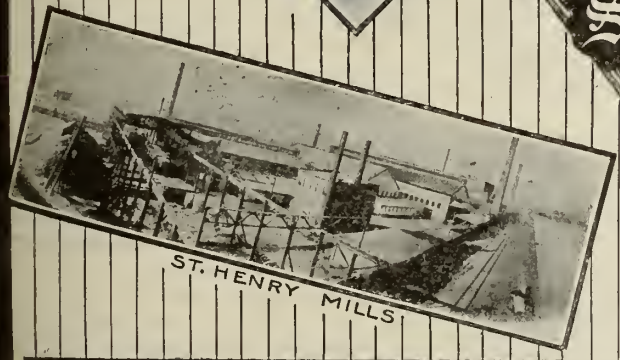


DOMINION WORKS



ST. HENRY MILLS

ST. PATRICK MILLS

GENERAL VIEW OF NOTRE DAME WORKS
MONTREAL

If interested, tear out this page and keep with letters to be answered.

The Week's Events in Montreal Industry

The Quebec Board of Trade has appointed O. H. Cote as industrial commissioner for the city.

* * *

Forrest, Jackson and Forrest, have removed their offices from 222 Craig St. West, to the ground floor of 230 Craig St. West, Montreal.

* * *

Alex. Peden has been appointed structural engineer for the Dominion Bridge Company at Lachine, Quebec. He will take charge of the structural drawing office.

* * *

The Canadian Pacific Railway Company are installing a new 80-foot Bertram planer and also a 50-foot travelling head Bertram slotter in the engine shop of the Angus plant.

* * *

C. B. Bate has been appointed to the engineering staff of the Riordon Pulp and Paper Company at Hawkesbury, Ont. Mr. Bate was formerly associated with the Soldiers' Civil Re-establishment at Ottawa.

* * *

D. C. Tennant has been appointed designing engineer for the Dominion Bridge Company at Lachine, and will be assistant to F. P. Shearwood, who is in charge of all the erection schemes of the company.

* * *

The Jamieson Engineering Company, of Vancouver, B.C., will be the Western Canadian representatives of the following Montreal firms: Hydraulic Machinery Company, Lytle Engineering Company, and the Asbestos Manufacturing Company.

* * *

P. L. Pratley, formerly associated with the Dominion Bridge Company as designing engineer, has accepted the position of chief of the valuation staff under Lt.-Col. C. N. Monsarrat in connection with the Department of Railways and Canals Valuation Board of the Grand Trunk Railway.

* * *

The Maple Leaf Manufacturing Company of Montreal has been given a contract by the City of Montreal for twelve additional street flushers and sprinklers. These machines are for the street cleaning department, and will cost about $8,970 each. These machines are to be delivered by July 1.

* * *

E. P. O'Shea, who has been associated with the Customs office in Montreal for the past nineteen years, has resigned from the civil service to accept the position of assistant manager of the Universal Import Company of Montreal, Fall River and New York, dealers in various products of the West Indies. Mr. O'Shea has had a long training in the handling of perishable goods, and his new duties will be largely devoted to this class of product.

The new steamship service between Montreal and West Africa, inaugurated by the Elder Dempster line, was started this week, with the loading of the steamer Fantee. Several other vessels will shortly be placed on this route.

* * *

Thos. E. Peck, president of the Peck Rolling Mills, Montreal, died last Thursday after a short illness of two weeks. Mr. Peck was forty years of age, and has been manager of the Peck Rolling Mills since the death of his father, Jas. H. Peck.

* * *

Following the announcement of the activities of the British Empire Steel Corporation it is interesting to note that an unofficial statement has been made that the Dominion Steel Corporation will erect an additional sixty-oven cooking plant at a cost of approximately $3,000,000 and will supplement the 120-oven built last year.

* * *

Friends of J. W. Lynch will be sorry to hear of his untimely death as a result of heart failure following an attack of pneumonia. For the past nine years he was general superintendent of the Rockfield plant of the Canadian Allis-Chalmers Company. He was connected for many years with the Metropolitan Water Board of Boston. He was well known in Canadian mechanical circles.

* * *

Negotiations have been entered into between the city of Montreal and some of the power companies with a view of placing the power lines underground in certain portions of the city. The various companies have been requested to submit a memorandum on the probable cost of the undertaking, and when this information is before them the commissioners will decide what course would be adopted.

* * *

The officers and directors of the Dominion Engineering Works, Limited, recently incorporated, are G. H. Duggan, president; A. J. Brown, K. C., vice-president; Julian C. Smith, vice-president; W. F. Angus, Geo. Chahoon, Jr., Sir Herbert S. Holt, Phelps Johnson, J. M. McIntyre, Howard Murray, H. Birchard, Taylor, F. L. Wanklyn and R. Montague Davy, secretary-treasurer.

* * *

The semi-annual meeting of the Society of Motion Picture Engineers was held last week in Montreal, meetings being conducted at the Windsor Hotel. This is the first time the association has held a conference in Canada. Motion picture engineers are the men whose task it is to look after the technical and mechanical end of the moving picture business, to eliminate the flicker from the screen, and constantly devise means for the improvement of service.

At a recent meeting of the Sydney, N. S., board of trade, a resolution was passed calling on the Federal Government to subsidize the shipbuilding industry in Eastern Canada. It is believed that the recently formed steel corporation are considering the building of a shipbuilding plant at Sydney, and that the resolution is the result of an intimation of this kind.

* * *

Among the American firms that are contemplating the erection of Canadian plants, to avoid the duty of goods coming in from the States, and at the same time benefit by the British trade preferential on exports within the British Empire, are the Thos. A. Edison Company of Orange, N.J., and the White Motor Truck Company, of New York. Both of these firms are looking for suitable sites in the Province of Quebec and may establish plants in the vicinity of Montreal.

* * *

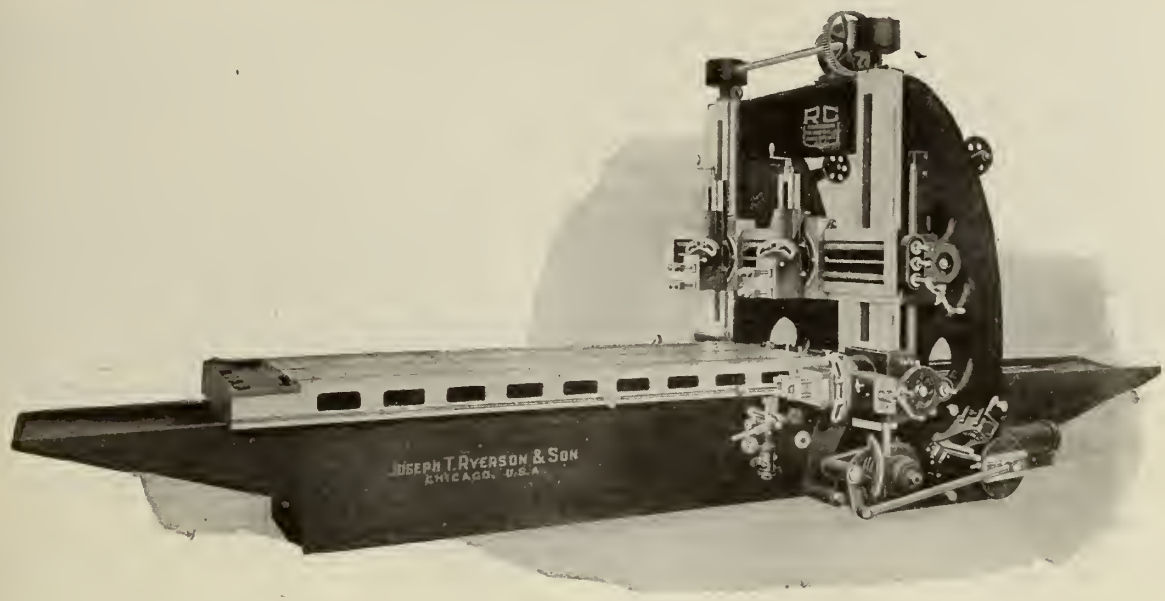
At a recent meeting of the Grand Trunk section of the St. John Ambulance Association, held in the rooms of the Literary and Scientific Institute, at Point St. Charles, 117 awards were presented to various employees who have successfully passed their first aid examinations. A first aid picture was thrown on the screen to illustrate the different methods that could be adopted in case of emergency. W. H. Sample, general superintendent of motive power, was chairman of the meeting.

* * *

The passing of the Grand Trunk Railway into the hands of the Government may have an important bearing on the terminal facilities for this road. There have been rumors afloat in connection with this matter of consolidating the present terminal of the Canadian National and those of the Grand Trunk with the view of making a union station for the two roads. While the Administration Commission of the city of Montreal would like to settle this question, it is learned that no immediate action is anticipated in this direction owing to the heavy expenditure involved. Some years ago the corporation was authorized by the Legislature to contribute $2,000,000 for improvements in connection with the entrance of the G. T. R. lines into the city. At that time the company thought that this sum was too small, and it is stated that the same improvements would cost in the neighborhood of five million. The Administration has, however, two years more in which to serve the interests of the city, and they may yet develop a project for improving the terminal of the Grand Trunk. It is probable that some plan may be adopted whereby the lines of the G. T. R. may be diverted so that trains may enter the city through the tunnel now utilized by the C. N. R.

Announcing the new

Ryerson-Conradson Multispeed Planing Machine



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Non-reversing constant speed motor drive (no belts)
No high speed reversing parts.
Four cutting speeds, constant quick return.
Herringbone gears, bull wheel and rack.
Self-compensating pneumatic clutches for reversing.
Pneumatic feeds.
Ways 15 degrees off horizontal, 15 degrees off vertical.
Separate motor for elevating cross rail.
Splash oiling throughout.
Side heads feed at an angle.
Aprons extended beyond maximum travel of table catch all surplus oil.
Considerable less power consumption, thereby reducing cost of operation.

The new bulletin No. 2101-B gives complete information.

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INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS PERSONAL AND TRADE NOTES

TRADE GOSSIP

The Locomotive Superheater Company, 30 Church Street, New York, have issued a new bulletin, T-5. This bulletin covers the advantages of superheated steam. The context presents the engineering reasons for these advantages from a new angle. The argument is clear and concise and should be of interest to all power plant owners and operators in every industry or power plant service.

No Strike in Galt.—An amicable settlement has been reached by the iron moulders and manufacturers of Galt, and all possibility of a strike has been removed. The moulders demanded a wage of 80 cents an hour and an eight hour day, but after two joint conferences an agreement was reached whereby the minimum wage will be 72 cents an hour, an increase of 7 cents, and the week's work 48 hours.

The Homestead Valve Mfg. Co., of Homestead, Pa., announces the removal of its New York office to No. 242 Lafayette St., New York City. The new office is on the third floor and is several times the size of its former location; the removal having been found necessary, due to the expansion of its New York business. The New York office is in charge of Mr. P. L. Rhodes, who has with him Mr. William Gormly, Mr. John Gormly, Mr. George Nagle, Mr. C. A. Tyler and Mr. W. B. Goering.

Orders for Steel.—Important developments are expected from a survey which is now being made of the iron ore area at Lock Lomond and at other parts of Cape Breton. The examination is being made by a geological expert in the employ of the Dominion Steel Corporation. The Armstrong Whitworth Company, one of the largest shipbuilding firms in Great Britain, has been endeavoring to place an order for 20,000 tons of ship plate with the Dominion Steel Corporation here. The Government of New South Wales has also been negotiating for 15,000 tons with the Dominion Government. A total of 19,000 additional tons have been sold to other Governments.

Northern Electric Changes.—M. K. Pike, general sales manager of the Northern Electric Company, is now on a business trip to the branch houses, and will be absent from the head office at Montreal for six weeks. A. Dwight Smith, former sales manager of the Montreal district of the Northern Electric Company, has been transferred to the Montreal head office, and will have charge of train dispatching, fire alarm and marine supply sales. N. S. Richards, who, for the past three years, has been sales manager of the Calgary house, has been transferred to Montreal, and appointed sales manager of the Montreal district, effective June 1st.

Meet in Rochester.—Rochester, N. Y., has been selected by the general executive board of the International Association of Machinists as the convention city for the association this year. Toronto was longer under consideration as a convention centre, but apparently lost favor at the last moment. It will be recalled that the association endeavored to get certain grants, as well as facilities with which to make the convention an all-round success. The grant was not donated, although the facilities were offered. Rochester has apparently made the grant which Toronto refused to make. More than three thousand machinists will attend the convention, which is to be held next September, and it will last three weeks.

General Strike.—The Toronto "Globe" carries the following:—Executive officials of Local 152, International Union of Steam Operating Engineers, who met in the Labor Temple to discuss phases of the wage schedule which they expect to go into operation on June 1 in local plants, admitted that officials with the authority to call a general strike of the craft in Canada were now in Hamilton, where the local union is engaged in a fight with the Steel Company of Canada. They said that these officials had the power to call this general strike, which would paralyze industry in Canada, upon twenty-four hours' notice to all local unions. "There is a very serious unrest among members of the organization throughout the Province upon wages. We are the lowest paid of any skilled craft," said Business Agent Cummings, who stated that the international officers in Hamilton had not asked for an expression of opinion upon a sympathetic strike.

MARINE

Kingston.—Capt. William Leslie will leave shortly to resume operations on the raising of the sunken steamer Keystorm, off Scow Island, opposite Chippawa Bay, Capt. Leslie is making all the necessary preparations for getting at the work again. It will be recalled that the Keystorm, some few years ago, struck a rock and sank while en route to Montreal with 2,500 tons of soft coal. Examination of the wreck made by the divers showed that a large hole had been torn in the side of the vessel.

THE BIG CHANCE IS TO FILL THE CARS TO THEIR VERY LIMIT NOW

The Railway Association of Canada, formerly the Canadian Railway War Board, is calling attention to the need of loading freight cars to the limit. The claim is made that poor and part-full loading has added something like $18,000,000 to the cost of operating the roads in the last twelve months.

The part-loading, "call it a car" business has added 500,000 unnecessary car trips to the Canadian transportation programme in the last year—each trip averaging 243 miles under load and 89 miles empty and occupying 14 car days.

Thus the constant service of 10,000 freight cars was devoted to unnecessary work instead of remaining in reserve to meet emergencies.

Thus 4,000 unnecessary trains were moved.

Thus 8,000 unnecessary engines were employed instead of being in reserve.

Thus 79 miles of precious track roo was occupied instead of being free to pr serve the elasticity of terminal and pas ing track capacity, thus reducing th margin between an easy car moveme —and possible congestion with emba goes.

Thus 10,000 times 17 tons of ta weight (the weight of the car alon was added to the constant burden of t railways the whole year through— 170,000 extra tons.

Thus 6,000,000 tons of coal were tak from the available supply.

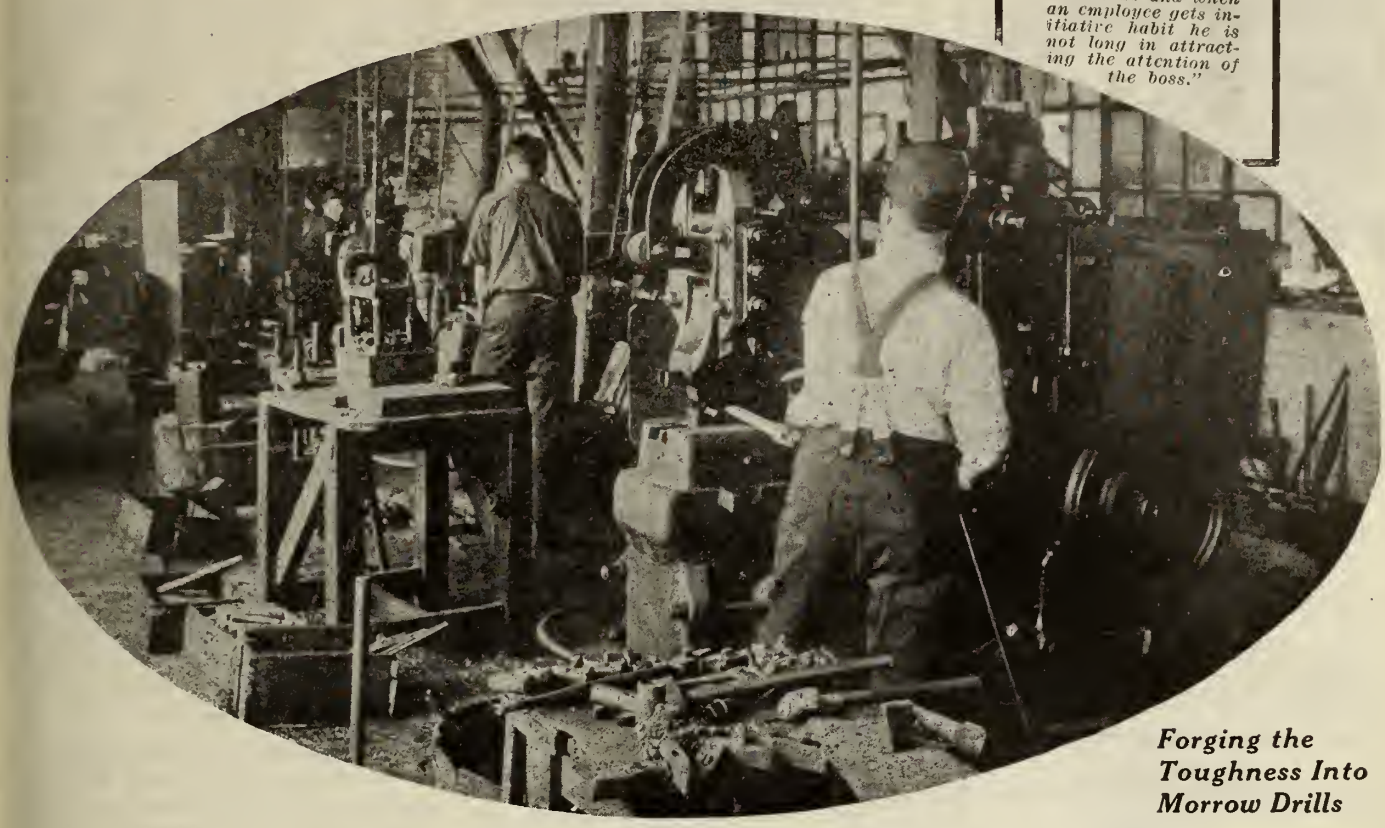
Thus all movement was slower.

When shippers were on their toes d ing the war, average load per car r to 27.05 tons.

Now it is averaging 22.69 tons!

The loss is almost 5 tons per car!

"In every great business there are many opportunities for the employee to do things he is not told to do and when an employee gets initiative habit he is not long in attracting the attention of the boss."



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"PURO" WILL SAFEGUARD THE HEALTH OF YOUR EMPLOYEES and protect your staff against disorganization by sickness.
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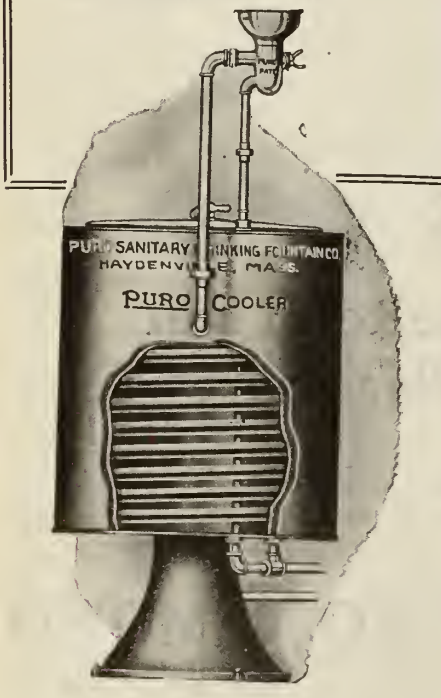

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QUIETLY GETTING READY FOR ANOTHER STEEL STRIKE IN AUGUST

Pittsburgh, Pa.—Another nation-wide steel strike is scheduled for next August, the exact date to be determined later, according to information obtained here, when six organizers, sentenced to jail for thirty days last Monday by Mayor Crawford of Duquesne, were fighting for their liberty on the ground that their constitutional rights had been violated. Judge Jones, in the County Court, freed the men in $500 bail each, pending a decision on their appeal from the sentence of the mayor.

The men thus released are: Rev. William M. Fincke, of Katonah, N.Y.; J. L. Beaghen, R. W. Riley, James G. Sauce, B. Danich and John Olohron.

It developed while the appeal of the organizers was being heard, that representatives of the American Federation of Labor's National Committee for Iron and Steel Workers have been working in steel plants throughout the country since the last strike, quietly getting the men ready for the next strike.

New York.—Charles M. Schwab revealed that the greatest of all battleships was being built for the United States Government. His announcement, made at a luncheon for the New York University Endowment Fund, disclosed plans of the Navy Department, hitherto secret. The monster warship, which is of the battle cruiser type, wil cost $15,000,000, displace 65,000 tons, and be 105 feet wide. It is one of several of similar design and power planned by the Navy Department.

Cleveland.—A large number of freighters have not been started, and more will be dropped next week, as not all the steamers in commission will be able to get fuel. Shippers and vesselmen say the supply, which has been very short since the start, has been cut down, and the boats are waiting all along the line. Steamers are unable to get enough bunker coal to take them from one Lake Erie port to another. A number of ore and grain carriers are coming down and some will not be sent back until there is a better supply of fuel.

Goderich.—The first vessel to make Goderich harbor this season was the Collingwood, which arrived from the head of the lakes with a cargo of 287,000 bushels of grain for the Goderich Elevator Company. It was followed shortly after by the W. D. Matthews, with 200,000 bushels of wheat for the Western Canada Flour Mills Co. On Saturday morning a little ceremony took place in the town council chambers, where Capt. Peter McKay of the Collingwood was presented with a hat, in accordance with the old custom of so honoring the first arrival of the season.

PERSONAL

Charles C. Phelps recently became associated with the Uehling Instrument Co., 71 Broadway, New York, combustion engineers and manufacturers of CO_2 recording equipment and other fuel economy apparatus. He is devoting most of his attention to research work in connection with the efficient combustion of fuel oil in boiler furnaces. It is estimated that nearly $100,000,000 is wasted unnecessarily every year, due to improper methods of burning fuel oil, which fact shows the importance of this field of investigation. Mr. Phelps graduated from Stevens' Institute of Technology with the degree of mechanical engineer and has since spent several years studying power plant problems. For five years of this period he was connected with the Ingersoll-Rand Co., manufacturers of power plant equipment and pneumatic machinery. Mr. Phelps is an associate member of the American Society of Mechanical Engineers.

WELDING AND CUTTING

Continued from page 490

thorough and intimate mixture; higher pressures are unnecessary, and, in certain cases, may be dangerous.

Connecting Oxygen Regulator

Connect the oxygen regulator, first opening the cylinder valve slightly to allow gas to leak slowly into the regulator. After fully opening the cylinder valve place the ear near the regulator. A sharp hiss indicates a leak, which should be located with soap and water. Test the outlet with moistened thumb to see that regulator does not leak.

Connecting and Cleaning Oxygen Hose

Blow the dust from oxygen hose, after which release pressure until flow of gas stops. Then connect the oxygen hose to torch.

Adjusting the Oxygen Pressure

For cutting, set the oxygen pressure on the working gauge at 10 pounds per inch of metal to be cut plus 10 more pounds allowed for driving the gas through hose and torch.

For welding set the oxygen pressure as required to produce the neutral flame with the oxygen needle valve on the torch opened one full turn.

Adjusting the Flame

Few welders are proficient in securing proper adjustment of the neutral flame. The true neutral flame is not the clear-cut brilliant flame so often sought and used, but is the characteristic flame of less brilliancy that is intermediate between this and the reducing flame that is indicated by the streaks of free carbon that are visible when insufficient oxygen is supplied. This, however, has

been fully described in the chapter on "Regulating and Testing the Neutral Flame," and requires no further comment.

Stopping Work

When the work is to be temporarily discontinued, as at meal hours, shut off the cylinder valves, take out the pressure-adjusting keys and put them away. A rapid dropping of the pressures shown on the gauges indicates a leak which should be located before resuming work.

Shutting Down

To shut down and disconnect regulators, first close the cylinder valves on both cylinders. Then open both needle valves on the torch. When all gauges have dropped to zero, take out the pressure-adjusting keys and disconnect regulators. Test cylinders with moistened thumb to see that no gas is escaping. Replace dust caps on cylinders. It is an excellent plan to write the cylinder pressure on each cylinder with chalk before disconnecting regulators.

The inauguration of a new freight route will take place this week from the port of Montreal, when the steamer Western Star will sail for Antwerp. It is expected that sufficient vessels will be placed on this route so as to provied fr three sailings a month. The boats used will be from 8,000 to 10,000 tons gross. P. V. G. Mitchell, formerly of Montreal, is at present general manager of the Red Star Line at Antwerp, and it is this line that will operate the new service.

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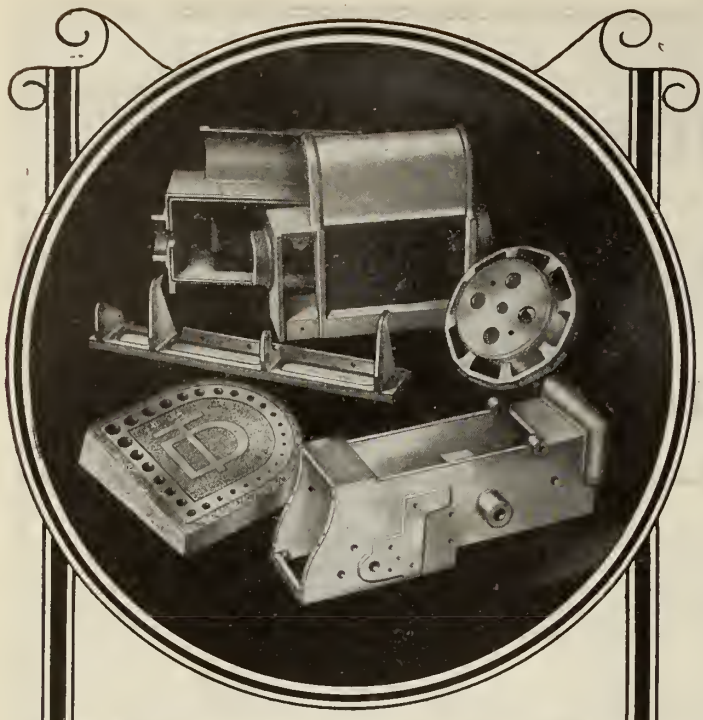

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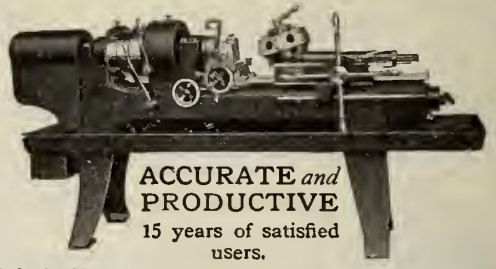

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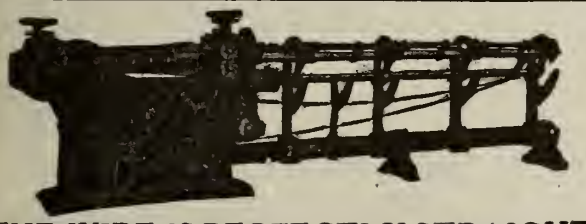

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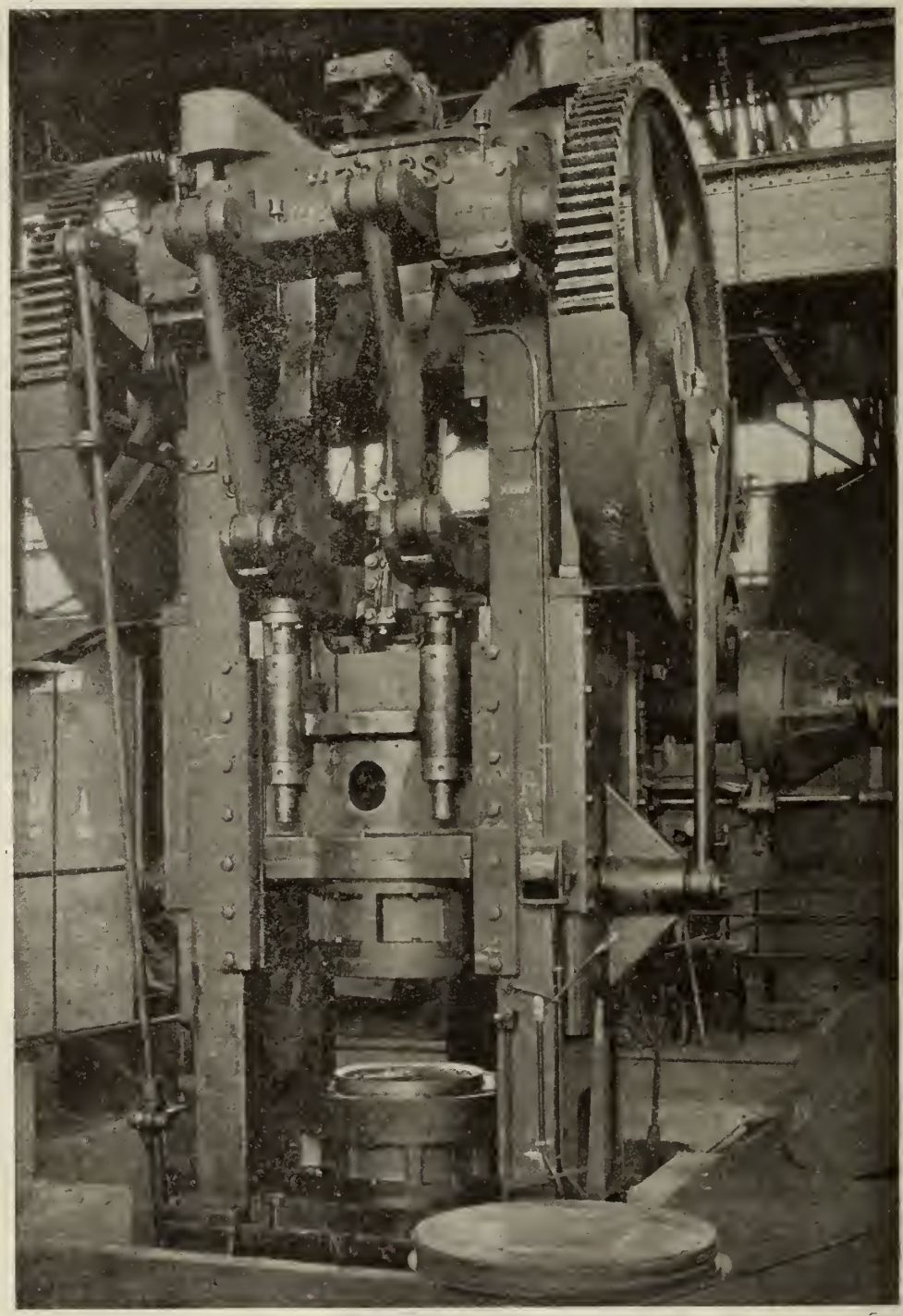

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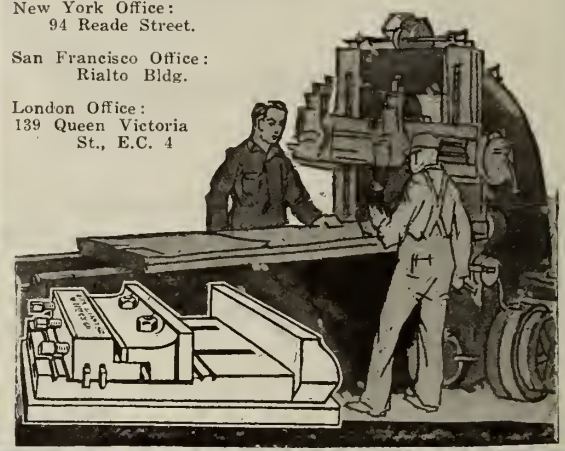

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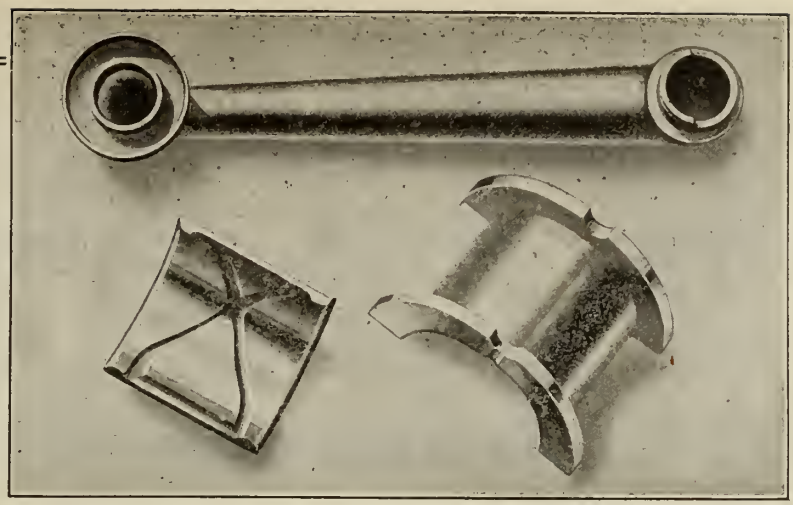

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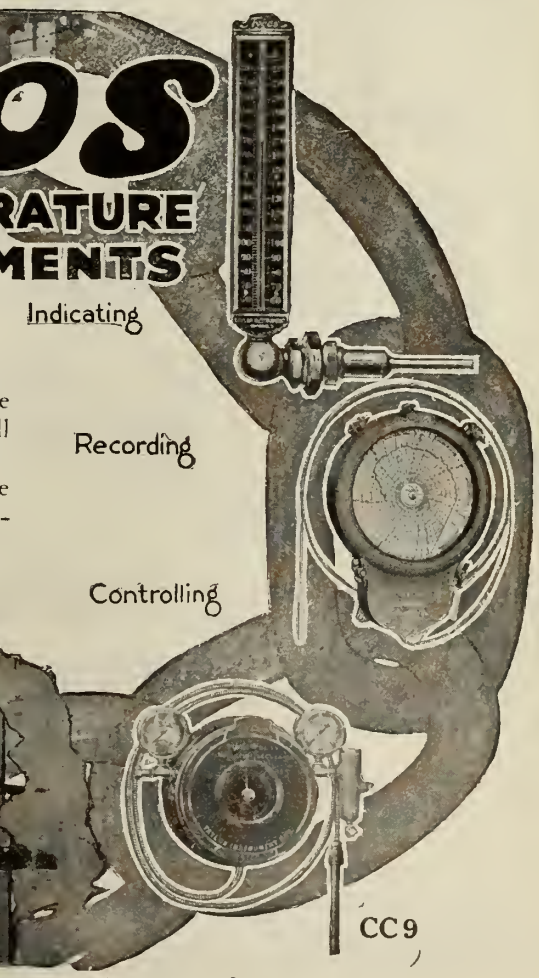

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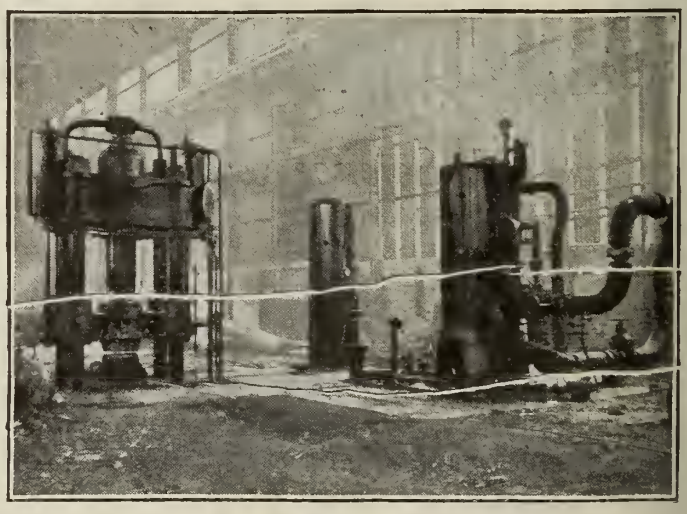

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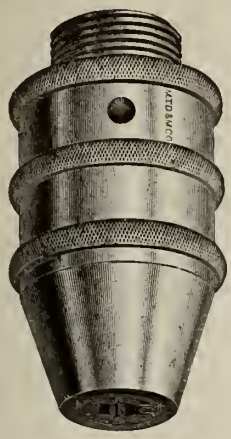

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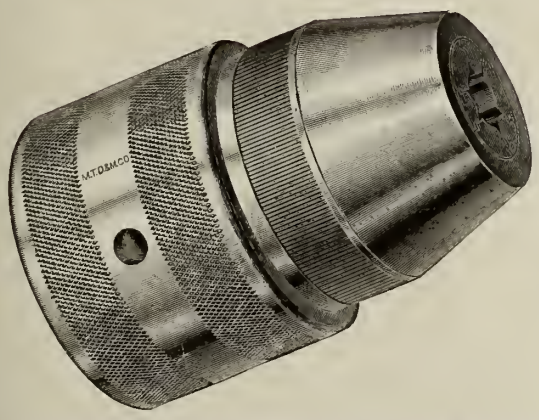

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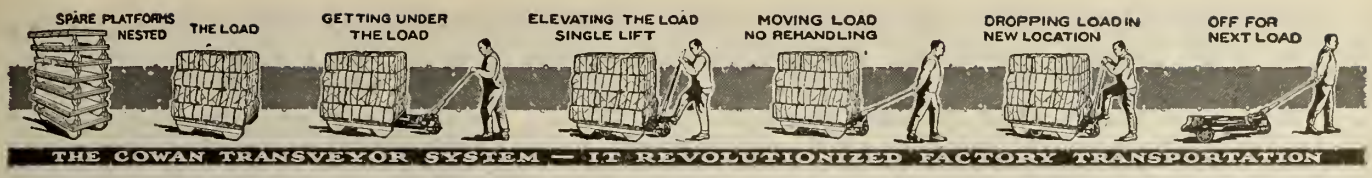
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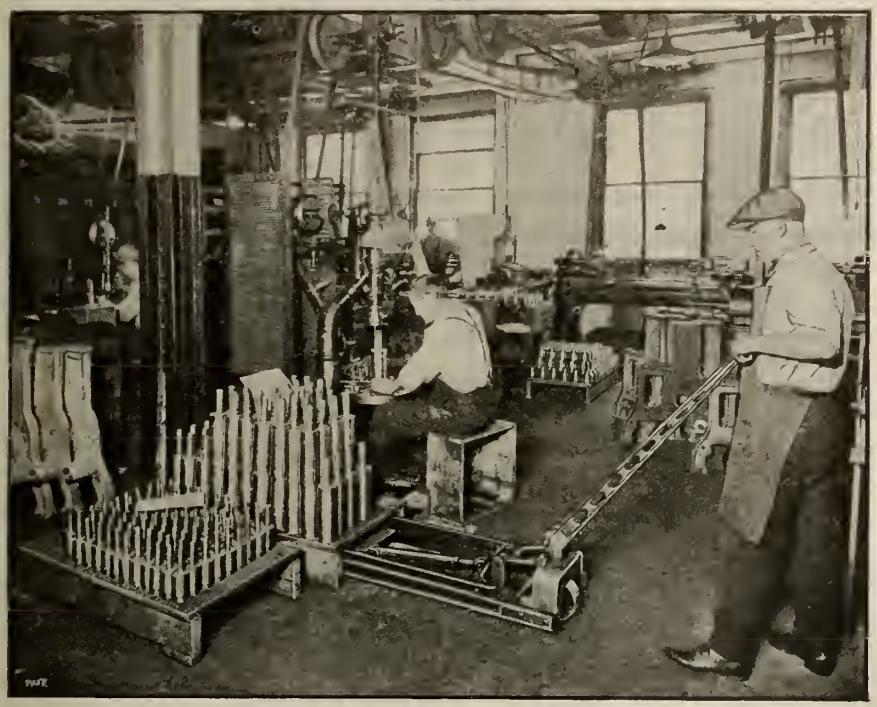

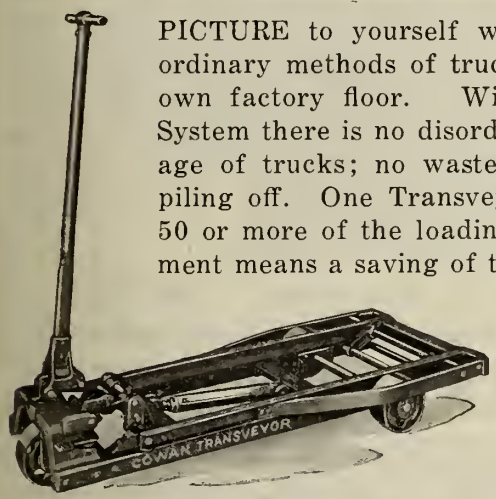

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NOTATIONS

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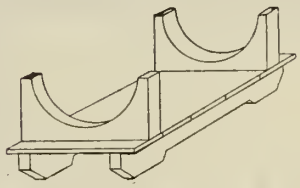
IT is interesting to note how the bakery, once a "hand proposition," has been transformed into a strictly mechanical "dough factory." In handling flour, sugar and salt, the Transveyor System has proven itself indispensable. The Snow White Bakery mourns the fact that their storage basement is not high enough to permit piling on a maximum load, as it is now they can only load 21 bags at a time!

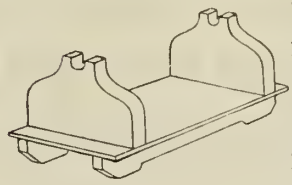
Fruit for Thought

THE Santiago Orange Growers' Association use the Transveyor trucking system in connection with platforms 40 in. x 48 in. They placed 30 filled boxes on a platform, weighing approximately a ton, and move these loads with ease and dispatch. This is simply an illustration of the adaptability of the Transveyor to every line of business.

The Size of Your Roll



There is nothing more awkward to store or truck than a large, heavy roll. This applies with equal force to solid metal rolls, of sheet metal, rolls of paper or fabric.



The small line drawings, shown herewith, demonstrate how simple a matter it is to solve this problem with a Transveyor and special pattern wooden skids. In the first design the roll is placed in the half-circle rests, the roll is supported on a rod which runs through the centre of the roll and is held by the end rests.

Try 'Em Out

It is the experience of most manufacturers, that securing a first order is an operation attended with more sales effort than a single sale would seem to justify. If the manufacturer has confidence in his goods, he feels that a try-out will frequently be more convincing than an eloquent sales talk.

A large carriage factory writes, "We gave a cheaper truck a trial, but found the Cowan Transveyor well worth the difference in price. No other equipment has given us better satisfaction or effected a greater economy."

ATKINS Sterling Quality **SAWS**

When in need of Circular Metal Cutting Saws, Hack Saw Blades, Hack Saw Frames, Kwik-Kut Power and Metal Cutting Band Saw Machines we will be pleased to have your specifications.

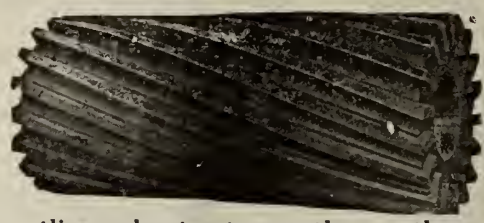
"A BETTER SAW FOR EVERY USE"

Address the nearest point below

E. C. ATKINS & CO.

Canadian Factory, Hamilton, Ontario
Branch House, Vancouver.

Taylor-Newbold Milling Cutters



Will outlive and out-cut any other on the market
4-in. Diameter for General Use.
Send for Bulletin R-P and 30-day trial offer.

THE TABOR MANUFACTURING COMPANY
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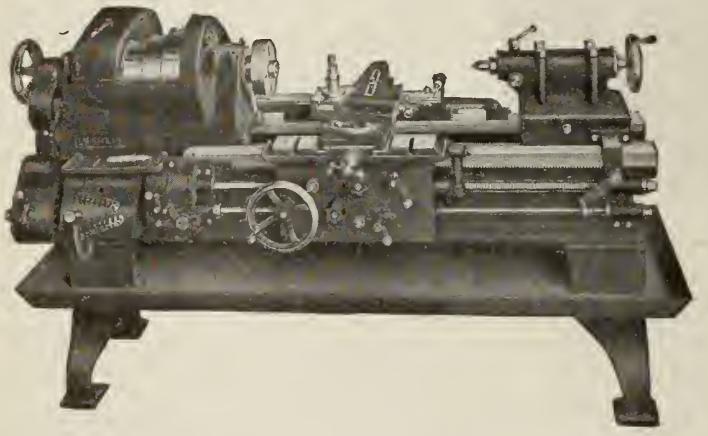
"LEHMANN LATHES"

Will Put the Same Degree of Efficiency Into *Your* Shops as They Have in Many Others



TWO SIZES—16", Swing 18¼" and 18", Swing 20¼"

Because they are constructed "right" of the best material, workmanship and design, and therefore are adaptable to all conditions, whether it be work requiring accuracy to the highest standards or for the heavy duty where power, strength and rigidity are required.

Convince yourself of these facts! Let us send you complete specifications of this superior lathe and the names of some of the larger concerns who are using "LEHMANN LATHES" for better results.

We know you are interested, so don't put off writing us. Do it to-day. Now!

LEHMANN MACHINE COMPANY, 612 S. BROADWAY, ST. LOUIS, U. S. A.

ELECTRIC AND OXY-ACETYLENE WELDED
STEEL TUBING ALSO BUTT STEAM TUBING

Prompt service in supplying Steel Tubing for all purposes. Oxy-Acetylene Tubing is recommended for bending purposes. Electric for straight tubing or slight bends. Also fully equipped for Butt Seam Tubing. Tubing made hot or cold-rolled finish. Our plant is fully equipped for slitting all gauges of stock from sheets or coils. Enquiries solicited.

The Tube Company of Canada LIMITED

233 Dufferin Street, TORONTO, Canada

THE TUBE COMPANY OF CANADA LIMITED

We are prepared to give expert advice on the selection of tubing for various purposes. This service costs you nothing and may save you a lot of expense.

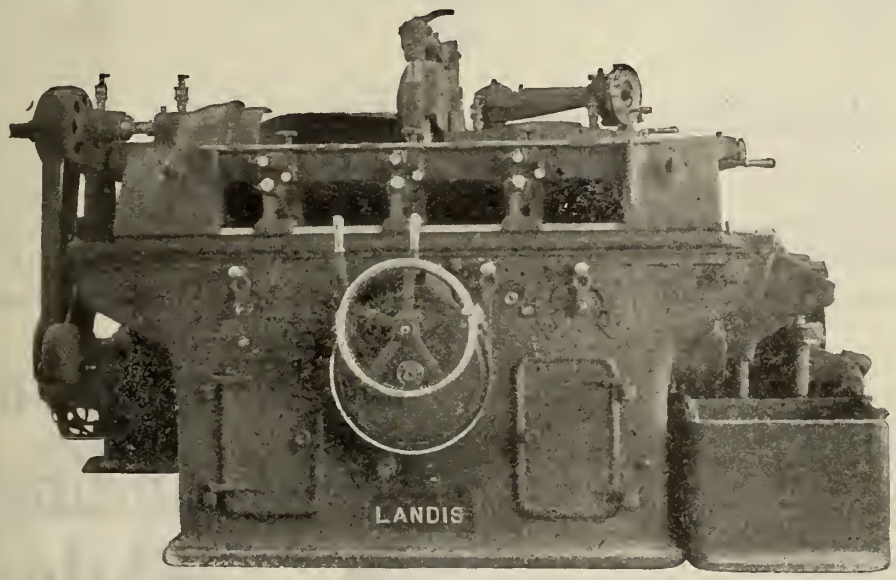
DIAMONDS
For Truing Grinding Wheels

A new and large assortment of the finest diamonds for dressing emery wheels has been added to our stock. Canadian manufacturers will do well to let us know their requirements.

Canadian Desmond-Stephan Mfg. Co., Limited
Hamilton, Ontario, Canada

LANDIS

Self-contained Plain Grinding Machine



No matter how excessive the tool-load may be, there can be no variation of the degree of accuracy because the work is held stationary —and "the wheel travels."

In addition the Landis is compactly and rigidly built to avoid any chatter.

A study of the machine will convince you of its many advantages and its fool-proofness. The built-in, labor-saving features insure big production.

Let us send you our catalog.

LANDIS TOOL CO., Waynesboro, Penn.
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STEEL PLATE CONSTRUCTION

Oil Storage, Gasoline Tanks, Air Receivers, Pneumatic Water Supply Tanks, Smoke Stacks, Boiler Breeching, Riveted Steel Pipe, Bins and Hoppers.

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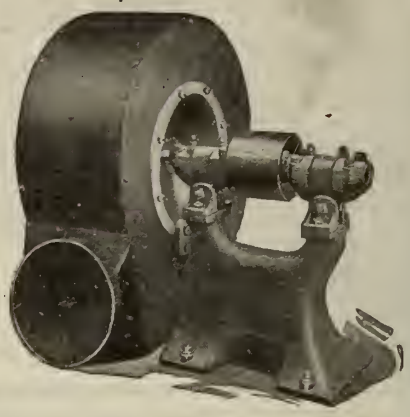
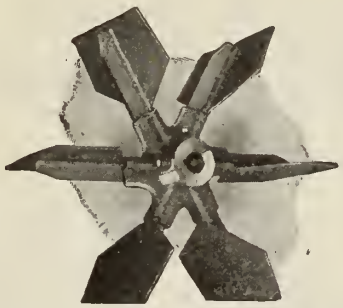
"CANADIAN" MILL EXHAUSTERS

Handle Any Material



The Canadian Standard Mill Exhauster will handle any kind of material efficiently—sawdust, shavings, cotton lint, or stringy material, gases, fumes, smoke, etc.



They are adjustable to any angle of discharge instantly—have universal type of wheel and carefully constructed self-aligning oil-ring bearings.

Catalog 410-77—gives technical data and prices. Write for a copy.

Canadian Blower & Forge Co., Ltd.
KITCHENER, ONT.

Don't Be Prejudiced!

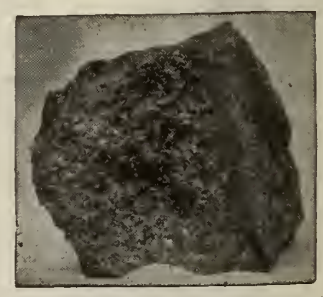
Dominion Grinding Wheels

MADE IN CANADA

Because some inferior grinding wheels have, in the past been put on the market labelled **Made in Canada**. Don't be prejudiced—don't condemn (without a test) all Canadian wheels. Canadian products if equal in quality to foreign brands, are entitled to the preference.

Dominion Grinding Wheels are: carefully and conscientiously made with abrasives from our own furnaces—the quality is thus guaranteed to be uniform. They are rapidly removing the stigma from the "Canada Wheel," making it instead one to be chosen for the more difficult jobs. A trial has convinced many manufacturers; why not you?

Made in Canada from the Raw Product to the Finished Wheel.



Dominion Abrasive Wheel Co., Limited
MIMICO, ONTARIO

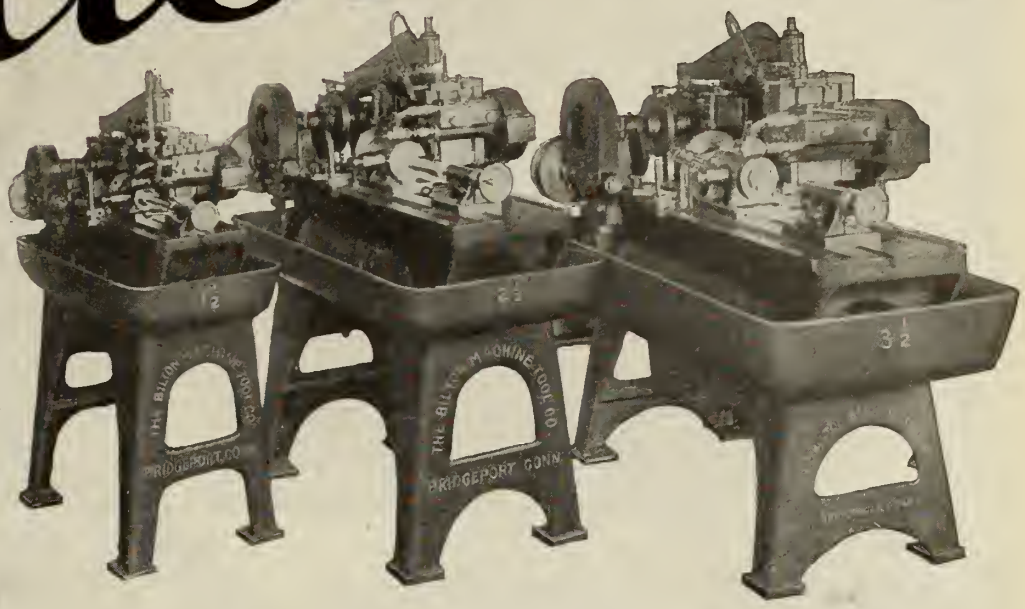
Bilton GEAR MILLERS

Fully Automatic

Their adaptability is almost unlimited on small work—such as cutting spur, bevel, miter, angle gears, saws, ratchets, sprockets, cutters, knurls, taps, cylinders, form cutting, manufacturing, milling, etc.

A big time saver, as indexing takes place during return stroke of cutter — which is removing metal 90% of the time.

Write us for Catalog 30-6



Over 500 leading manufacturers now use the Bilton for high production on accurate work

Bilton Machine Tool Co. Housatonic Avenue **Bridgeport, Conn., U.S.A.**

Foreign Agents: Alfred Herbert, Ltd. Chas. Churchill & Co., Ltd.

Thor

Thor Tools for Economy and Efficiency

- Pneumatic Drills
- Pneumatic Wood boring Machines
- Pneumatic Grinders
- Chipping, Calking, Flue-Beading and Scaling Hammers
- Pneumatic Hoists
- Pneumatic Sand Rammers
- Close Quarter Air Drills
- Pneumatic Riveting Hammers
- Pneumatic Holder On
- Hose & Hose Couplings
- Electric Grinders, Electric Drills

Standardize Your Plant With *Thor* Tools

For strength, speed, power and durability **Thor** Pneumatic Tools have no equal. The plant that is standardized with **Thor** equipment produces more work with less expense. So why not commence now to "**standardize**" with **Thor** Tools? It pays!

The **Thor** Pneumatic Grinder illustrated above gives an example of the sound scientific principles embodied in **Thor** tool construction.

This grinder is of the reciprocating type, equipped with Corliss Valves, pressed Vanadium steel pistons and connecting rods. Roller bearings carry both ends of crankshaft and all journals run in a constant bath of oil. A guard is provided for the emery wheel as a feature of safety.

This construction assures you of the **service** you require. Specify **Thor** on all occasions.

Independent Pneumatic Tool Company

General Office: 600 West Blvd., Chicago

CANADIAN OFFICES: 334 St. James St., MONTREAL; 32 Front St., TORONTO; 123 Bannatyne Ave. E., WINNIPEG; 1142 Homer St., VANCOUVER

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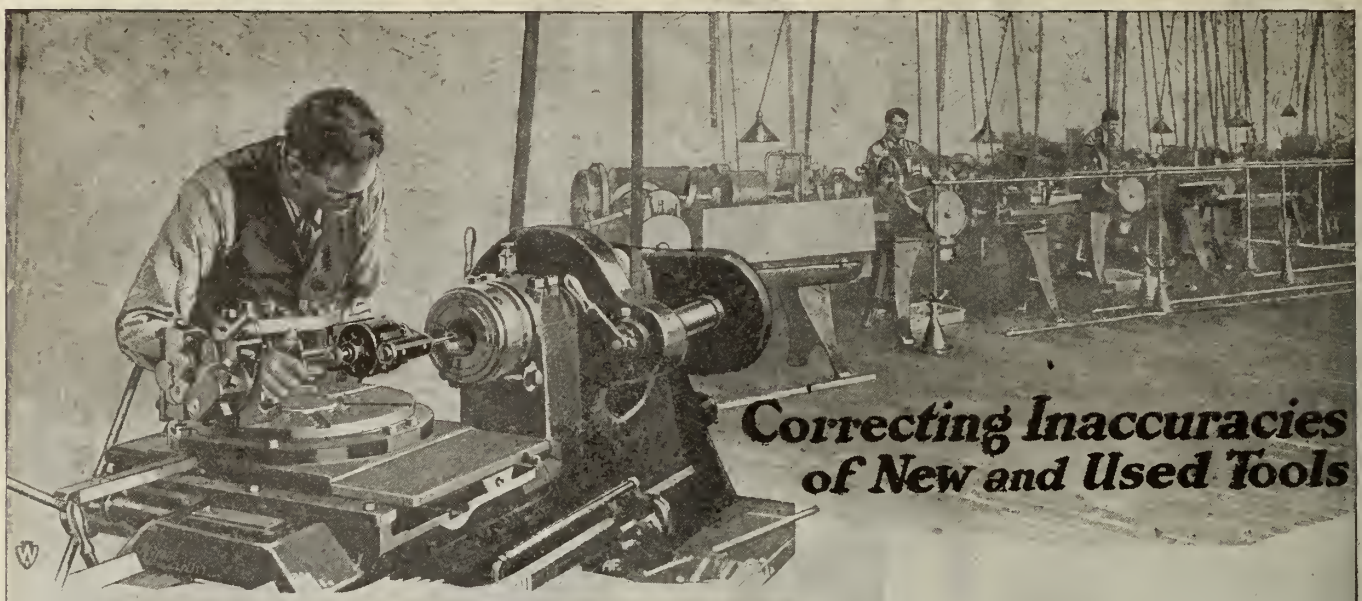


Correcting Inaccuracies of New and Used Tools

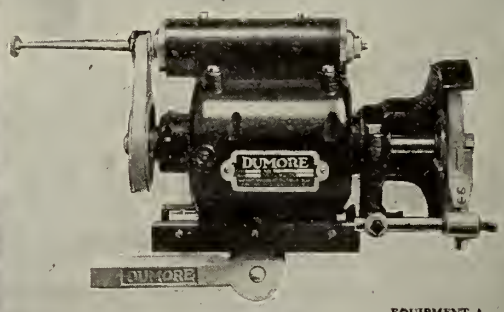
GRINDING chuck pads true with the spindle of the screw machine is a positive, easy method of obtaining accuracy when you have a **DUMORE**. War-time production has told heavily upon machines and tools—your own shop verifies this—and the change back to a peace basis demands a start with efficient equipment.

Your products are always as good as your tools—never better. And the accuracy of your jigs, dies and gages depends upon your facilities for grinding them. Close limits can be obtained only from a grinder having both speed and balance. That's why the **DUMORE** carries a dynamically balanced armature and operates at speeds ranging from 10,000 to 50,000 R. P. M. Chatter-marks, taper and bell-mouth are positively eliminated.

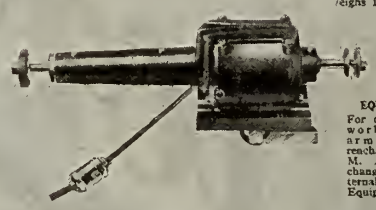
Now is the right time to put your tools in shape. Let your dealer demonstrate right in your own shop what a **DUMORE** grinder will will do for you.

WISCONSIN ELECTRIC CO.

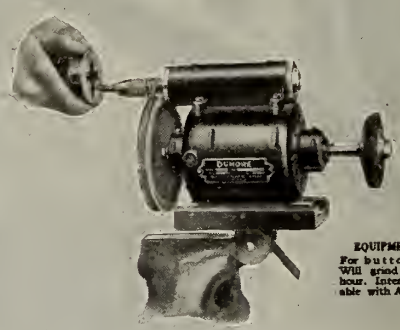
2923 16th St. RACINE, WIS.



EQUIPMENT A
or general tool room use. ncludes High Speed In- rnal Spindle A with reach 3 inches. 30,000 R.P.M. omes fully equipped. /eighs 17½ pounds.



EQUIPMENT B
For deep internal work. Extension arm has 10-inch reach. 10,000 R.P. M. Arm interchangeable with internal spindle on Equipment A.



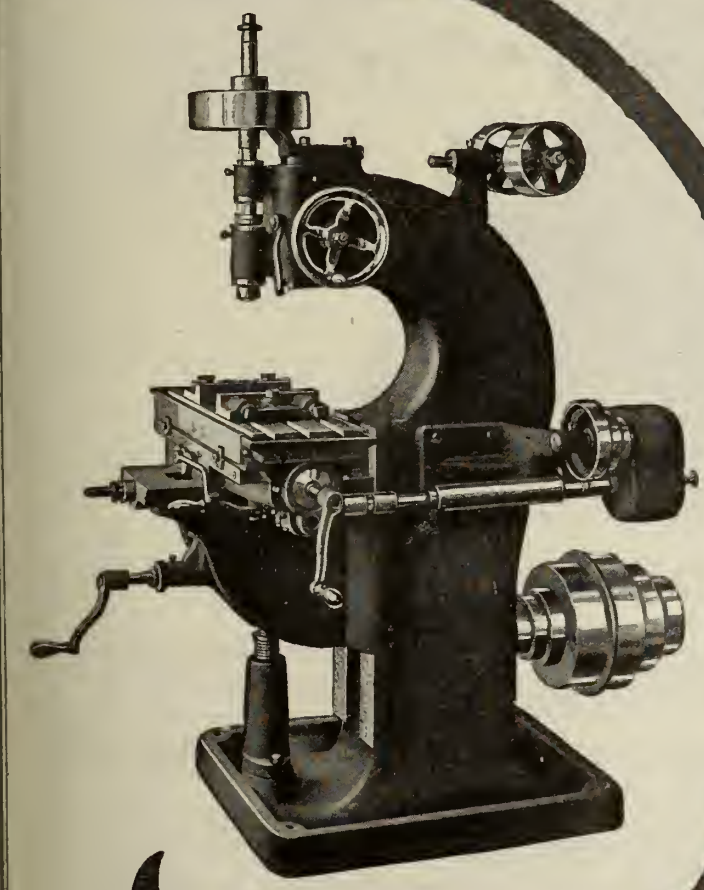
EQUIPMENT C
For button dies. Will grind 20 an hour. Interchangeable with A and B.

DUMORE HIGH SPEED GRINDERS

BRISTOOL

Bristol Vertical Milling Machine

A Tool of Large Capacity



Ball Bearings are used at the most important points making it a free running tool, which, combined with its being a belt-driven machine, makes it capable of turning out work on which an extra smooth finish is desired.

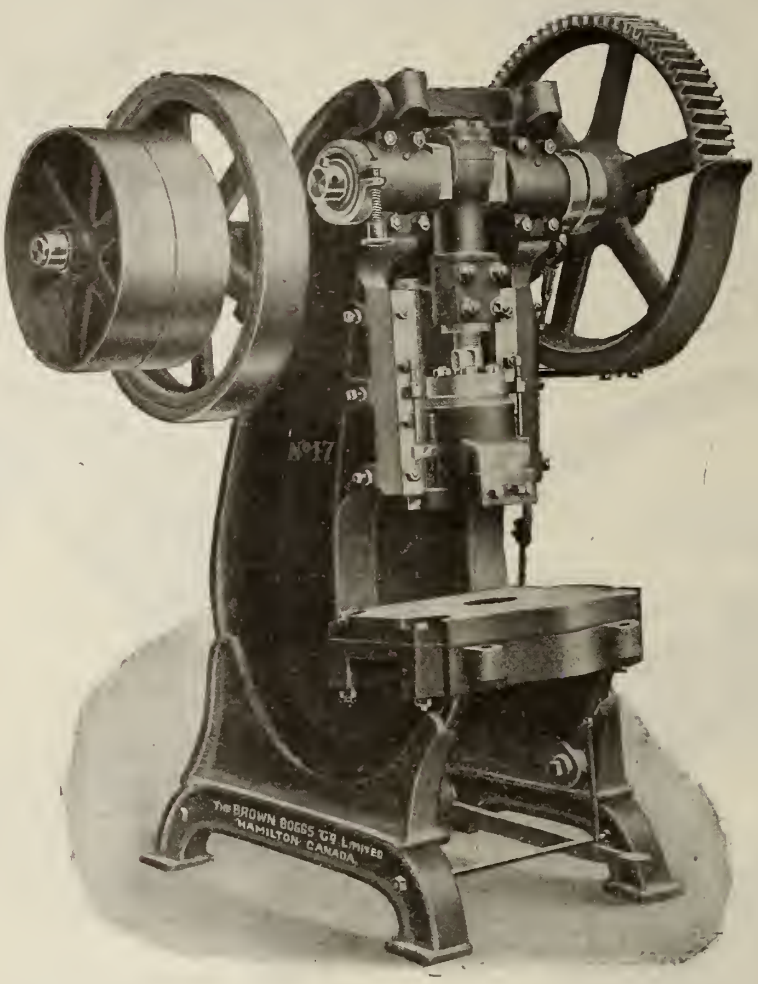
The longitudinal table feed is controlled by the gear change box which gives six different feeds for each change of spindle speed. A stop to gauge with micrometer adjustment is used on the head to regulate the depth of cuts.

Learn all about its production capacity.

Write for bulletin giving fullest particulars.

BRISTOL MACHINE TOOL CO.
SUCCESSORS TO C. G. GARRIGUS MACH. CO.
BRISTOL, CONN.

"B.B." Power Presses



No. 17 Geared Inclinable Press

We have recently redesigned our line of Inclinable Power Presses, adding several new features that increase their efficiency and add life to the dies used in them.

The pitman connection is of the ball type made from **High Carbon Steel** carefully heat treated so as to give the maximum **Service.**

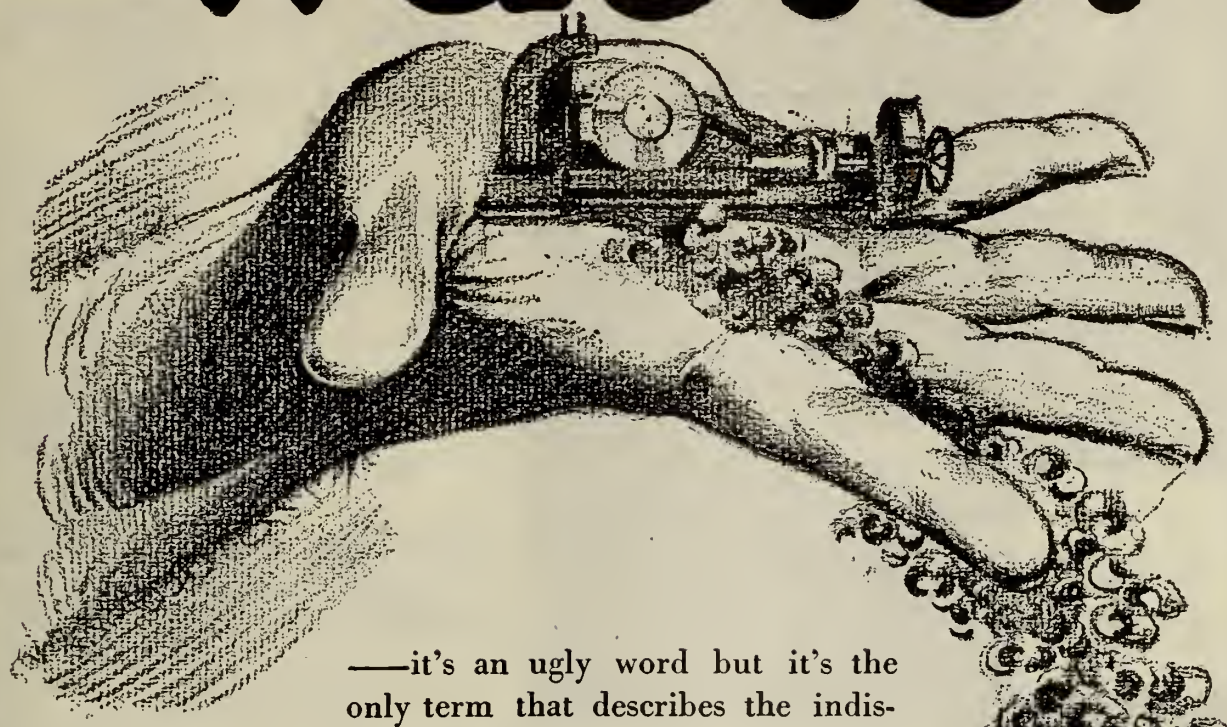
Crankshafts are also made from Carbon Steel properly heat treated, which greatly increases their tensile strength and prevents crystallization.

We manufacture a full line of Power Presses for blanking, forming, punching, trimming, etc., in many different types. Also Shears, Bending Rolls, Brakes, etc.

The BROWN-BOGGS CO., Limited
HAMILTON, CANADA

Manufacturers of Sheet Metal Working Machinery, Presses, Shears, Rolls, etc.

-waste!



——it's an ugly word but it's the only term that describes the indiscriminate use of rotary cutting-off saws with steel at present prices.

The heaviest Starrett Hack Saw made—a blade that does the work a half-inch rotary is often used for—is but .065 inch thick.

Compare its "kerf" with that of the rotary and the saving isn't hard to see.

If you're a hack saw user you need a copy of the Starrett Hack Saw Book. Sent free with Catalog No. 21 "3", upon request.

To get the most out of every box of Starrett Blades, you need the Starrett Hack Saw Chart—sent free on request.

THE L. S. STARRETT CO.

The World's Greatest Toolmakers
Mfrs. of Hack Saws Unexcelled

ATHOL, MASS.

42-55

STARRETT HACK SAWS CUT QUICKER LAST LONGER — STARRETT TOOLS

Starrett Hack Saws

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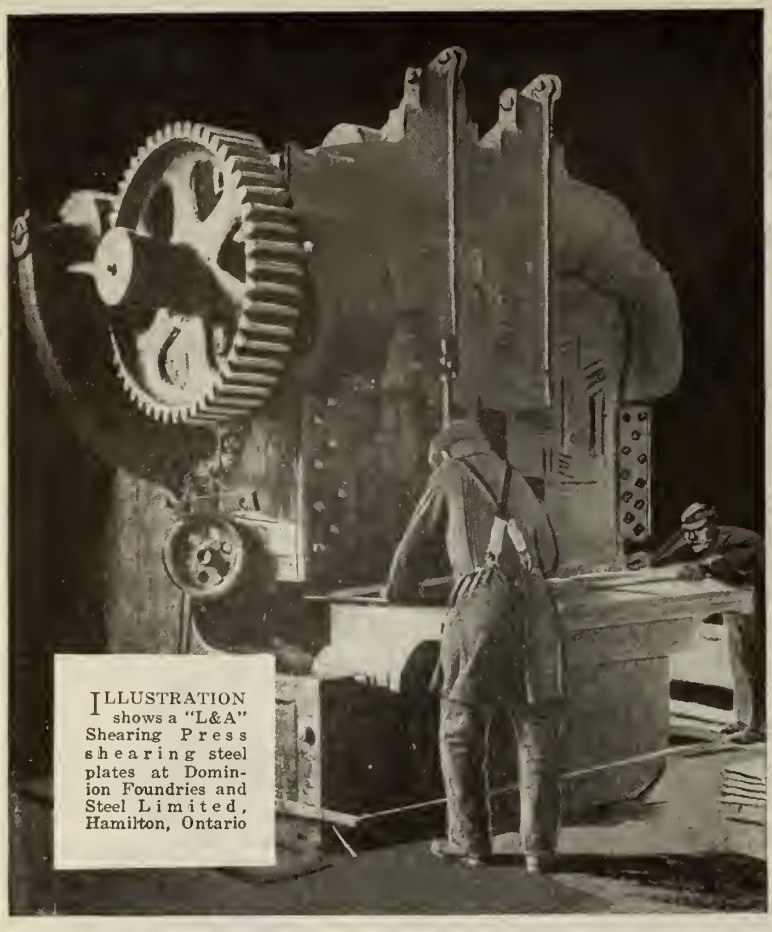

ILLUSTRATION shows a "L&A" Shearing Press shearing steel plates at Dominion Foundries and Steel Limited, Hamilton, Ontario

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PUNCHING and SHEARING MACHINERY

We manufacture "The Quality Line" machinery equipment for Rolling Mills, Bridge and Structural Works, Steel Car Plants and Shipyards. All machines are built of the same high grade workmanship and material that have given the "L & A" product a recognized standard of quality of over 50 years.

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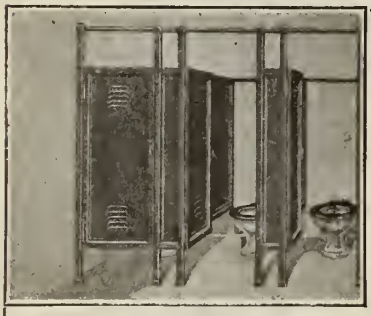

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Made in Canada

Steel Lavatory Partitions

are unequalled for factories, industrial plants and public buildings—Hygienic, Fireproof, Non-markable, Easily cleaned, Non-absorbent, with surfaces free from cracks, crevices and corners.

We also make

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Globe Angular Hole Drilling Tools

Indispensable for the rapid machining of square, hexagonal, octagonal, or any angularly shaped hole. Saves time and labor spent in laborious chipping and filing, and is more certain and accurate in its results.

Invaluable in the toolroom—and often essential in manufacturing work.

Globe Angular Hole Drilling Tools have been found very useful in die-making and general profile work.

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Hexagon Guide

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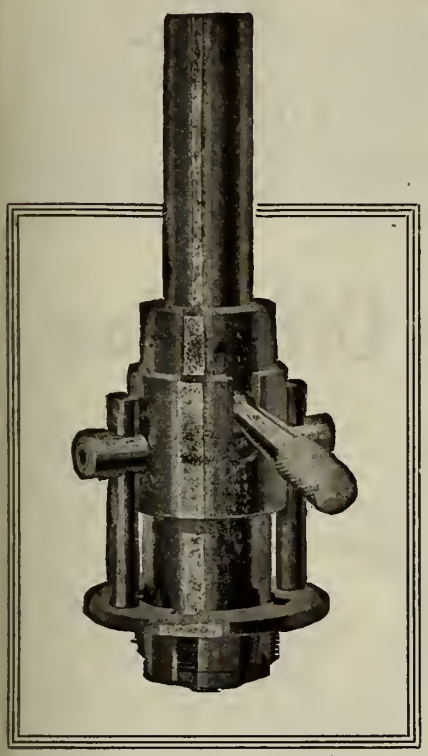

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The most economical way to cut threads.

Murchey Tools are sources of increased profit for your shop. They are production boosters on a dozen tools —tapping machines, drill presses, monitor machines, boring machines, turret lathes — on every machine where threading operations are performed, where quantity production is required, **where clean, accurate threads are essential.**

Backed up in operation by our perfect chaser service—a service that gets replacements and new chasers to you when you need them without waiting for expensive delays.

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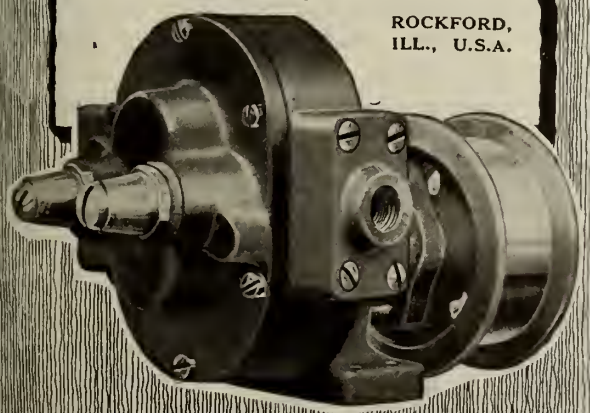
Circulating Pumps

SHOOT COOLANT FORCEFULLY

Due to the Rotary Geared Construction of Trahern Pumps they shoot smooth, even streams of coolant forcefully and with absolutely no pulsation. The discharge is of sufficient force to wash chips and foreign matter from deepest cuts and bores. This is an advantage which is recognized at once. Centrifugal and other types cannot shoot coolant forcefully—it merely falls through discharge opening.

Our bulletin No. 44 will explain in detail.

TRAHERN PUMP DIVISION
Geo. D. Roper Corp.
ROCKFORD, ILL., U.S.A.



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Sterling
POWER HACK SAW MACHINE

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The selection of the proper location of an industry is so vital to its future success that no pains should be spared in the careful investigation of all available sites.

For every industry there is a logical location, whether it be decided by labour conditions, by the location of raw materials and market, by demands for power or by special factors peculiar to the business.

St. Johns is in the front rank of Canada's industrial cities. It possesses such unusual advantages of great economic importance, such as its commanding geographical location, unequalled transportation facilities, adequate fuel, power and labour supply, that it should always be included in investigations preparatory to the location of a new industry.

In addition to the natural advantages of St. Johns as an industrial site, the city also offers extraordinary inducements, such as: tax exemptions; street extensions; bonus of five per cent. on your payroll for five years, which considerably reduces the initial difficulties of organization.

You risk a serious mistake if you do not include this city in your investigations.

What St. Johns has to Offer

—Seven Railroads, including Canada's great transcontinental lines.

—Finest ocean shipping facilities.

—Canal connections with New York, the Eastern States, and the Great Lakes.

—Cheapest labor market in Canada.

—Plentiful supply of skilled and unskilled labor.

—Cheap and abundant electric power.

—Cheap coal and lower freight rates.

—Desirable factory sites with all public conveniences immediately available.

—Extraordinary inducements to new industries.

For Detailed Information, Write:

The Secretary of the City Council

ST. JOHNS, QUEBEC, CAN.

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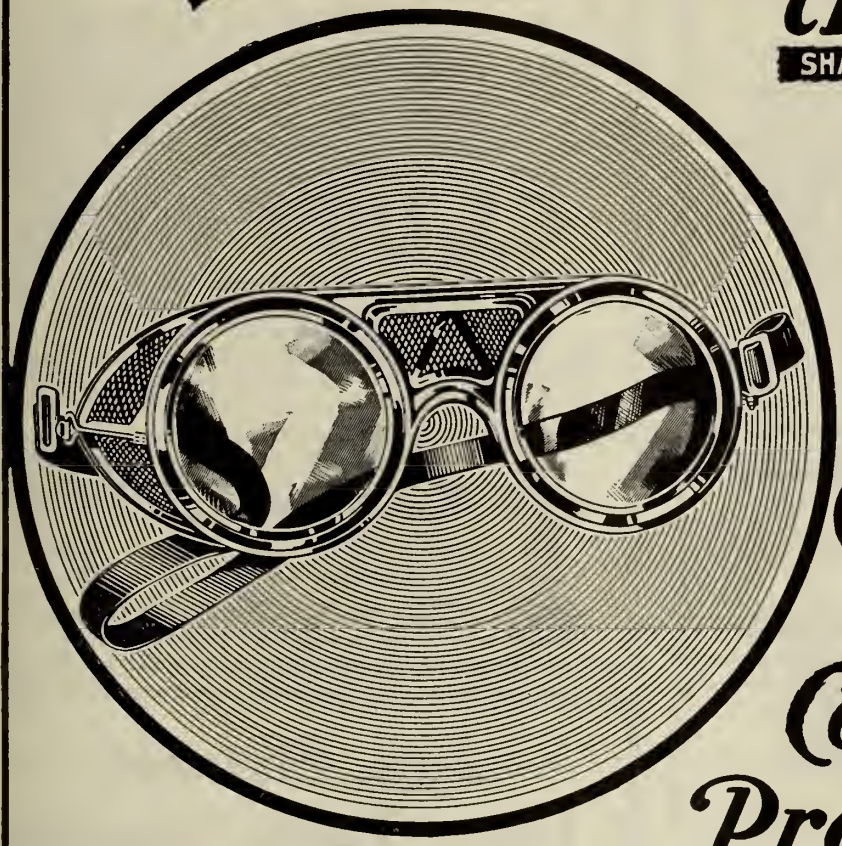
"CELOGLAS"
SHATTER-PROOF LENS



Sturdy, Durable, Comfortable and Completely Protective

No matter how strictly your protection glass specifications are written, no matter how strongly you stress the three safety goggle essentials—protection, comfort and durability—you will find in the Stoco Safety Goggle every feature you demand.

Price (F.O.B. Geneva, N.Y.)

With Celoglas Shatter-Proof Lenses ....$115.00 per hundred
With optical glass lenses ..... 90.00 per hundred

Black elastic headbands (as illustrated) or easy cable earbows at same price. Each goggle comes packed in cardboard container.

We are always glad to send a sample Stoco Safety Goggle and specimen Celoglas lens to interested responsible people on receipt of request on letterhead.

STANDARD OPTICAL CO.
GENEVA, N.Y. U.S.A.

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Sheet Metal Working Machinery
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Press Attachments, Automatic.
Metal and Wire Forming Machines.
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Send for complete catalogue showing 50 styles 10 to 100 tons capacity.
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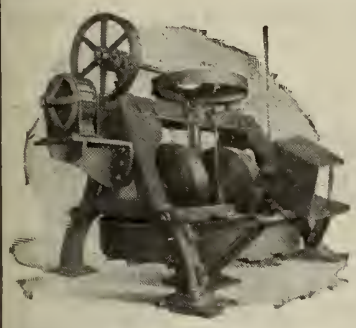
All Mountings Fully Guaranteed

Office and Factory:

88 West Pitt Street, WINDSOR, ONTARIO

Canadian Steel Foundries Need Frost Improved Sand Mills



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Unloading Device
Motor or Belt Drive

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Is a Very Important Feature of

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They are so simply and sturdily constructed that few repairs and adjustments are required. The necessary supplies such as charts and ink are extremely low in cost; especially when compared with similar material furnished with other makes.

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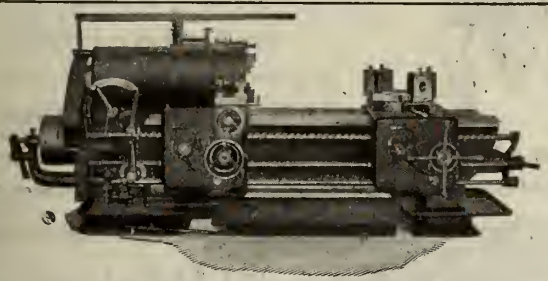

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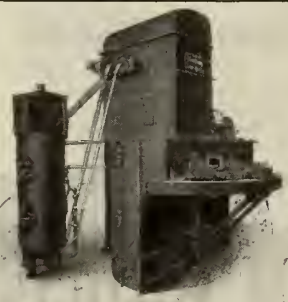

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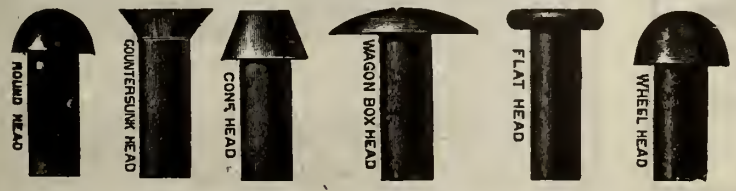

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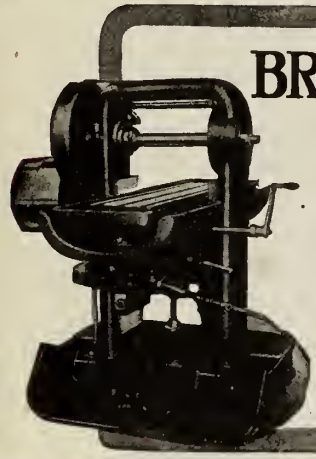

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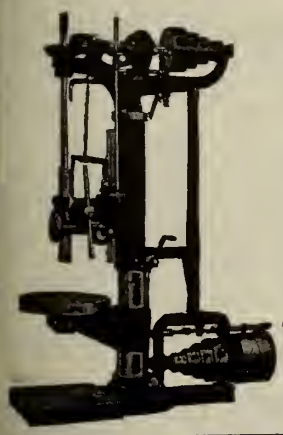

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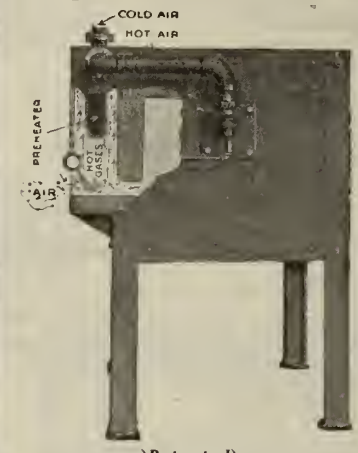

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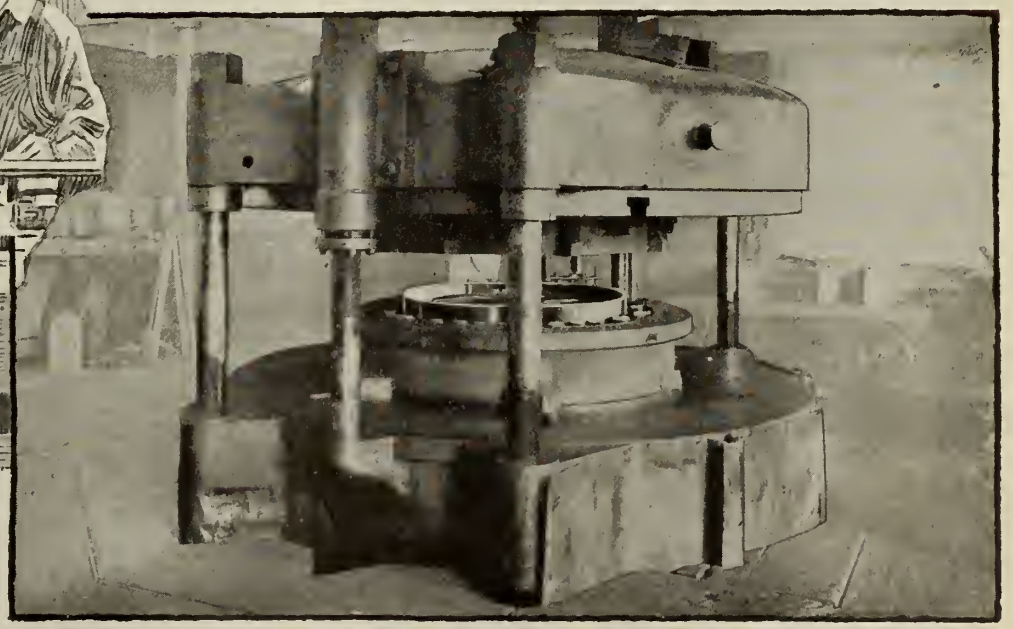

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CUTTING AND WELDING PLANTS
Davis-Bournonville Co., Jersey City, N.J.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.
CYANIDE AND LEAD BATH POTS
Swedish Crucible Steel Co., Windsor.
CYLINDERS, AIR
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Smalley General Co., Inc., Bay City, Mich
CYLINDERS, AUTOMATIC REBORING JIGS AND REAMERS
Kelley Reamer Co., Cleveland, O.
DEHUMIDIFYING
B. F. Sturtevant Co, Galt, Ont.
DERRICKS
Aikenhead Hardware Co., Toronto, Ont.
Dominion Bridge Co., Montreal.
Hepburn Co., Ltd., J. T., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
DERRICK HOISTS
Canadian Mead-Morrison Co., Limited, Montreal, Que.
DIAMOND (BORTZ)
Furniss, Clarke & Co., Montreal, Que.
DIAMOND TOOLS
Ford-Smith Machine Co., Hamilton, Ont.
Furniss, Clarke & Co., Montreal, Que.
Joyce-Koebel Co., Inc., New York City.
Wheel Trueing Tool Co., Detroit.
Petrie, Ltd., H. W., Toronto.
DIAMONDS, CARBON AND BORTZ
Wheel Trueing Tool Co., Detroit.
DIAMONDS, BLACK AND ROUGH
Joyce, Koebel & Co., Inc., New York.
Wheel Trueing Tool Co., Windsor, Ont.
DIE CASTINGS
Fisher Motor Co., Ltd., Orillia, Ont.
Tallman Brass & Metals Ltd., Hamilton, Ont.
DIE HEADS, AUTOMATIC
Greenfield Tap & Die Corp., Greenfield Mass.
Wells Bros. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
DIES, BRASS PRINTING, EMBOSSING AND LETTERING
Matthews, Jas. H., & Co., Pittsburgh, Pa
DIES FOR BIT BRACE USE
Butterfield & Co., Rock Island, Que.
Crescent Mche. Co., Ltd., Montreal, P.Q.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Wells Brothers Co., of Canada, Galt.
DIES AND DIE STOCKS
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Rock Island, Que.
Brown, Boggs Co., Hamilton, Ont.
Crescent Mche. Co., Ltd., Montreal, P.Q.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt. & Son, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Jones & Lamson, Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.
Marshall, Son & Bunney, Toronto.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Rickert-Shafer Co., Erie, Pa.
Stoll Co., Inc., D. H., Buffalo, N.Y.
Wells Brothers of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.
DIES, HAMMERED
Kimber & Hillier Mfg., Co., St. Catharines, Ont.
DIES, DROP FORGE.
Kimber & Hillier Mfg., Co., St. Catharines, Ont.
DIES, METAL STAMPING
Crescent Mche. Co., Ltd., Montreal, P.Q.
Elliott & Whitehall, Galt, Ont.
DIES, PIPE THREADING
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Crescent Mche. Co., Ltd., Montreal, P.Q.
Landis Machine Co., Waynesboro, Pa.
DIES, THREADING
Butterfield & Co., Inc., Rock Island, Que.
Crescent Machine Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.
DIE SINKERS
Becker Milling Machine Co., Boston
Garvin Machine Co., New York.
Kimber & Hillier Mfg., Co., St. Catharines, Ont.
Pratt & Whitney Co., Dundas, Ont.
Walcott Lathe Co., Jackson, Mich
DIES FOR MACHINES
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Rock Island, Que.
Firth & Sons, Thos., Montreal, Que.
Landis Machine Co., Waynesboro, Pa.
Wells Brothers Co. of Canada, Galt.
DIE HEADS
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Canada, Galt, Ont.
DIES, SELF-OPENING
Geometric Tool Co., New Haven.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Wells Brothers Co. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
DIE FILING MACHINES
Oliver Mach. Co., Grand Rapids, Mich.
DIE STEEL, HOT AND COLD WORK
Armstrong-Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.
Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
DIES FOR SCREW PLATES
Butterfield & Co., Inc., Rock Island, Que.
Wells Bros. Co. of Can., Galt, Ont.
DIES, SHEET METAL WORKING
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada
Globe Engineering Co., Hamilton, Ont.
Stoll Co., D. H., Buffalo, N.Y.
DIES, SCREW AND THREAD
Butterfield & Co., Rock Island, Que.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
National-Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co. of Can., Galt, Ont
DISCS, LEATHER, STEEL
Graton & Knight Mfg. Co., Worcester, Mass.
Swedish Steel & Importing Co., Montreal.
DIRECT CONNECTED UNITS
MacGovern & Co., Montreal, Que.
DRAFT, MECHANICAL
Butterfield & Co., Rock Island, Que.
Can. Blower & Forge Co., Kitchener.
A. B. Jardine & Co., Hespeler, Ont.
Pratt & Whitney Co., Dundas, Ont.
Sturtevant Co., B. F., Galt, Ont.
DRAINAGE FITTINGS
Crane, Ltd., Montreal, Que.
DRAWING INSTRUMENTS
Hughes, Owens Co., Ltd., Montreal, Que.
DRAWING OFFICE SUPPLIES
Hughes, Owens Co., Ltd., Montreal, Que.
DRESSERS, GRINDING AND EMERY WHEEL
Atkins & Co., E. C., Hamilton, Ont.
Can. Desmond-Stephan Mfg. Co., Hamilton
Dominion Abrasive Co., Ltd., Mimico, Ont.
Petrie, Ltd., H. W., Toronto.
Wheel Trueing Tool Co., Windsor, Ont.
DRILL PRESSES
Aurora Tool Works, Aurora, Ind.
Barber Mchy. Co., Ltd., Toronto, Ont.
W. F. & John Barnes Co., Rockford.
Can. Blower & Forge Co., Kitchener.
Canada Machinery Corp., Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
U. S. Mach. Tool Co., Cincinnati, Ohio.
A. R. Williams Machinery Co., Toronto.
DRILL RODS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Kayser-Ellison & Co., Ltd., Montreal.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
Marshall, Son & Bunney, Toronto.
Swedish Steel & Importing Co., Ltd., Montreal.
DRILLING MACHINES, GANG
Barnes, W. F. & John, Co., Rockford, Ill.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bilton Mach. Tool Co., Bridgeport, Conn
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Silver Mfg. Co., Salem, Ohio.
DRILLING MACHINES, LOCOMOTIVE AND MULTIPLE SPINDLE
Barber Mchy. Co., Ltd., Toronto, Ont.
John Bertram & Sons Co., Dundas.
Bilton Mach. Tool Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Mach. Co., Toronto.
Garvin Machine Co., New York.
Hoefer Mfg., Co., Freeport, Ill.
Henry & Wright Mfg. Co., Hartford, Conn
A. B. Jardine & Co., Hespeler, Ont.
Landis Tool Co., Waynesboro, Pa.
Nat. Automatic Tool Co., Richmond, Ind.
Niles-Bement-Pond Co., New York.
Rockford Drilling Mach Co., Rockford, Ill

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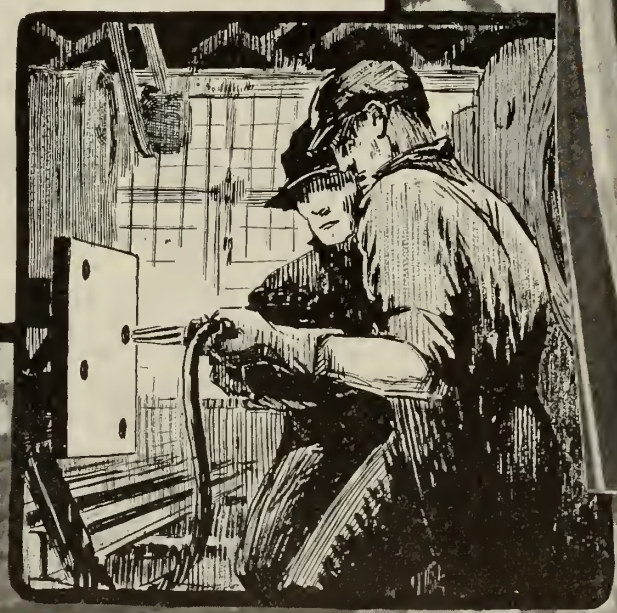

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CHAS. A. STRELINGER CO., LTD.
Windsor, Ontario

AMERICAN MACHINE PRODUCTS, CO.,
Detroit, Mich., U.S.A.

If interested tear out this page and place with letters to be answered

DRILLING MACHINES, RADIAL AND TURRET
Barber Mchy. Co., Ltd., Toronto, Ont.
John Bertram & Sons Co., Dundas.
Canadian Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Henry & Wright Mfg. Co., Hartford,
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLING MACHINES, SENSITIVE
Barber Mchy. Co., Ltd., Toronto, Ont.
Milton Mach. Tools Co., Bridgeport, Conn.
W. F. & John Barnes Co., Rockford, Ill.
Canadian Fairbanks-Morse Co., Montreal.
Canadian Machinery Corp., Galt, Ont.
Geo. F. Foss Mch. & S'ply Co., Montreal
Garlock-Walker Mach. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
United States Mach. Tool Co., Cincinnati
Williams Mchy Co., A. R., Toronto, Ont.

DRILLING MACHINES, UPRIGHT AND HORIZONTAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Aurora Tool Works, Aurora, Ind.
John Bertram & Sons Co., Dundas.
Garlock-Walker Mach. Co., Toronto, Ont
Can. Blower & Forge Co., Kitchener.
Canada Mach. Corp., Galt, Ont.
Garvin Machine Co., New York.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mach. Co., Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
A. B. Jardine & Co., Hespeler, Ont.
Knight Metal Products, Toronto.
Landis Tool Co., Waynesboro, Pa.
R. McDougall Co., Galt.
Nat. Automatic Tool Co., Richmond, Ind.
Rockford Drilling Mach. Co., Rockford, Ill.
Niles-Bement-Pond Co., New York.
Silver Mfg. Co., Salem, Ohio.
A. R. Williams Machinery Co., Toronto.

DRILLING MACHINES, SPECIAL
Hoefer Mfg. Co., Freeport, Ill.

DRILLING POSTS
Aikenhead Hardware Co., Toronto, Ont.
Keystone Mfg. Co., Buffalo, N.Y.
Rice Lewis & Son, Toronto, Ont.
Silver Mfg. Co., Salem, Ohio.

DRILLS, BENCH
Aikenhead Hardware Co., Toronto.
W. F. & John Barnes Co., Rockford, Ill
Can. Blower & Forge Co., Kitchener.
Can. Fairbanks-Morse Co., Montreal.
Geo. F. Foss Mch. & S'ply Co., Montreal
Garlock-Walker Machinery Co., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

DRILLS, BLACKSMITH AND BIT STOCK
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Can. Blower & Forge Co., Kitchener.
Cleveland Twist Drill Co., Cleveland.
Geo. F. Foss Mch. & S'ply Co., Montreal
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.
Whitman & Barnes Mfg. Co., Akron, O.
Wilkinson & Kompass, Hamilton, Ont.
Wilt Twist Drill Co. of Can., Walkerville

DRILLS, CENTRE
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto.
Rice Lewis & Son, Toronto, Ont.
Wilt Twist Drill Co., of Can., Walkerville

DRILLS CORE, INTERCHANGEABLE
Eclipse Counterbore Co., Ltd., Walkerville, Ont.

DRILLS, CARBON
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Marshall, Son & Bunney, Toronto.
John Morrow Screw & Nut Co., Ingersoll

DRILLS, ELECTRIC, PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener.
Cincinnati Electrical Tool Co., Cincinnati
Geo. F. Foss Mch. & S'ply Co., Montreal
Hoskins Co., R. C., Chicago, Ill.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Pilot Steel & Tool Co., Montreal, Que.
Prest-O-Lite Co., Inc., Toronto, Ont.
U. S. Electrical Tool Co., Cincinnati, O.
A. R. Williams Mach. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLS, HAMMER
Samuel Osborne, Ltd., Montreal, P.Q.

DRILLS, EMERY
Garlock-Walker Mach. Co., Toronto, Ont.

DRILLS, HIGH SPEED TWIST
Aikenhead Hardware Co., Toronto, Ont.
Armstrong-Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Canadian Fairbanks-Morse Co., Montreal
H. A. Drury Co., Montreal.
Geo. F. Foss Mch. & S'ply Co. Montreal
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
W. F. & John Barnes Co., Rockford, Ill
Osborne, Samuel, Montreal, P.Q.
Pratt & Whitney Co., Dundas, Ont.
Petrie, H. W. Toronto.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Taylor J. A. M., Stair Bldg., Toronto.
Wilt Twist Drill Co. of Can., Walkerville
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLS, OIL TUBE
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

DRILLS, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Williams Mchy Co, Ltd., A. R., Montreal
Greenfield Tap & Die Corp., Greenfield, Mass.

DRILLS, PNEUMATIC CORNER
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago,

DRILLS, RATCHET AND HAND
Aikenhead Hardware Co., Toronto, Ont.
Armstrong Bros. Tool Co., Chicago, Ill.
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cincinnati Electrical Tool Co., Cincinnati.
Cleveland Twist Drill Co., Cleveland.
Garlock-Walker Mchy. Co., Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilt Twist Drill Co. of Can., Walkerville.

DRILLS, ROCK
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
The Foss Mchy. & Supply Co., Montreal.
Samuel Osborne Ltd., Montreal, P.Q.
A. R. Williams Machy. Co., Toronto.

DRILLS, SQUARE & HEXAGON
Globe Engineering Co.

DRILLS, TRACK
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
The Foss Mchy. & Supply Co., Montreal.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Wilt Twist Drill Co. of Can., Walkerville.

DRINKING FOUNTAINS, SANITARY
Crane, Ltd., Montreal, Que.
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

DRIVES, CHAIN
See Belting, Chain.

DRIVING TOOLS
The Thos. Pink Co., Ltd., Pembroke, Ont.

DRY CLEANING SYSTEM
Bowser Co., Ltd., S. F., Toronto, Ont.

DRYERS, SAND
Lyman Tube & Supply Co., Montreal, Que.
Pangborn Corporation, Hagerstown, Md.

DRYING APPLIANCES
Baird Machine Co., Bridgeport, Conn.
Sturtevant Co., B. F., Galt, Ont.
W. S. Rockwell Co., New York, N.Y.

DRUM CONTROLS
Volta Manufacturing Co., Welland, Ont.

DUMP CARS
Canadian Fairbanks-Morse Co., Montreal.
MacKinnon Steel Co., Sherbrooke, Que.

DUST EXHAUSTER. ARRESTER SYSTEM
Pangborn Corporation, Hagerstown, Md.

DUST HANDLING EQUIPMENT
Pangborn Corporation, Hagerstown, Md.
Sturtevant Co., B. F., Galt, Ont.

DUST SEPARATORS
Can. Blower & Forge Co., Kitchener, Ont.
Sturtevant Co., B. F., Galt, Ont.

DYNAMOS AND ELECTRICAL SUPPLIES
Canadian Fairbanks-Morse Co., Montreal.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
MacGovern & Co., Montreal, Que.
A. R. Williams Machy. Co., Toronto.

ELECTRICAL SUPPLIES
Can. General Electric Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Northern Electric Co., Ltd., Montreal Que

ELECTRIC FURNACES
Electric Furnace Construction Co., Philadelpria, Pa.
Hamilton & Hansell, Inc., New York City
Volta Manufacturing Co., Welland, Ont.

ELECTRIC FURNACE REGULATORS, WINCHES, ROOF COOLERS AND ELECTRODE HOLDERS
Volta Manufacturing Co., Welland, Ont.

ELECTRICAL RESISTANCE MATERIALS, NICHROME, KROMORE, CHROMAX, CLIMAX, NICKEL, SILVER, ADVANCE.
Can. Driver-Harris Co., Walkerville, Ont.

ELECTRIC HOISTS, STATIONARY AND MONO RAIL
Canadian Link-Belt Co., Ltd., Toronto,
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Volta Manufacturing Co., Welland, Ont.

ELECTRIC MOTORS
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
Sturtevant Co., B. F., Galt, Ont.
Volta Manufacturing Co., Welland, Ont.

ELECTRIC TRUCKS
Cowan Truck Co., Holyoke, Mass.
Goad Engineering Co., Toronto, Ont.

ELEVATOR, ENCLOSURES
Volta Mfg. Co., Welland, Ont.
Canada Wire & Iron Goods Co., Hamilton

ELEVATOR WEIGHTS
Katie Foundry, Galt, Ont.

ELEVATORS AND BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Machy. Co., St. Louis.

ELEVATING AND CONVEYING MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Petrie, Ltd., H. W., Toronto.

EMBOSSING PRESSES
Dom. Steel Products Co., Ltd., Brantford.
Oliver Machinery Co., Grand Rapids, Mich

EMERY GRINDERS (PNEUMATIC)
Can. Ingersoll-Rand Co., Ltd.; Sherbrooke,
Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.

EMERY CLOTH
Atkins & Co., E. C., Hamilton, Ont.

EMERY PAPER
Atkins & Co., E. C., Hamilton, Ont.

EMERY AND EMERY WHEELS
Atkins & Co., E. C., Hamilton, Ont.
Brantford Emery Wheel Co., Brantford, Canada.
The Foss Mchy. & Supply Co., Montreal.
Garvin Machine Co., New York.
Canadian Fairbanks-Morse Co., Montreal.
Canada Emery Wheels Co., Hamilton.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Wilkinson & Kompass, Hamilton, Ont.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.

EMERY WHEEL DRESSINGS
Dominion Abrasive Co., Ltd., Mimico, Ont.
Wheel Trueing Tool Co., Windsor Ont.

ENAMELWARE
Crane, Ltd., Montreal, Que.

END MILLS
John Morrow Screw & Nut Co., Ingersoll

ENGINEERS—INDUSTRIAL CLEANING (Free Consultation)
Oakley Chemical Co., New York, N.Y.

ENGINEERS
Samuel Osborne (Canada) Ltd., Montreal.

ENGINES—HOISTING, PILE DRIVING, BRIDGE ERECTING, MINING
Canadian Mead-Morrison Co., Limited, Montreal, Que.

ENGINES, STEAM, GAS, GASOLINE
Furniss, Clarke & Co., Montreal, Que.
Canadian Fairbanks-Morse Co., Montreal.
Johnson Mach. Co., Carlyle, Manchester, Conn.
MacGovern & Co., Montreal, Que.
Sturtevant Co., B. F., Galt, Ont.

ENGINES, HORIZONTAL AND VERTICAL
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Johnson Mach. Co., Carlyle, Manchester, Conn.
Petrie, Ltd., H. W., Toronto.
A. R. Williams Machy. Co., Toronto.

ENGINES, OIL
Ker & Goodwin Machine Co., Ltd., Brantford, Ont.

ENGINES, HEAVY OIL, DIESEL TYPE
Dom. Steel Products Co., Ltd., Brantford

ENGINES, MARINE
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Sturtevant Co., B. F., Galt, Ont.

ESCUTCHEON PINS
Parmenter & Bulloch, Gananoque, Ont.

EXHAUST HEADS AND HOODS
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Sturtevant Co., B. F., Galt, Ont.

EXHAUSTERS
Can. Blower & Forge Co., Kitchener, Ont.
Pangborn Corporation, Hagerstown, Md.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.

EXTRACTORS, TAP
Walton Co., The, Hartford, Conn.

EYE BOLTS AND NUTS
Can. Foundries & Forgings, Ltd., Welland, Ont.

EYE PROTECTORS
Standard Optical Co., Geneva, N.Y.

FACTORY GATES
Page Steel & Wire Co., Adrian, Mich.

FACTORY LOCATIONS
City of St. Johns, Quebec.

FACTORY SITES
City of St. Johns, Quebec.

FANS
Baird Machine Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont.
Sturtevant Co., B. F., Galt, Ont.

FENCING, WIRE
Page Steel & Wire Co., New York, N.Y.

FENCE, IRON AND FACTORY
Can. Wire & Iron Goods, Hamilton, Ont.
Page Steel & Wire Co., Adrian, Mich.

FERRO-TUNGSTEN
Vanadium-Alloys Steel Co., Pittsburgh, Pa

FIBRE, RODS AND SHEETS
Diamond State Fibre Co., Bridgeport, Pa.

FILES
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., Wm., Sheffield, Eng.
Ingersoll File Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Marshall, Son & Bunney, Toronto, Ont.
Nicholson File Co., Port Hope, Ont.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
Whitman & Barnes Mfg. Co., Akron, O.
Wilkinson & Kompass, Hamilton, Ont.

FILES, COMMUTATOR SLOTTING
Lyman Tube & Supply Co., Montreal, Que.

FILING MACHINES, BENCH AND MOTOR DRIVEN
Barry Mfg. Co., Chicago, Ill.

FILTERING AND CIRCULATING SYSTEMS FOR LUBRICATING OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. Wire & Iron Goods, Hamilton, Ont.

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Elk Fire Brick Co., Hamilton, Ont.
General Combustion Co., Ltd., Montreal, Que.

FIRE CLAY
Elk Fire Brick Co., Can., Ltd., Hamil-
General Combustion Co., Ltd., Montreal, Que.

FINISHING MACHINES
Brown & Sharpe Mfg. Co., Providence, R.I.

FIRE EXTINGUISHERS
Strong, Kennard & Nutt Co., Cleveland, O.

FITTINGS, CAST IRON, SCREWED, FLANGED
Crane, Ltd., Montreal, Que.

FIXTURES
Brown Engineering Corp., Toronto, Ont.
Crescent Mchy. Co., Ltd., Montreal, Que.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Toronto Tool Co., Toronto, Ont.

FLAT SPRINGS
The Dunbar Brothers Co., Bristol, Conn

FLEXIBLE SHAFT EQUIPMENT
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Volume XXIII.

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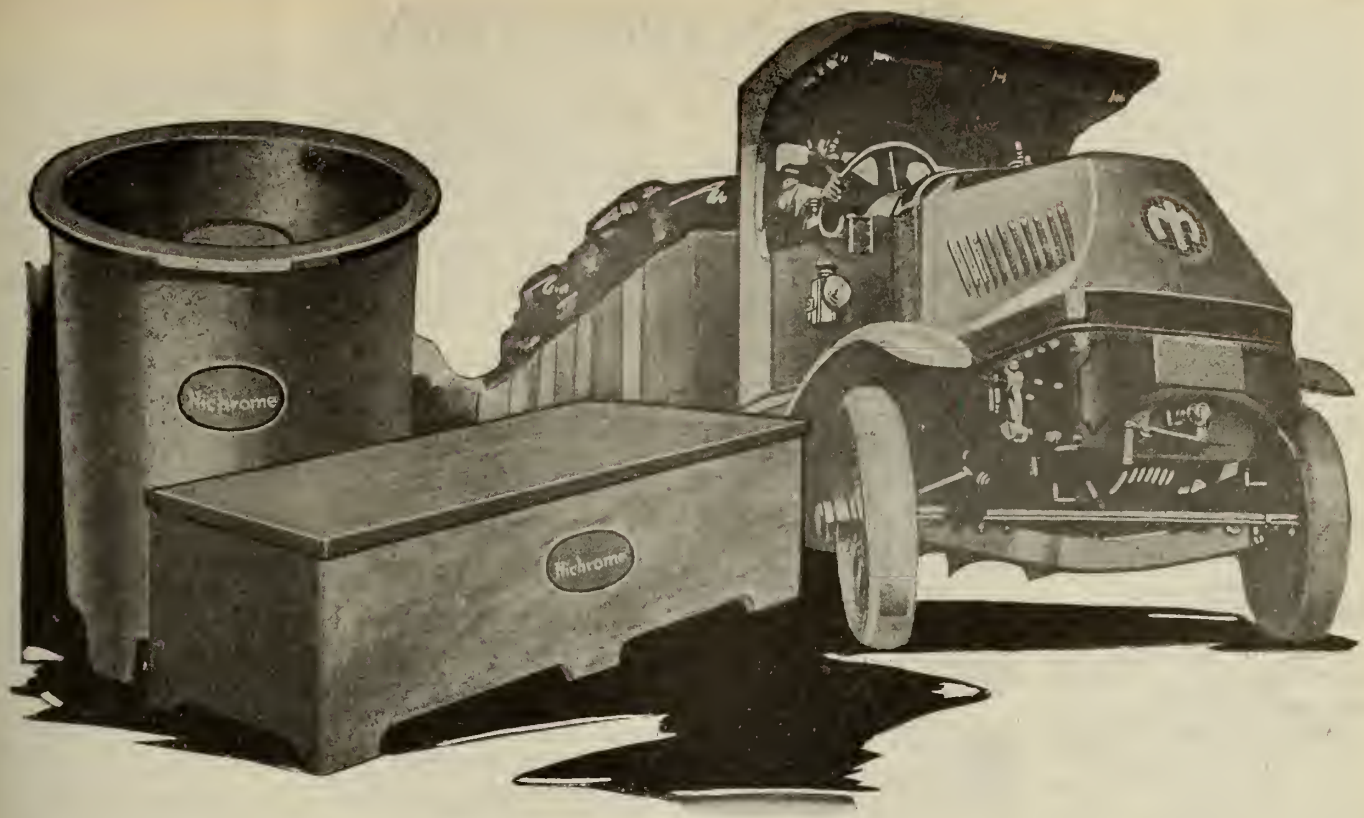

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Independent Pneumatic Tool Co., Chicago
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Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
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Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Gutta Percha & Rubber, Ltd., Toronto.
Independent Pneumatic Tool Co., Chicago.
Quaker City Rubber Co., Philadelphia, Pa.
Wells Bros. Co. of Canada, Galt, Ont.

HOSE, ALL KINDS
Goodyear Tire & Rubber Co., of Canada, Ltd., Toronto.
Gutta Percha & Rubber, Ltd., Toronto.
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.

HOSE, SAND BLAST
Pangborn Corporation, Hagerstown, Md.
Goodyear Tire & Rubber Co. of Can., Ltd. Toronto
Quaker City Rubber Co., Philadelphia, Pa.
Intern'l. Machine Tool Co., Indianapolis.

HOSE, STEAM, SUCTION AND WATER
Gutta Percha & Rubber, Ltd., Toronto.
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.

HUMIDIFIERS
Sturtevant Co., B. F., Galt, Ont.

HYDRAULIC ACCUMULATORS
Dom. Steel Products Co., Ltd., Brantford.

HYDRAULIC MACHINERY
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
West Tire Setter Co., Rochester, N.Y.
Victoria Foundry Co., Ottawa.

HYDRAULIC TURBINES
Que.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,

HYDROMETERS, HYGROMETERS, HYGRODNIKS
Taylor Instrument Co., Rochester, N.Y.

INDICATORS, SPEED
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol, Mass.

INDEX CENTRES
Brown & Sharpe Mfg. Co., Providence, R.I.
Dickow, Fred. C., Chicago, Ill.
Ford-Smith Machine Co., Hamilton, Ont.
Garvin Machine Co., New York.
Petrie, Ltd., H. W., Toronto.

INDICATING INSTRUMENTS
Taylor Instrument Co., Rochester, N.Y.

INDICATING SCALES
Can. Kron Scale Co., Montreal.

INDUSTRIAL SITES
City of St. Johns, Quebec.

INGOTS, BRASS, BRONZE, GUN METAL, PHOSPHOR
Thomas Moore & Son, Montreal.

INGOTS, FORGING AND ROLLING
Electric Steel & Metals Co., Welland.

INSULATING COMPOUNDS
Robertson Co., Ltd., H. H., Sarnia, Ont.

INSTRUMENTS, ENGINEERING
Consolidated Optical Co., Toronto.

IRON ORE
Hanna & Co., M. A. Cleveland, O.

IRON, WROUGHT, ROLLED, PIG
Swedish Steel & Impt. Co., Ltd., Montreal

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Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
The Engineering Co.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Norton, A. O., Coaticook, Que.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.

JACKS, PIT AND TRACK
Canadian Fairbanks-Morse Co., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Northern Crane Works, Walkerville.

JAWS, FACE PLATE
Dustman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford.
Skinner Chuck Co., New Britain, Conn.

JIGS, TOOLS, ETC.
Brown Engineering Corp., Toronto.
Crescent Mach. Co., Ltd., Montreal, P.Q.
Elliott & Whitehall Mach. & Tool Co., Galt.
Gisholt Machine Co., Madison, Wis.
Globe Engineering Co., Ltd., Hamilton.
Homer & Wilson, Hamilton, Ont.
Jones & Lamson, Springfield, Vt.
Toronto Tool Co., Toronto, Ont.

JOURNAL WEDGES
Canada Foundries & Forgings, Welland.
Dominion Foundries & Steel Ltd., Hamilton, Ont.

KEY SEATERS
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Morton Mfg. Co., Muskegon Heights, M.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.

KEYS, MACHINE
Whitney Mfg. Co., Hartford, Conn.
Williams & Co., J. H., Brooklyn, N.Y.

KILNS
Can. Blower & Forge Co., Kitchener, Ont.
General Combustion Co., Ltd., Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Sturtevant Co., B. F., Galt, Ont.

KNIVES, MACHINE
Atkins & Co., E. C., Hamilton, Ont.

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Matthews & Co., Jas. H., Pittsburgh, Pa.

LABORATORIES, INSPECTION AND TESTING (see Chemists)

LADLES, FOUNDRY
Northern Crane Works, Walkerville.

LACING MACHINES
Clipper Belt Lacer Co., Grand Rapids, M.

LAG SCREW GIMLET POINTERS
National Machy. Co., Tiffin, Ohio.

LATH
Robertson, Ltd., H. H., Sarnia, Ont.

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Acme Machine Tool Co., Cincinnati, Ohio.
Petrie, Ltd., H. W., Toronto.
Wood Turret Machine Co., Brazil, Ind.

LATHE CHUCKS (See Chucks)

LATHE DOGS AND ATTACHMENTS
Armstrong Bros. Tool Co., Chicago.
Hendey Machine Co., Torrington, Conn.
Williams & Co., J. H., Brooklyn, N.Y.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.
Wood Turret Machine Co., Brazil, Ind.

LATHES, AXLE
Barber Mchy. Co., Ltd., Toronto, Ont.
Betts Mach. Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.

LATHES, BORING
Barber Mchy. Co., Ltd., Toronto, Ont.
Bridgeford Mach. Tool Works, Rochester.
Canada Machinery Corp., Galt, Ont.
Ledge & Shipley, Cincinnati, O.
Petrie, Ltd., H. W., Toronto.

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W. F. & John Barnes Co., Rockford.
J. G. Blount & Co., Everett, Mass.
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Geo. F. Foss Machy. & Supply Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Hardinge Bros., Chicago, Ill.
Pratt & Whitney Co., Dundas, Ont.
Seneca Falls Mfg Co., Seneca Falls, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Acme Machine Tool Co., Cincinnati, Ohio.
Hardinge Bros., Chicago, Ill.
Wood Turret Machine Co., Brazil, Ind.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

LATHES, ENGINE
Acme Machine Tool Co., Cincinnati, O.
Barber Mchy. Co., Ltd., Toronto, Ont.
John Bertram & Sons, Co., Dundas.
Canada Machy. Corp., Galt, Ont.
Canadian Fairbanks-Morse Co., Montreal,
Cisco Machine Tool Co., Cincinnati, O.
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G. F. Foss, Mchy. & S'ply Co., Montreal
Garlock-Walker Machinery Co, Toronto.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
Kennedy & Sons, Wm., Owen Sound, Ont.
Lehman Mach. Co., St. Louis, Mo.
R. McDougall Co., Galt.
Miles-Bennet-Pond Co., New York.
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Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Sidney Tool Co., Sidney, Ohio.
Wabash Lathe Co., Jackson, Mich.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.
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Williams Mchy Co., A. R., Toronto, Ont.

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Seneca Falls Mfg. Co., Seneca Falls, N.Y.

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Intern'l. Mchy. Supplies Ltd., Montreal.
Wood Turret Machine Co., Brazil, Ind.

LATHES, JOURNAL TRUEING
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Canada Machinery Corp., Galt, Ont.

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Elliott & Whitehall, Galt, Ont.

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Can. Machinery Corp., Galt.
Wood Turret Machine Co., Brazil, Ind.
G. F. Foss Mchy. & S'ply Co., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.

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Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

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Bertram & Sons Co., John Dundas, nt.
Betts Machine Co., Rochester, N.Y.
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Fees Mchy. & S'ply Co., G.F., Montreal.
Foster Machine Co., Elkhart, Ind.
Gerlock-Walker Machy. Co., Toronto, Ont
Hardinge Bros., Inc., Chicago, Ill.
Hepburn Ltd., John T., Toronto, Ont.
Lehman Machine Co., St. Louis, Mo.
Niles-Bennet-Pond Co., New York.
Rae Mach. Tool Co., Hamilton.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.
Williams Machy. Co., A.R., Toronto.
Wood Turret Machine Co., Brazil, Ind.

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Bliss Co., E. W., Brooklyn, N.Y.

LATHES, TOOL ROOM
Barber Mchy. Co., Ltd., Toronto, Ont.
Cisco Machine & Tool Co., Cincinnati, O.
Canada Machinery Corporation, Galt, Ont.
Knight Metal Products, Toronto.
Lehman Machine Co., St. Louis, Mo.
Rae Mach. Tool Co., Ramilton.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.

LATHES, QUICK CHANGE
Lehman Machine Co., St. Louis, Mo.

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Atkins & Co., E. C., Hamilton, Ont.

LATHES, TURRET
Hardinge Bros., Chicago, Ill.
Acme Machine Tool Co., Cincinnati, Ohio

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Turner Brass Works, Sycamore, Ill.

LEATHER STRAPPING
Graton & Knight Mfg. Co., Worcester, M

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LEVELS
Hughes, Owens Co., Ltd., Montreal, Que

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Can. Winsley Co., Ltd., Windsor, Ont.

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See Belting, Chain.

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LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

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Dennis Wire & Iron Works, London, Ont

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Cataract Refining & Mfg. Co., Toronto.
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Oakley Chemical Co., New York, N.Y.

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Elliott & Whitehall, Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Williams Machy. Co., A. R., Toronto.

MACHINERY GUARDS (See Guards)

MACHINERY SUPPLIES
Crescent Machine Co., Ltd., Montreal.
Globe Engineering Wks., Hamilton, Ont.
Knight Metal Products, Toronto.

MACHINERY, SPECIAL
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Crescent Machine Co., Ltd., Montreal, Que.
McClean Machine & Tool Co., Ltd., Hamilton, Ont.

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Volta Mfg. Co., Welland, Ont.

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Cleveland Twist Drill Co., Cleveland.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Pratt & Whitney Co., Dundas, Ont.

MARKING DEVICES
Matthews & Co., Jas. H., Pittsburgh, Pa.

MARKING MACHINERY
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Foss Mchy. & S'ply Co., G. F., Montreal
Perrin, Wm. R., Toronto.
Petrie, Ltd., H. W., Toronto.

MATERIALS, HANDLING PLANTS
Canadian Mead-Morrison Co., Limited, Montreal, Que.

MATS, RUBBER MATTING
Quaker City Rubber Co., Philadelphia, Pa
International Mchy. Sply., Ltd., Montreal

MEASURING MACHINES
Pratt & Whitney Co., Dundas, Ont.

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Bowser Co., Ltd., S. F., Toronto, Ont.

MEASURING TAPES AND RULES
Chesterman & Co., Jas., Sheffield, Eng.

MERCHANTS, IRON AND STEEL
Samuel Osborne (Can.), Ltd., Montreal.

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See Chemists.

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Oakley Chemical Co., New York, N.Y.

METAL CUTTING MACHINES
Atkins & Co., E. C., Hamilton, Ont.
Lyman Tube & Supply Co., Montreal, Que.

METAL SAWS
See Saws.

METAL, ANTI-FRICTION
Thos. Moore & Son, Montreal.

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E. C. Atkins & Co., Inc., Indianapolis.
Hoefer Mfg. Co., Freeport, Ill.
Lyman Tube & Supply Co., Montreal, Que.

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Brown's Copper & Brass Rolling Mills, New Toronto, Ont.
Canada Metal Co., Toronto, Ont.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.

METAL, STAMPINGS, SMALL
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METERS, OIL, GASOLINE, KEROSENE, ETC.
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General Combustion Co., Ltd., Montreal, Que.

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Petrie, Ltd., H. W., Toronto.

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Elec. Steel & Metals, Welland, Ont.

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MILLS, SAND
Frost Mfg. Co., Chicago, Ill.

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Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

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Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.

MILLING ATTACHMENTS
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Becker Milling Machine Co., Boston, Mass.
Bertram & Sons Co., John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence.
Canada Machinery Corp., Galt, Ont.
Cincinnati Milling Machine Co., Cincinnati
Ford-Smith Mach. Co., Hamilton, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Knight Metal Products, Toronto.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Rockford Milling Mach. Co., Rockford, Ill
United States Mach. Tool Co., Cincinnati.
Whitney Mfg. Co., Hartford, Conn.
Williams Machy. Co., A. R., Toronto.

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Becker Milling Machine Co, Boston, Mass.
Bilton Mach. Tool Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence.
Canada Machinery Corp., Galt, Ont.
Cleveland Milling Machine Co., Cleveland.
Cincinnati Milling Machine Co., Cincinnati
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
National Machy. Co., Tiffin, Ohio.
Gooley & Eddund, Inc., Cortland, N.Y.
Hardinge Bros., Inc., Chicago, Ill.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Knight Metal Products, Toronto.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.

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Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Kempsmith Mfg. Co., Milwaukee, Wis.
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MacKinnon Steel Co., Sherbrooke, Que.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.

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Can. Fairbanks-Morse Co., Montreal.
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Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., A. R., Toronto, Ont

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Frost Mfg. Co., Chicago, Ill.

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U. S. Ordnance, Toronto, Ont.
Volta Mfg. Co., Welland, Ont.
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MOTORCYCLE FRAME AND FORK
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Cleveland Pneumatic Tool Co., Toronto.

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Graton & Knight Mfg. Co., Worcester, M.

MULTI-DRILLING, MULTI-BORING, MULTI-TAPPING MACHINERY,
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NAME PLATES, BRONZE, ETCHED AND STAMPED
Matthews & Co., Jas. H., Pittsburgh, Pa.
Turner Brass Works, Sycamore, Ill.

NICHROME CASTINGS
Can. Driver-Harris Co., Ltd., Walkerville.

NICKEL
Pilot Steel & Tool Co., Montreal, Que.

NICKEL STEEL
See Steel.

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Brown's Copper and Brass Rolling Mills, New Toronto.

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Garvin Machine Co., New York.
Hall & Son, J. H., Brantford, Ont.
Jardine & Co., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.

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Prest-o-Lite Co., Inc. Toronto, Ont.
Davis-Bournonville Co., Toronto, Ont.

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Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto, Ont.
Nat. Electro Products Ltd., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.

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International Mach. Spls., Ltd., Montreal
Petrie, Ltd., H. W., Toronto.
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Can. Link-Belt Co., Toronto, Ont.
Gutta Percha & Rubber, Ltd., Toronto.
MacKinnon Steel Co., Sherbrooke, Que.

PARTITIONS, WIRE
See Guards

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Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Machinery Co., Toronto.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

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Garlock-Walker Machinery Co., Toronto.
Oliver Machy. Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto.

PATTERN MAKERS' LATHES
See Lathes.

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Marion & Marion, Montreal.
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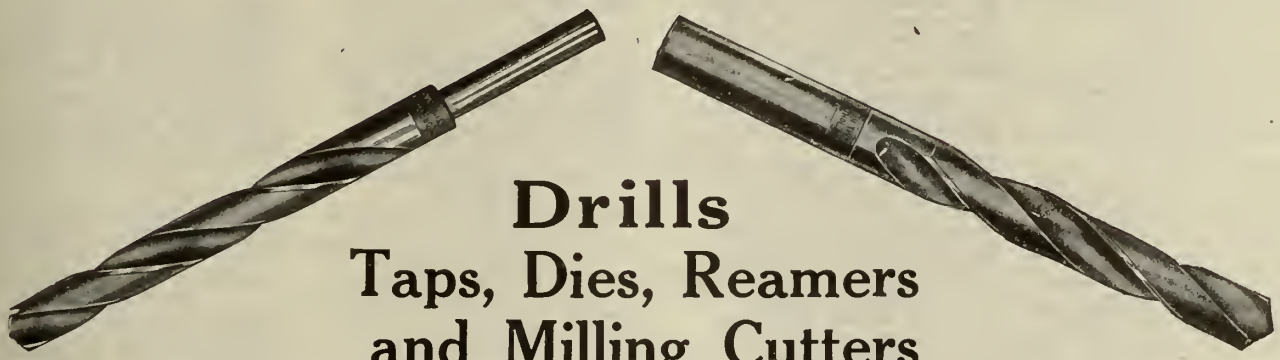

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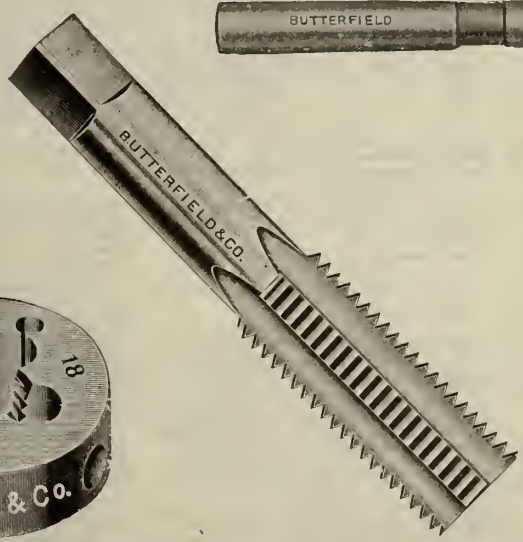

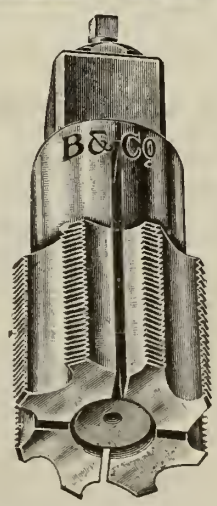

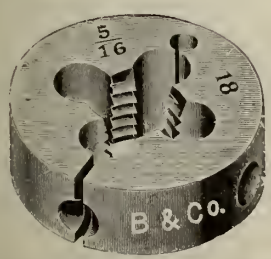

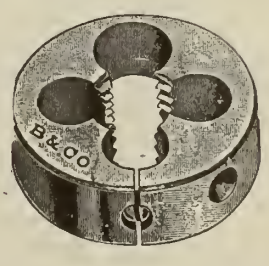

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GARVIN MACHINE TOOLS

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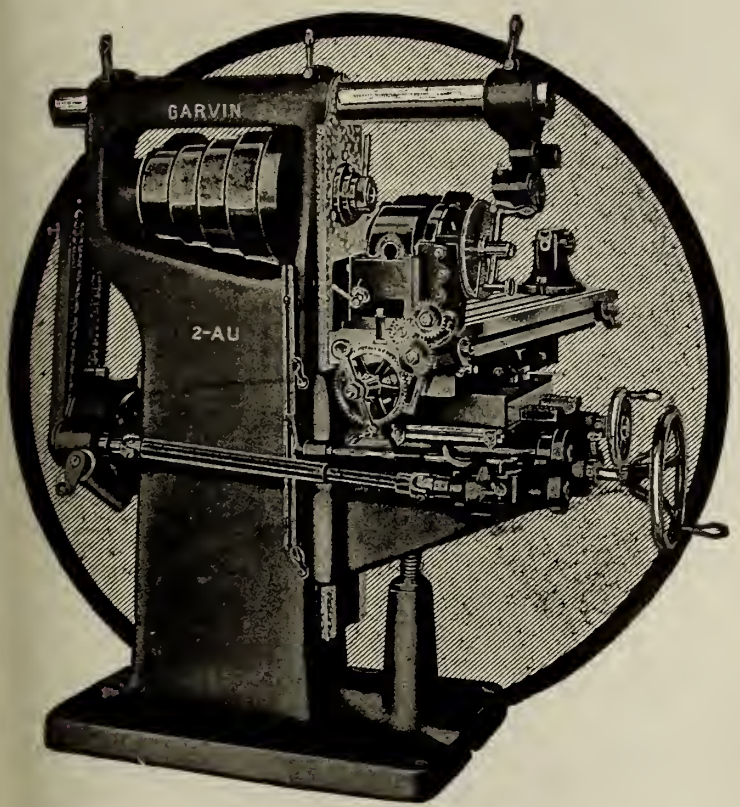

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GARVIN

BUILDER OF BETTER MACHINE TOOLS

If interested tear out this page and place with letters to be answered

BUYERS' DIRECTORY

ROLLER CHAINS
Can. Link-Belt Co., Toronto.
Jones & Glasseo, Montreal.
Lyman Tube & Supply Co., Montreal, Que

ROLLS, BENDING, STRAIGHTENING
John Bertram & Sons Co., Dundas.
Brown, Boggs Co., Ltd., Hamilton.
Can. Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto
Niles-Bement-Pond Co., New York.
Petrie Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo, O.

ROLLS CRUSHING
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

ROLLS AND TABLES
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Elec. Steel & Metals, Welland, Ont.

ROOFING
H. H. Robertson, Ltd., Sarnia, Ont.

ROPE, GALX, MONEL METAL.

BRONZE, TILLER AND SASH CORD
Can. Driver-Harris Co., Ltd., Walkerville

ROTARY SHEARS
The Quickwork Co., St. Mary's, Ohio.

ROOF COOLERS
Electric Steels & Metals, Ltd., Welland

ROLLING MACHINES, SHEET METAL
Manhattan Machine & Tool Co., Grand Rapids, Mich.

ROLLING MILL MACHINERY
Dom. Steel Products Co., Ltd., Brantford.
Mesta Machine Co., Pittsburgh, Pa.

ROLL LATHES
Mesta Machine Co., Pittsburgh, Pa.

ROLLS, BENDING, STRAIGHTENING
Manhattan Machine & Tool Co., Grand Rapids, Mich.

ROLLS, CRUSHING
Can. Link-Belt Co., Toronto.

RUBBER MOULDS AND CORES
Elliott & Whitehall, Galt, Ont.

RUBBER MILL DRIVES
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dom. Steel Products Co., Ltd., Brantford.
Can. Link-Belt Co., Toronto.

RUBBER MILL MACHINERY
Bertrams Ltd., Edinburgh, Scotland.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dom. Steel Products Co., Ltd., Brantford.

RUBBER MOULDS & CORES
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

RUBBER PRODUCTS, MECHANICAL
Dunlop Tire & Ruhber Goods Co., Ltd., Montreal

RUBBING BRICKS
Dominion Abrasive Co., Mimico, Ont.

RULES
Brown & Sharpe Mfg. Co., Providence.
James Chesterman & Co., Ltd., Sheffield
Rice, Lewis & Son, Toronto.
L. S. Starrett Co., Athol, Mass.

RULES, STEEL, STRAIGHT, AND FOLDING
Lufkin Rule Co. of Can., Windsor.

RULES, BOXWOOD, FOLDING
Lufkin Rule Co. of Can., Windsor.

RULES, BOARD AND LONG
Lufkin Rule Co. of Can., Windsor.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N.Y.

SAW MILL CONVEYORS
Can. Link-Belt Co., Toronto.
Petrie, Ltd., H. W., Toronto.

SAND MILLS
Frost Mfg. Co., Chicago, Ill.

SAND-BLAST EQUIPMENT
SAND BLAST SUPPLIES AND ACCESSORIES
Pangborn Corporation, Hagerstown, Md.

SAND BLAST ABRASIVES
Pangborn Corporation, Hagerstown, Md.

SAND MIXING MACHINERY
Frost Mfg. Co., Chicago, Ill.

SANITARY DRINKING FOUNTAINS
Puro Sanitary Drinking Fountain Co., Haydenville.

SANDING MACHINES
Canada Machinery Corp., Galt.

SAW MILL MACHINERY
Can. Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt.
Robert Gardner & Son, Montreal.
Curtis Pneumatic Machy Co St Louis
Hamilton Co., Ltd., Wm., Peterborough, Ont.
A. R. Williams Machy. Co., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

SASH SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

SAWS FOR EVERY USE
Atkins & Co., E. C., Hamilton, Ont.

SAWS, CIRCULAR METAL
Atkins & Co., E. C., Hamilton, Ont.
Wm. Atkins & Co., Ltd., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.
Plewes Ltd., Winnipeg, Man.
Simonds Mfg. Co., Fitchburgh, Mass.
Tabor Mfg. Co., Philadelphia, Pa.

SAWS, HACK (See Hack Saws)
SAW GUARDS
Atkins & Co., E. C., Hamilton, Ont.

SAWS, METAL, HACK AND BAND
Atkins & Co., E. C., Hamilton, Ont.

SAWS, SILVER STEEL
E. C. Atkins & Co., Inc., Indianapolis

SAW SHARPENERS
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Can., Galt, Ont.

SAWS, SLITTING
J. A. M. Taylor, Stair Bldg., Toronto.
Atkins & Co., E. C., Hamilton, Ont.
Elliott & Whitehall Machine and Tool Co., Galt, Ont.

SAWS — HIGH-SPEED FRICTION
Atkins & Co., E. C., Hamilton, Ont.

SAWS — PATTERN SHOP
Atkins & Co., E. C., Hamilton, Ont.

SAWS — SWING
Atkins & Co., E. C., Hamilton, Ont.

SCALES
Can. Kron Scale Co., Montreal, P.Q.

SCALES, MECHANICS'
Lufkin Rule Co. of Can., Windsor.

SCLEROSCOPES
Shore Instrument & Mfg. Co., New York.

SCREENING MACHINERY
Can. Link-Belt Co., Toronto.

SCREW EXTRACTORS
Cleveland Twist Drill Co., Cleveland.

SCREW MACHINES, HAND, AUTOMATIC
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Ltd., Toronto
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield.
A. B. Jardine & Co., Hespeler.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Warner & Swasey Co., Cleveland, O.
Wells Bros. of Can., Galt, Ont.
Wood Turret Mach. Co., Brazil, Ind.

SCREWS, MACHINE, SET, CAP AND SPECIAL
Galt Machine Screw Co., Galt.
John Morrow Screw & Nut Co., Ingersoll.
National Acme Co. Montreal.
Rice Lewis & Son, Toronto.
Steel Co. of Canada, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.

SCREW COLLARS
Galt Machine Screw Co., Ltd., Galt, Ont.
John Morrow Screw & Nut Co., Ingersoll.

SCREW MACHINES, PLAIN WIRE FEED
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.

SCREW PLATES
Butterfield & Co., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
A. B. Jardine & Co., Hespeler.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto.
J. A. M. Taylor, Stair Bldg., Toronto.
Wells Bros. of Can., Galt.
Wilkinson & Kompass, Hamilton.

SCREWS, SAFETY SET
Galt Machine Screw Co., Ltd., Galt, Ont.

SCREW SLOTTERS
Butterfield & Co., Inc., Rock Island, Que.
Garvin Machine Co., New York.
National Acme Co., Cleveland, O.
Pratt & Whitney Co., Dundas, Ont.

SEPARATORS, MOISTENERS AND OIL FOR COMPRESSED AIR
Pangborn Corporation, Hagerstown, Md.

SELF-OPENING DIES
See Dies.

SEPARATORS, SAND
Pangborn Corporation, Hagerstown, Md.

SET SCREWS, SAFETY
Aikenhead Hardware Co., Toronto.
Bristol Co., Waterbury, Conn.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wilkinson & Kompass, Hamilton.

SHANKS, STRAIGHT AND TAPER
Jacobs Mfg. Co., Hartford, Conn.

SHAPERS
Barber Mchy. Co., Ltd., Toronto, Ont.
John Bertram & Sons Co., Dundas.
Can. Fairbanks-Morse Co., Montreal.
Canadian Machinery Corp., Galt.
Geo. F. Foss Mchy. & Sply. Co., Montreal
Robt. Gardner & Son, Montreal.
Garlock-Walker Mach'y. Co., Toronto.
Hendey Machine Co., Torrington, Conn.
Milwaukee Shaper Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto.
Rae Mach. Tool Co., Hamilton.
Standard Equipment & Tool Wks., Montreal.
Walcott Lathe Co., Jackson, Mich.
Williams Mchy Co., A. R. Toronto, Ont.

SHAPERS, GEAR
Fellows Gear & Shaper Co., Springfield, V.
Knigh Metal Products, Toronto.

SHAFTING
Algoma Steel Corp., Sault Ste. Marie, O.
Can. Fairbanks-Morse Co., Montreal.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Jones & Glasseo, Montreal.
Niles-Bement-Pond Co., New York.
Can. Drawn Steel Co., Hamilton.
Peckovers, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas.
Rice, Lewis & Son, Toronto.
A. R. Williams Machy. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

SHARPENING STONES
Norton Co, Worcester, Mass.
Rice, Lewis & Son, Toronto.

SHEARING MACHINES, ANGLE IRON, BAR AND GATE
John Bertram & Sons Co., Dundas.
Bertrams Ltd., Edinburgh, Scotland.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
A. B. Jardine & Co., Hespeler, Ont.
Long & Allstatter Co., Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo, O.

SHEARS, POWER
John Bertram & Sons Co., Dundas.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton.
Can Blower & Forge Co, Kitchener.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Long & Allstatler, Hamilton, Ohio.
A. B. Jardine & Co., Hespeler, Ont.
National Machy. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
H. D. Stoll Co., Inc., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Williams, White & Co., Moline, Ill.
Williams Mchy Co., A. R., Toronto, Ont.

SHEARS, ROTARY
The Quickwork Co., St Mary's, Ohio.

SHEARS, PNEUMATIC
Toledo Machine & Tool Co., Toledo, Ohio

SHEARS, PLATE CUTTING, SLITTING
Dom. Steel Products Co., Ltd., Brantford.
Quickwork Co., St. Mary's, Ohio.

SHEARS, SPLITTING
Dom. Steel Products Co., Ltd., Brantford.

SHEARS, IRREGULAR AND CIRCLE CUTTING
The Quickwork Co., St. Mary's, Ohio.
D. H. Stoll Co., Inc., Buffalo, N.Y

SHEARS, SERPENTINE
The Quickwork Co., St. Mary's, Ohio.

SHEARS, SQUARING
Brown, Boggs & Co., Hamilton, Ont.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEET METAL WORKING MACHINERY
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEET METAL WORKING TOOLS
Baird Machine Co., Bridgeport, Conn.
Barber Mchy. Co., Ltd., Toronto, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton.
Peck, Stow & Wilcox Co., Southington, C.
Petrie, Ltd., H. W., Toronto.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEETS, CRUCIBLE, CAST
British Smelting & Refining Co., Ltd., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.

SHEETS, BLACK AUTO AND GALVANIZED
Peckovers, Ltd., Toronto, Ont.

SHEETS, NICKEL, RESIST. ALLOY
Can. Driver-Harris Co., Ltd., Walkerville.

SHELVING, STEEL
Dennis Wire & Iron Works, London.

SHIPYARD MACHINERY, SHOP FURNITURE
Dennis Wire & Iron Works, London.

SIDE TOOLS
Armstrong Bros. Tool Co., Chicago.
J. H. Williams & Co., Brooklyn, N.Y.

SILENT CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glasseo, Montreal.

SLEDGES
Aikenhead Hardware Co., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont

SLEDGES, CAST IRON
Katie Foundry, Galt, Ont.

SLICING CLAMPS
Peck, Stow & Wilcox Co., Southington Conn.

SLINGS, CHAINS
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

SLOTTERS
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
National-Acme Co., Cleveland, Ohio.
Niles-Bement-Pond Co., New York.

SMOKESTACKS
Williams Hamilton Co., Peterboro, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

SNIPS, TINNERS AND SHEET METAL WORKERS
Kearney & Trecker Co., Milwaukee, Wis.
J. Morrow Screw & Nut Co., Ingersoll, Ont.

SOCKETS
Brown & Sharpe Mfg. Co., Providence.
Butterfield & Co., Inc., Rock Island, Que
Cleveland Twist Drill Co., Cleveland.
Keystone Mfg. Co., Buffalo, N.Y.
Modern Tool Co., Erie, Pa.
J. Morrow Screw & Nut Co., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

SOIL PIPE FITTINGS, CAST IRON
Katie Foundry, Galt, Ont.

SOLDERING IRONS
Aikenhead Hardware Co., Toronto, Ont.
Brown, Boggs & Co., Hamilton, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.

SOLDER
British Smelting & Refining Co., Ltd., Montreal, Que.
Aikenhead Hardware Co., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Tallman Brass & Metal Co., Hamilton.

SPELTER
British Smelting & Refining Co., Ltd., Montreal, Que.

SPEED REDUCING GEARS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glasseo, Montreal.

SPRINGS, MACHINERY
Barnes, Wallace Co., Bristol, Conn.
Can. Steel Foundries, Ltd., Montreal.
Cleveland Wire Spring Co., Cleveland.
Dunbar Bros. Co., Bristol, Conn.
Garlock-Walker Machinery Co., Toronto.

SPECIAL MACHINERY
Baird Machine Co., Bridgeport, Conn.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram, John, & Sons Co., Dundas.
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada
Brown Engineering Corp., Toronto, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
Globe Engineering Co., Ltd., Hamilton.
John H. Hall & Sons, Brantford.
Hamilton Co., Ltd., Wm., Peterborough,
A. B. Jardine & Co., Hespeler, Ont.
Katie Foundry, Galt, Ont.
Ker & Goodwin Machine Co., Ltd., Brantford, Ont
McCrosky Tool Corp., Meadville, Pa., U. S. A.
National-Acme Co., Cleveland, Ohio.
Mesta Machine Co., Pittsburgh, Pa
Rae Mach. Tool Co., Hamilton.
Stoll Co., D. H., Buffalo, N.Y.
Victoria Foundry Co., Ottawa, Ont.
William R. Perrin, Ltd., Toronto.

SPECIAL TOOLS, MACHINERY
Crescent Machine Co., Ltd., Montreal Que.
McClean Machine & Tool Co., Ltd. Hamilton, Ont.
Hoggson & Pettis Mfg. Co., New Haven Conn.

SPOT FACERS, INTERCHANGEABLE
Eclipse Counterbore Co., Ltd., Walkerville, Ont.

SPRING COILING AND WINDING MACHINERY
Baird Machine Co., Bridgeport, Conn.
Garvin Machine Co., New York.

SPRING MAKING MACHINERY (AUTOMATIC)
Baird Machine Co., Bridgeport, Conn.

SPRINGS, SPIRAL, TOOL
The Dunbar Bros. Co., Bristol, Conn.

SPRINGS STEEL
Barnes Co., Wallace, Bristol, Conn.

SPROCKETS, COMPENSATING
Morse Chain Co., Ithaca, New York.

SPROCKETS, SPRING
Morse Chain Co., Ithaca, New York.

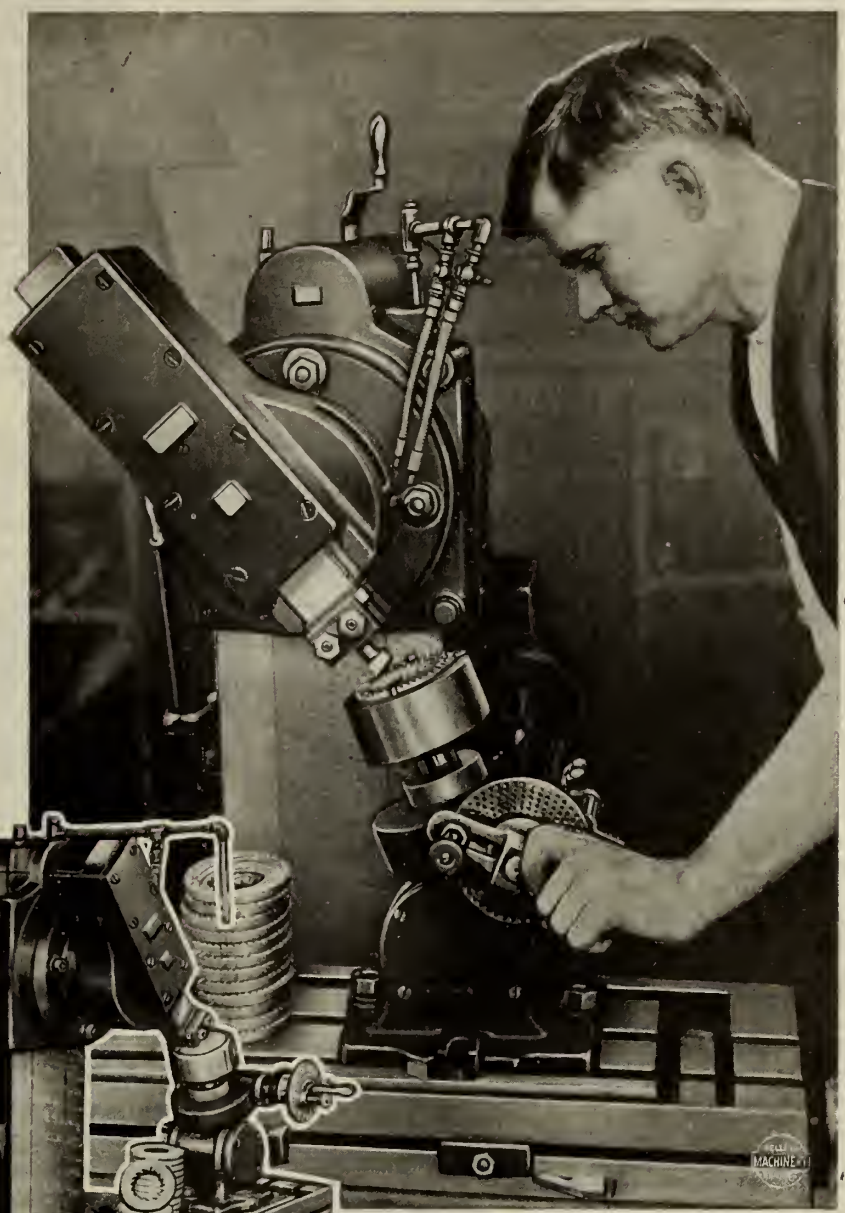
SPROCKETS, CHAIN
Can Link-Belt Co., Toronto, Ont.
Grant Gear Works, Boston, Mass.
Jones & Glasseo, Montreal.
Lyman Tube & Supply Co., Montreal, Q
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia

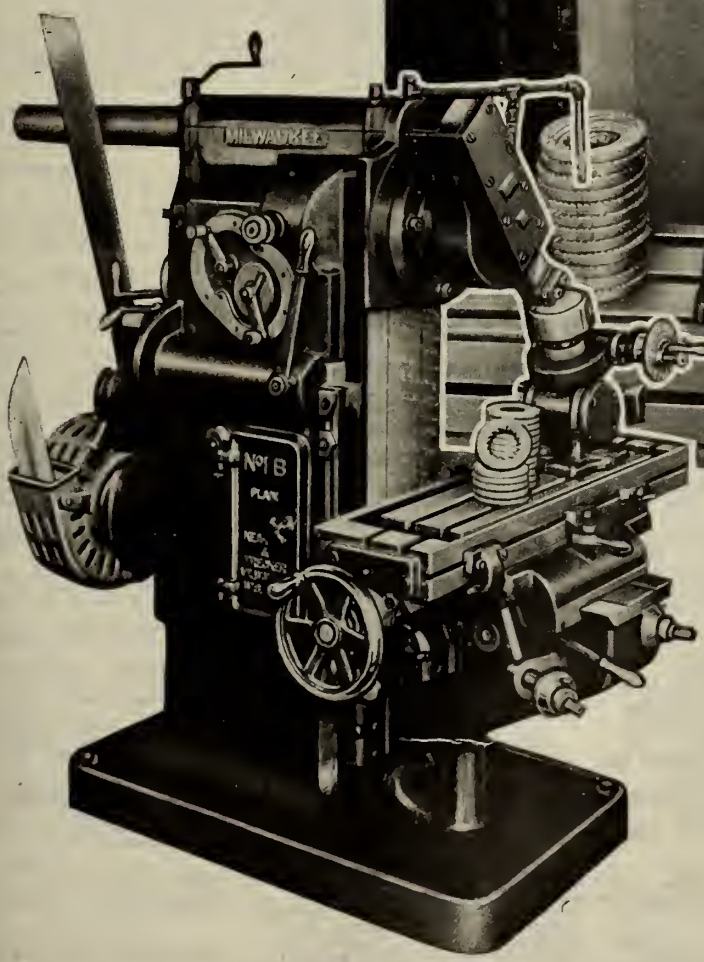
SPRINGS FOR TOYS AND ELECTRIC DEVICES
The Dunbar Bros. Co., Bristol, Conn.

SPROCKET WHEELS, CAST
Can. Link Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Ltd., Montr

MILWAUKEE MILLING MACHINES

Making Good Use of the Milwaukee Slotting Attachment





The piece is a coffee mill burr which has fourteen teeth, or slots, cut at an angle in the central opening. Material is .20 per cent. carbon drop forged steel.

The slotting attachment is swung to the proper angle and the slots are cut one at a time. Slots are 7/16″ wide, ⅜″ deep, ½″ long. Cutter makes 60 strokes per minute. Limits are plus or minus 0.002.

It will be noticed that the machine is an old, single overarm one; all latest models have the double overarm. Write for catalog showing present styles.

KEARNEY & TRECKER CO. MILWAUKEE, WIS. U.S.A.

If interested tear out this page and place with letters to be answered

SAFETY CYLINDERS
Oliver Mach. Co., Grand Rapids, Mich.

SANDERS
Oliver Mach. Co., Grand Rapids, Mich.

SAW BENCHES
Oliver Mach. Co., Grand Rapids, Mich.

SAW GUARDS
Oliver Mach. Co., Grand Rapids, Mich.

SAWS SWING
Oliver Mach. Co., Grand Rapids, Mich.

STAYBOLT TOPS
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

STAIRS, IRON
Canada Wire & Iron Goods Co., Hamilton, Ont.

STAMPINGS, SHEET BRASS, COPPER, ALUMINUM AND STEEL
Dom. Forge & Stamping Co., Walkerville
Globe Engineering Co., Hamilton, Ont.
Hosmer & Wilson, Hamilton, Ont.

STAMPING MACHINERY
Niles Co., E. W., Brooklyn, N.Y.
Brown, Boggs, & Co., Hamilton, Can.
Canada Machinery Corp., Galt, Ont.
Matthews, Jas. H & Co., Hartford, Conn.

SAFETY CYLINDERS
Oliver Mach. Co., Grand Rapids, Mich.

STEAM APPLIANCES
Darling Bros., Ltd., Montreal, Quebec.

STEAM SEPARATORS AND TRAPS
Can. Fairbanks-Morse Co., Montreal.

STEAM HOISTING ENGINES
Canadian Mead-Morrison Co., Limited, Montreal, Que.

STEAM TURBINES
General Combustion Co., Ltd., Montreal, Que.
Sturtevant Co., B. F., Galt, Ont.

STEEL BALLS
See Balls Steel.

STEEL, CRUCIBLE TOOL
Atkins & Co., Ltd., Wm. Sheffield, Eng.
Baines & David, Toronto.
Wingworth Steel Co., John, New York.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.

STEEL, CARBON, FERRO-TUNGSTEN
Armstrong, Whitworth of Can., Montreal
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Baines & David, Toronto.
Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Latrobe Electric Steel Co., Latrobe, Pa
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
Marshall, Son & Bunney, Toronto.
Peckovers, Ltd., Toronto, Ont.
Samuel Osborne (Can.), Ltd., Montreal.
Vanadium-Alloys Steel Co., Pittsburgh

STEEL CHROME VANADIUM
Kayser-Ellison & Co., Ltd., Montreal.
Norton, Ralph B., Agent, Montreal.
Atkins & Co., Ltd., Wm. Sheffield, Eng.
Marshall, Son & Bunney, Toronto.

STEEL CHROME NICKEL
Firth & Sons, Ltd., Thos., Montreal,
Kayser-Ellison & Co., Ltd., Montreal.
Lyman Tube & Supply Co., Ltd., Montreal
Norton, Ralph B., Agent, Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.

STEEL CASTINGS
Can. Elec. Steel Casting Co., Aurora, Ont
Davidson Mfg. Co., Ltd., Montreal, Que.
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Dom. Iron & Steel, Sydney, N.S.
Joliette Steel Co., Montreal, Que.
Kennedy & Sons, Wm., Owen Sound
Electric Steel & Metals Co., Welland.
Nova Scotia Steel & Coal Co., Windsor.
Swedish Crucible Steel Co., Windsor.

STEEL, COLD ROLLED
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Drawn Steel Co., Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co. Ltd., Montreal.
Union Drawn Steel Co., Hamilton, Ont.

STEEL FJAB
Lincoln Electric Co., of Canada, Ltd., Toronto, Ont.

STEEL, NICKEL
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.

STEEL, HIGH SPEED
Armstrong-Whitworth of Can., Montreal
Baines & David, Toronto.
Wm. Atkins & Co., Sheffield, Eng.
Can. Fairbanks-Morse Co., Montreal
Deloro Smelting & Refining Co., Ltd. Toronto, Ont.
H. A. Drury Co., Ltd., Montreal.
Firth & Sons, Thos., Montreal, Que.
Wingworth Steel Co., J., New York.
Kayser Ellison & Co., Sheffield, Eng.
Latrobe Electric Steel Co., Latrobe, Pa
Marshall, Son & Bunney, Toronto, Ont.
Osborne, Samuel, Montreal, P.Q.
Plewes, Ltd, Winnipeg, Man.
Pilot Steel & Tool Co., Montreal, Que.
Ralph B. Norton, Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co., Ltd., Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL, CHROME, MANGANESE
Joliette Steel Co., Montreal, Que.

STEEL, OPEN HEARTH
Illingworth Steel Co., John, New York.

STEEL PLATES
Dominion Foundries & Steel Ltd., Hamilton, Ont.

STEEL PRODUCTS AND MACHINERY
Dom. Steel Products Co., Ltd., Brantford

STEEL, ROCK DRILL
Armstrong, Whitworth of Canada, Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.

STEEL, SPRING AND REINFORCING
Peckovers, Ltd., Toronto, Ont.

STEEL, STRUCTURAL
Algoma Steel Corp., Sault Ste. Marie
Dom. Iron & Steel Co., Sydney, N.S.
MacKinnon Steel Co., Sherbrooke, Que.
Peckovers, Ltd., Toronto, Ont.

STEEL, TOOL
Armstrong, Whitworth of Can., Montreal
Atkins & Co., Wm., Sheffield, Eng.
Baines & David, Toronto.
Can. Fairbanks-Morse Co., Montreal.
Drury Co., H. A., Montreal, Que.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.
Firth & Sons, Thos., Montreal, Que.
Hawkridge Bros. Co., Boston, Mass.
Kayser-Ellison & Co., Ltd., Montreal.
Lincoln Electric Co., of Canada, Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Ltd., Montreal
Marshall, Son & Bunney, Toronto, Ont.
Latrobe Electric Steel Co., Latrobe, Pa.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son Toronto, Ont.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL TUBING
Tube Co. of Canada, Ltd., Toronto, Ont.

STEEL, VANADIUM
Wm. Atkins & Co., Ltd., Sheffield, Eng.
Armstrong, Whitworth of Can., Montreal.
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Drury, H. A., Co., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.
Wells Bros. of Can., Galt, Ont.

"STELLITE"
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.

STOCK RACKS FOR BARS, PIPING, ETC.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

STOCKS AND DIES
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros., of Can., Galt, Ont.

STOCKS, PIPE
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Wells Bros., Co., of Canada, Galt, Ont.

STONES, COMMUTATORS
Lyman Tube & Supply Co., Ltd., Montreal

STRAIGHTENING MACHINERY
Baird Machinery Co., Bridgeport, Conn.
Bertrams, Ltd., Edinburgh, Scotland.

STRAND
Dom. Steel Products Co., Ltd., Brantford.
Page Steel & Wire Co., Adrian, Mich.

SURFACE PLATES
Brown & Sharpe Mfg. Co., Providence, R.I.

STRUCTURAL STEEL WORKS
William Hamilton Co., Peterboro, Ont.

SWITCHBOARDS
Northern Electric Co., Ltd., Montreal Que

SWITCHES, RAILWAY
Can. Steel Foundries, Ltd., Montreal.

TABLES, DRAWING
Economy Drawing Table Co., Adrian, Mich.

TABLES, SAND-BLAST
Pangborn Corporation, Hagerstown, Md.

TAPPING MACHINES (PNEUMATIC)
Cleveland Pneumatic Tool Co., Toronto.

TANKS, AIR, EXPANSION
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, GASOLINE, KEROSENE AND OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. John Wood Mfg. Co., Ltd., Toronto
Dominion Bridge Co., Montreal, Que.
Dom. Forge & Stamping Co., Walkerville.
MacKinnon Steel Co., Sherbrooke, Que.
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Greenfield Tap & Die Corp., Greenfield.
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Greenfield Tap & Die Corp., Greenfield.
Ingersoll Mach. Co., Ingersoll, Ont.
Jardine & Co., A. B., Hespeler, Ont.
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Morse Twist Drill & Mchy. Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit.
Pratt & Whitney Co., Dundas, Ont.
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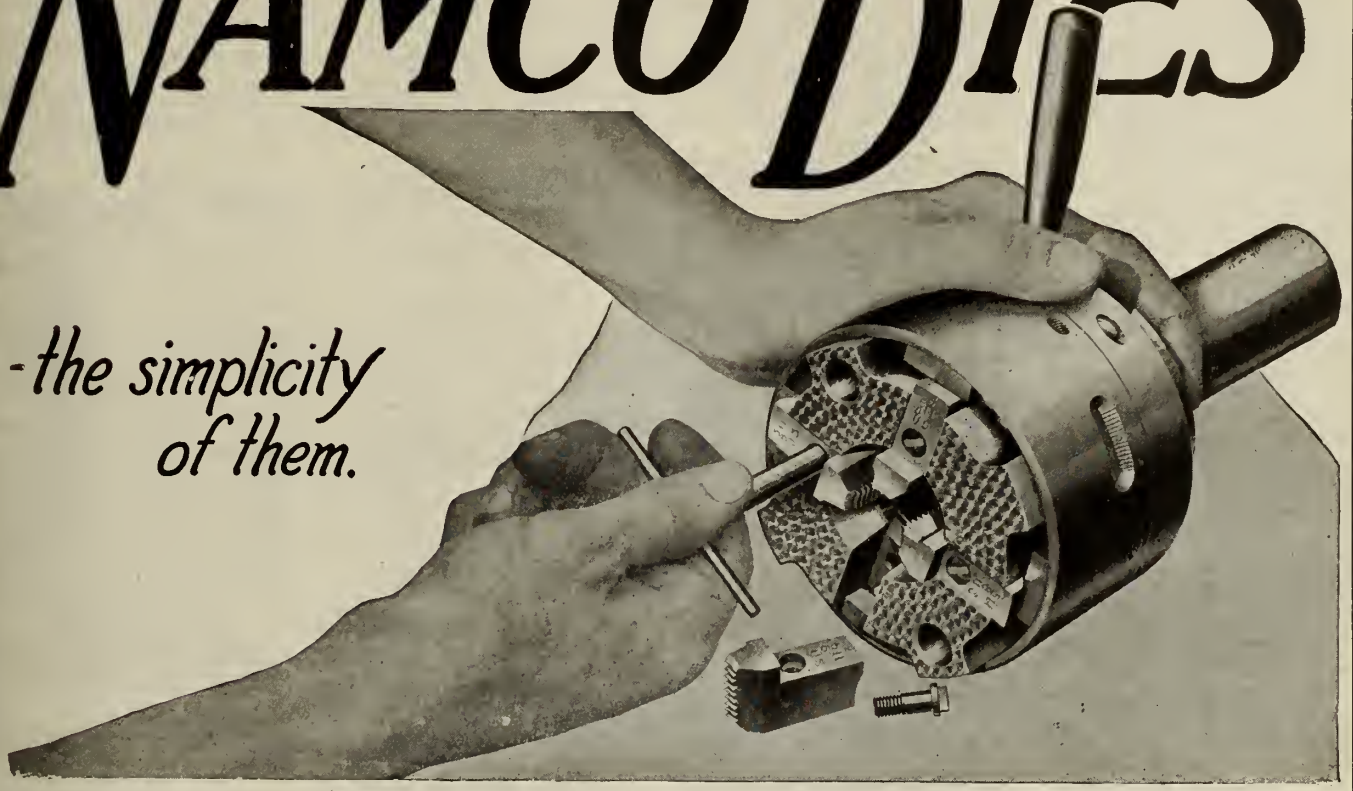

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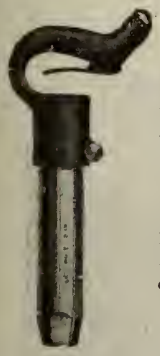

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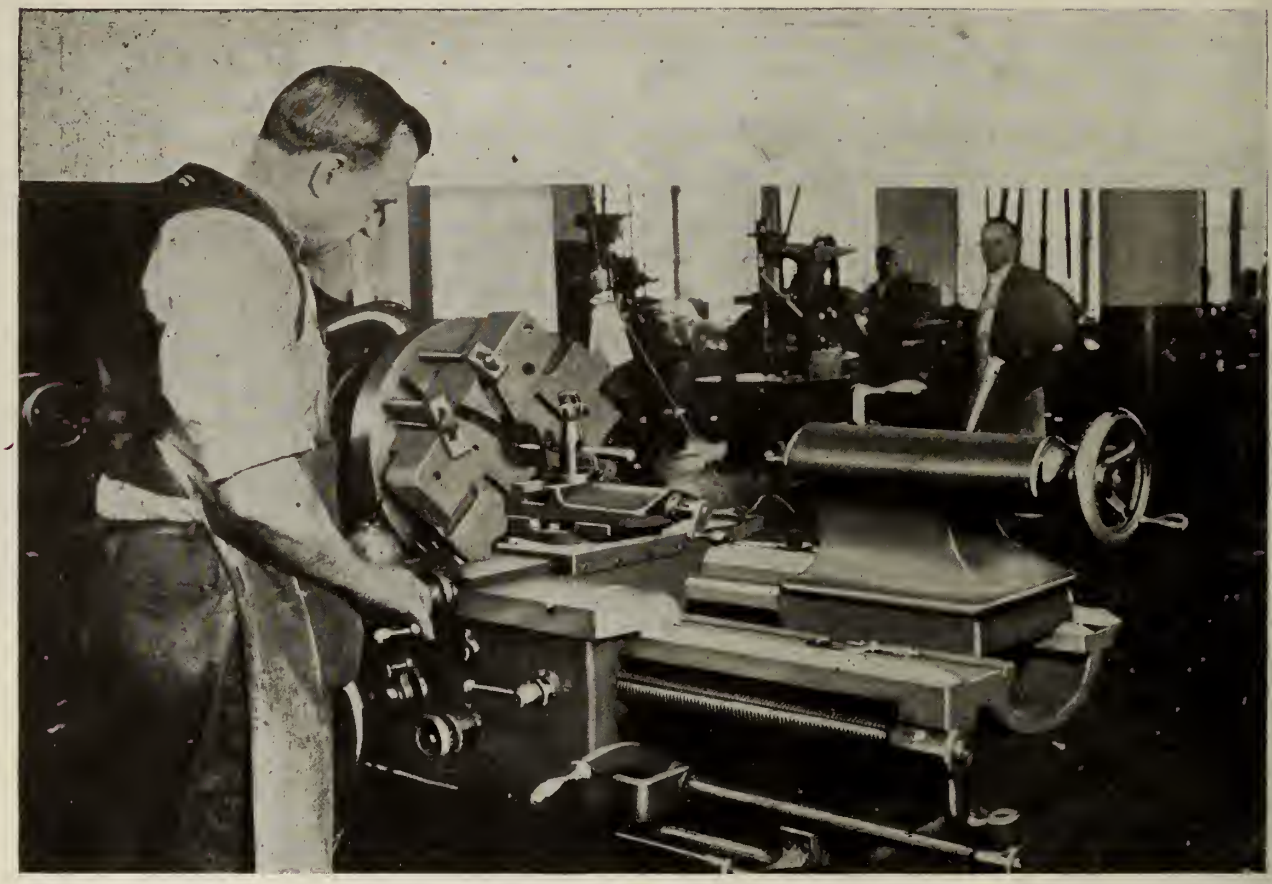

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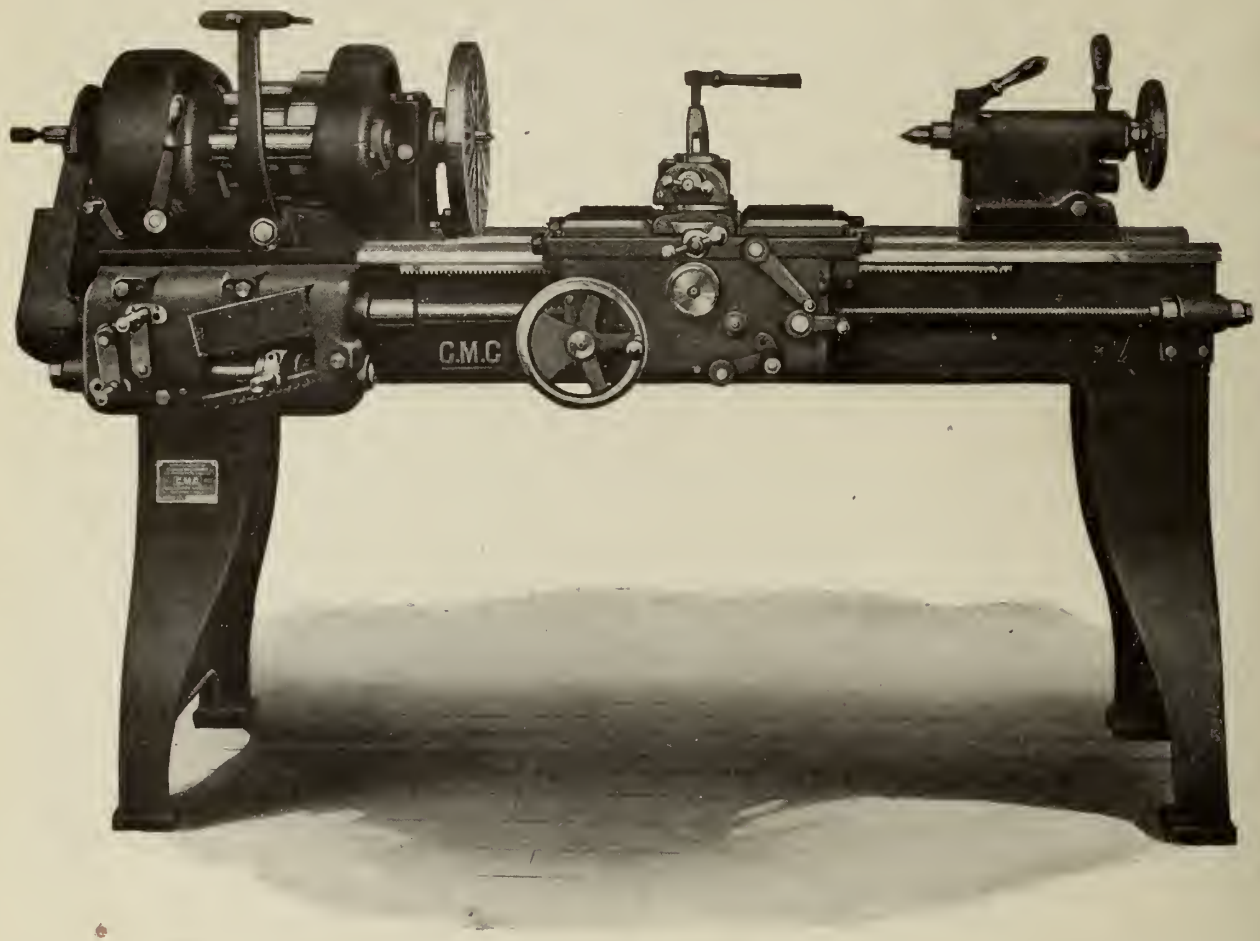

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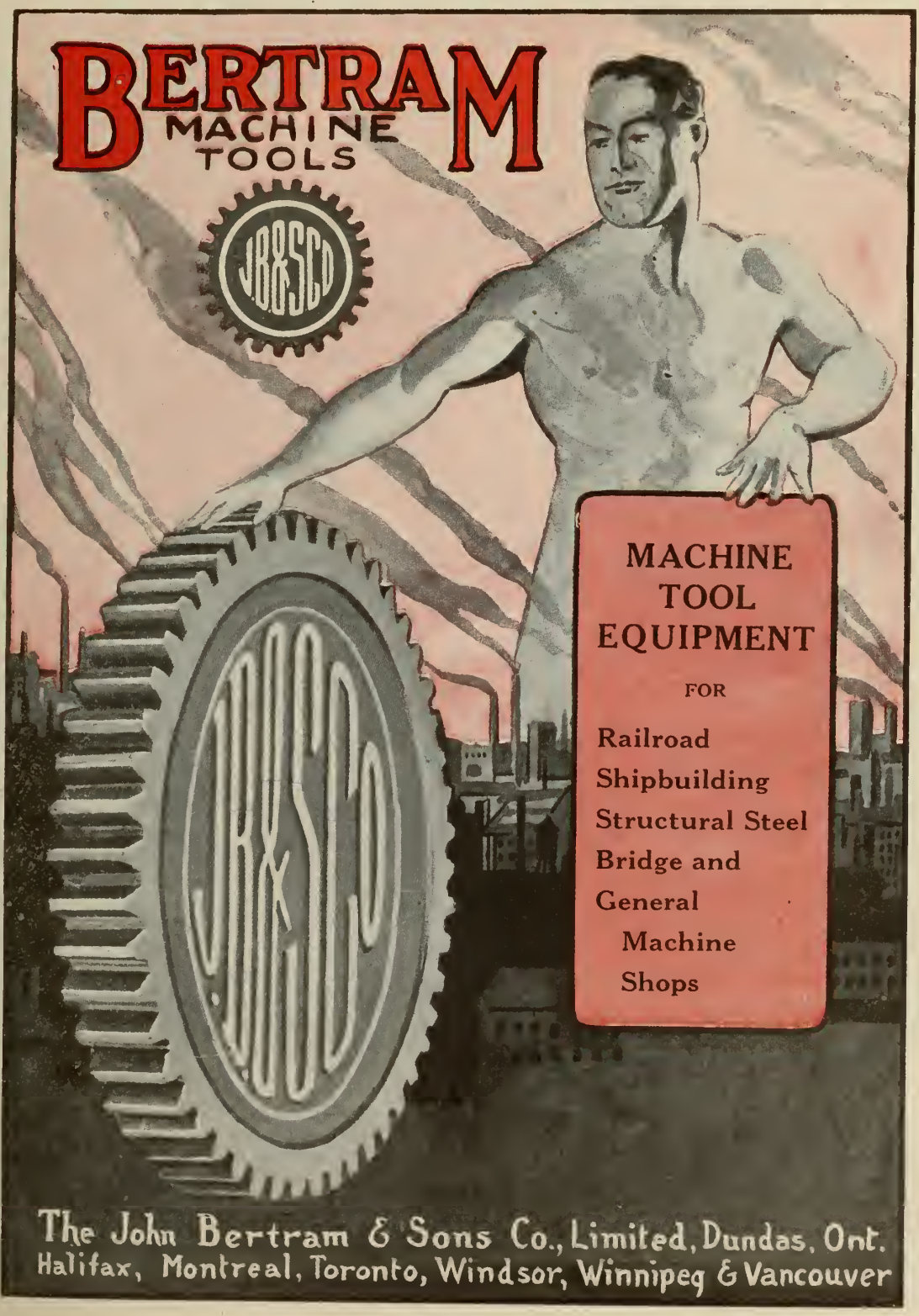

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The BERTRAM Page

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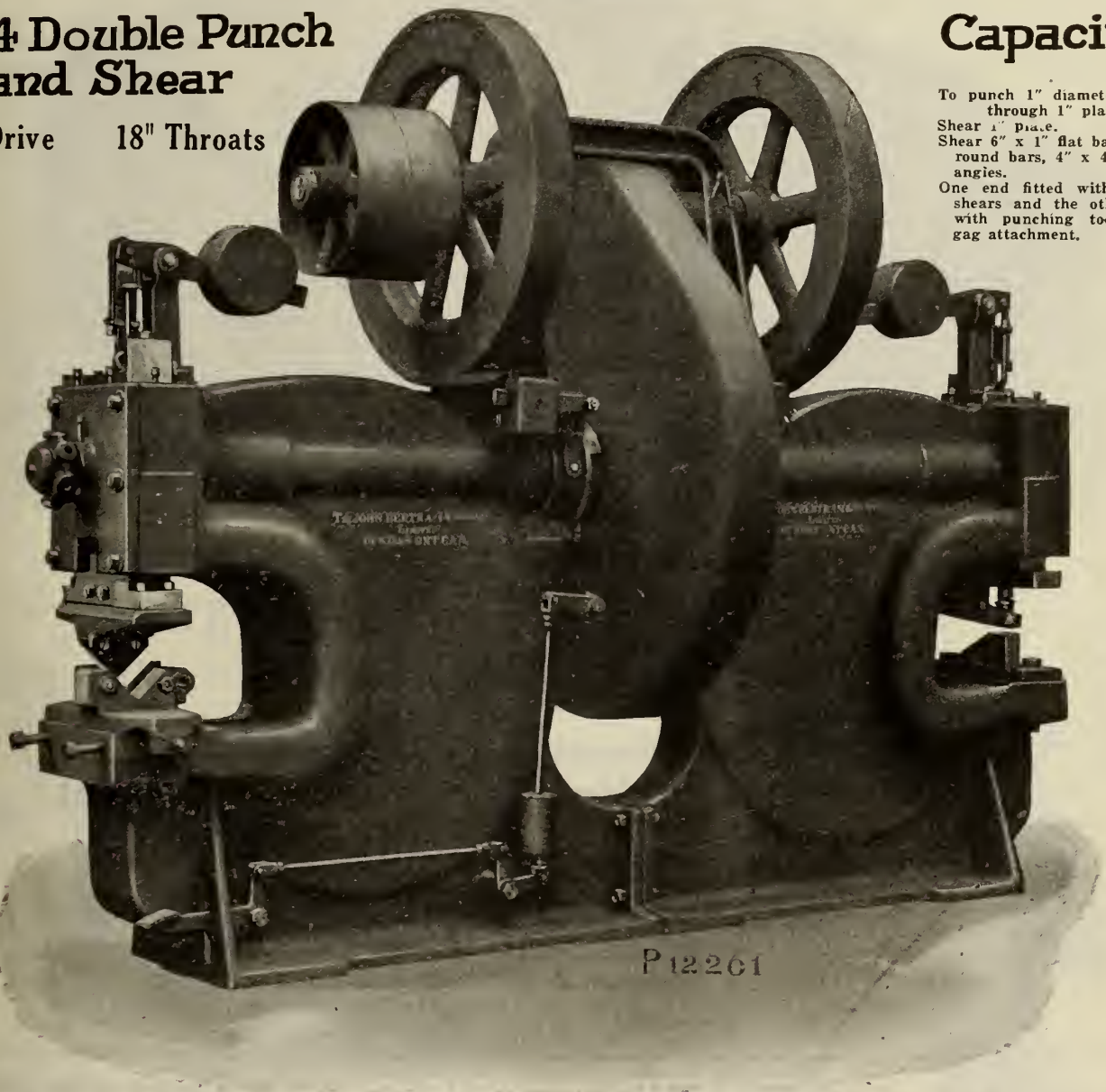

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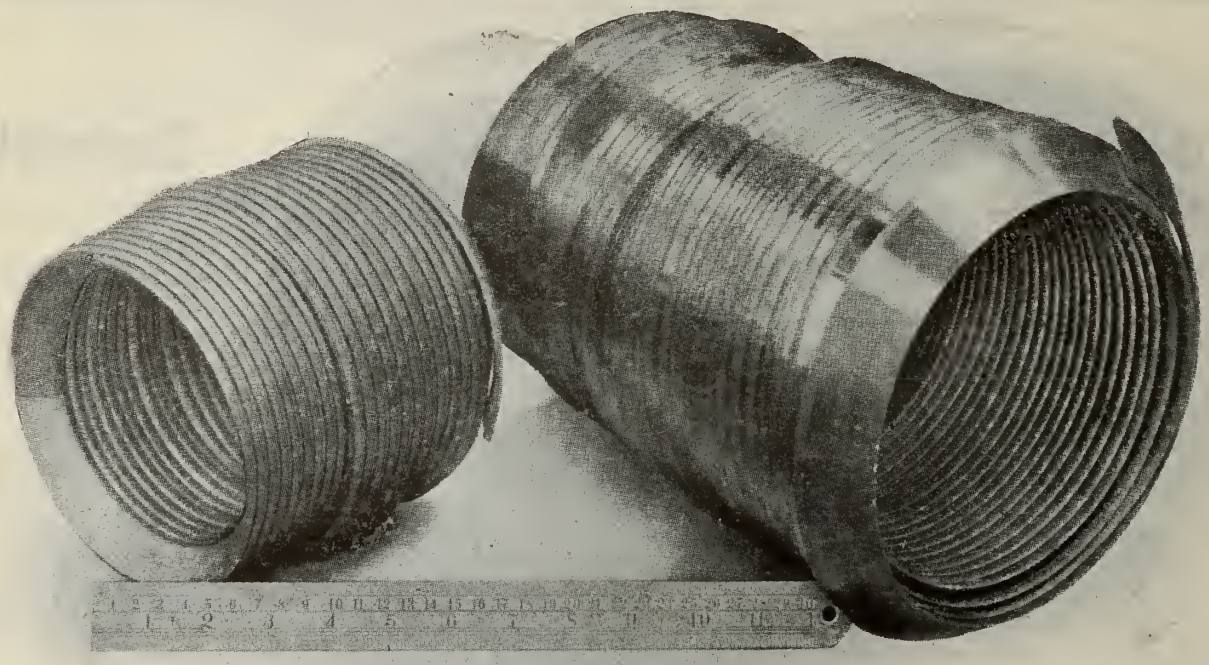

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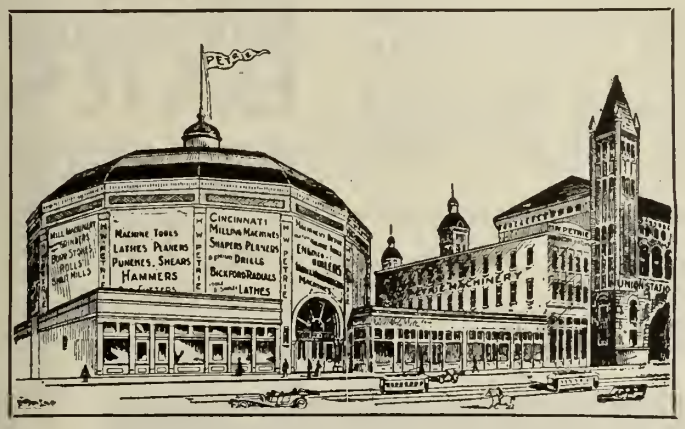

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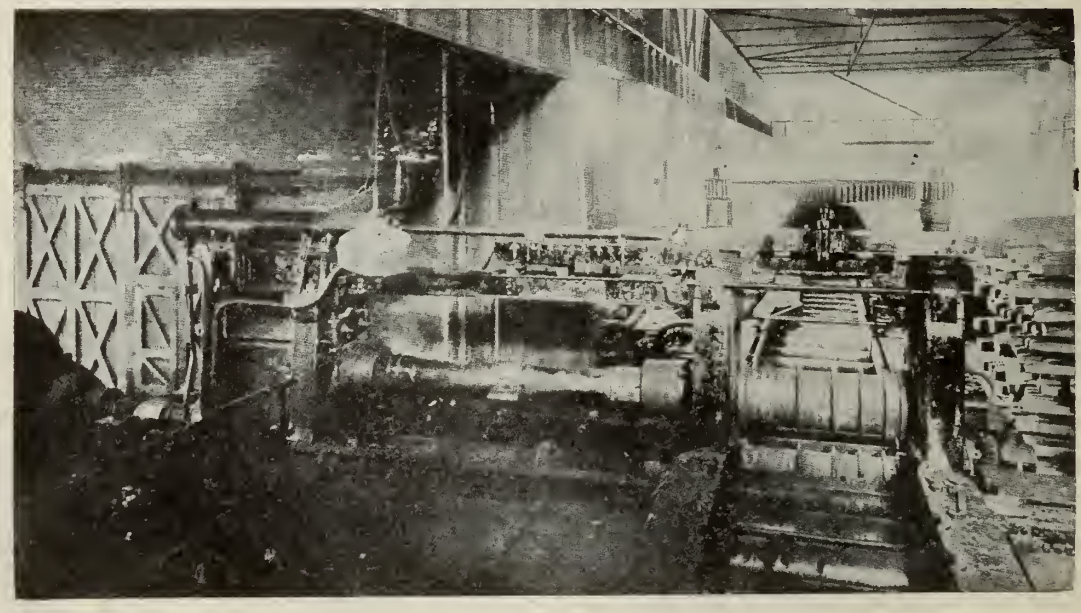

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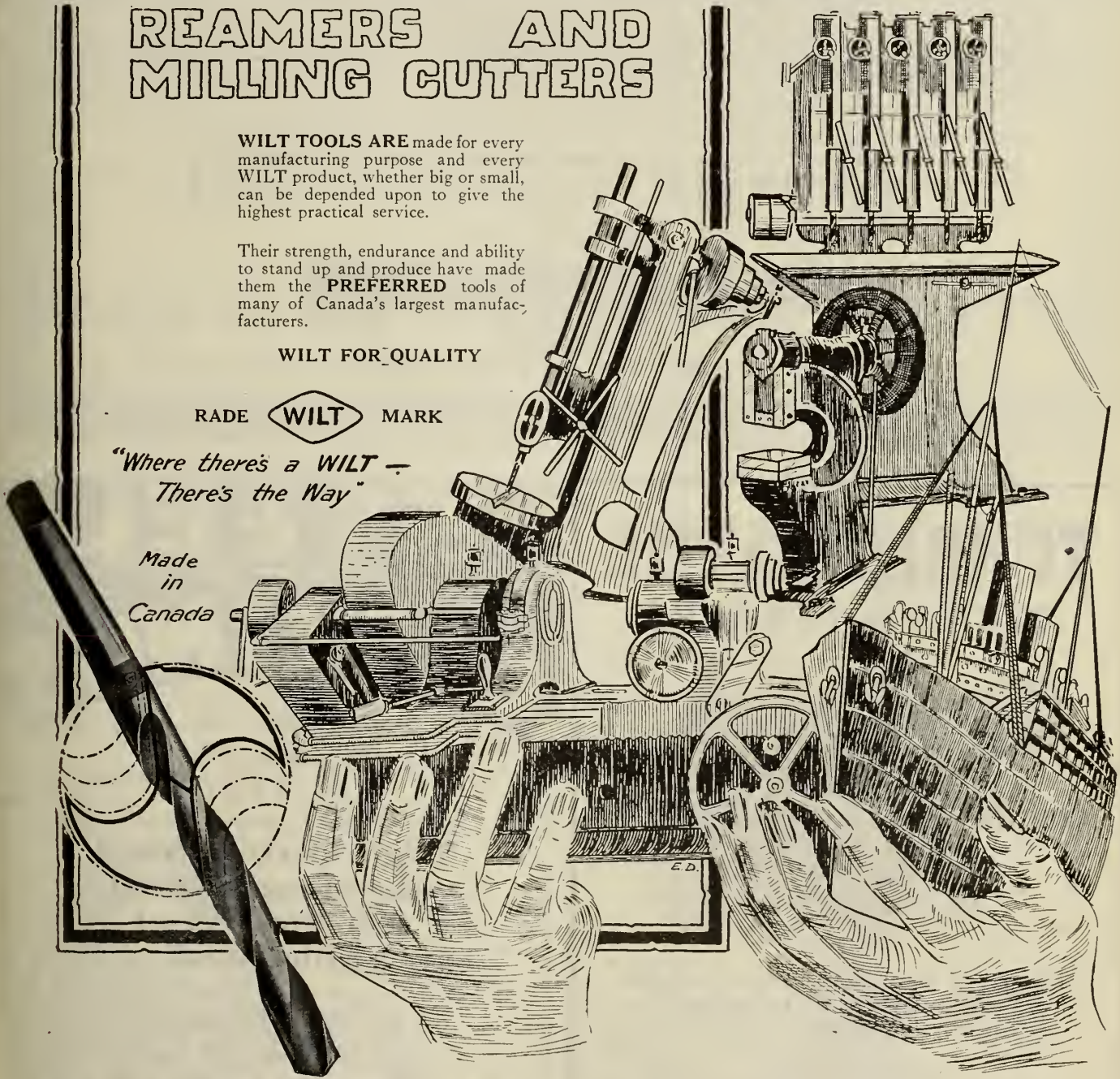

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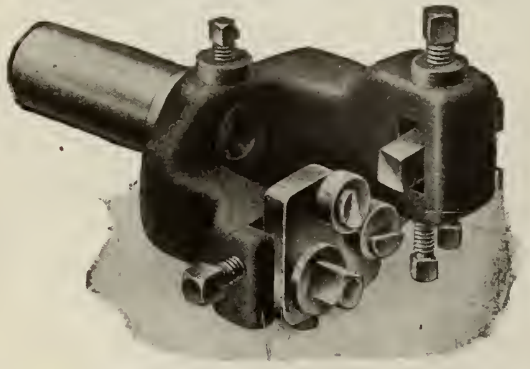

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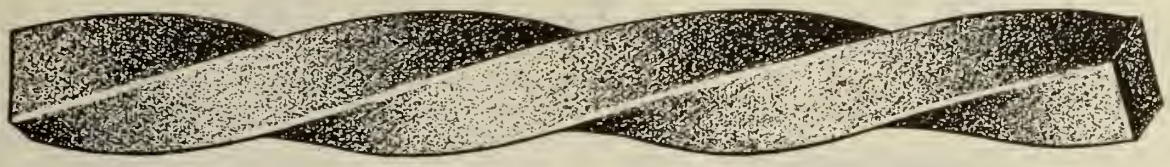

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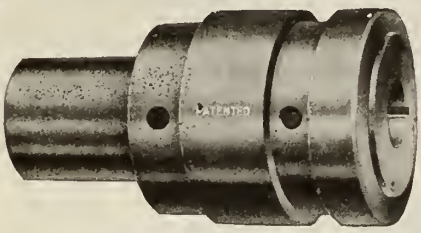

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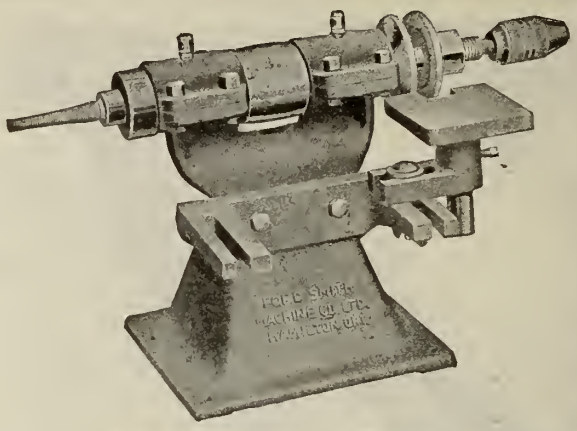

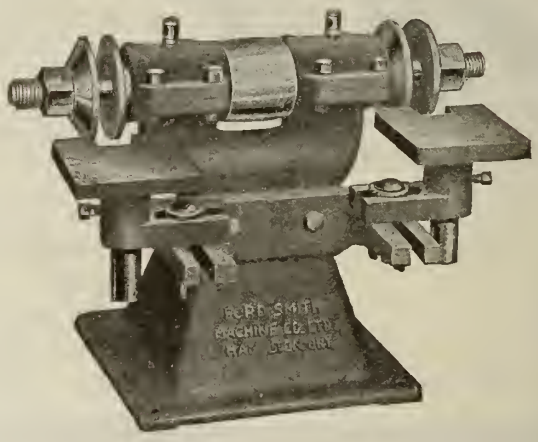

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It handles work either singly or in multiples within the capacity of the chuck and not thicker than 6-in., and grinds within quarter thousand in. of manufacturing accuracy.

And it is built to last.

It is provided with exceptionally long bearings throughout, especially in the back column. This prevents the wear, which is very slight, from affecting the accuracy of the grinder. The Back Column is made to swivel four degrees, which allows concave or convex grinding.

Bristol Rotary Surface Grinders are made in several types and sizes and are regularly equipped with 8-in., 12-in., and 16-in. magnetic chucks, either belt or motor driven and for dry or wet grinding.

Our Bulletin describes the many good points fully. Send us your name and address and we'll gladly mail you one.

Grinds within .0004 in. of absolute Accuracy

BRISTOL MACHINE TOOL CO.
SUCCESSORS TO C. G. GARRIGUS MACH. CO.
BRISTOL, CONN.

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15 TON PRESS

A Simpler Hydro-Pneumatic Press

Complications in the construction of our High Speed Hydro-Pneumatic Press are so few that its operation is more readily understood than that of a more intricate machine.

Straightening, Forcing, Broaching

Particularly adapted for straightening cam, crank, pinion and wheel shafts, axle tubes, pinion tubes, assembling differential housings, assembling bearings in hubs, bushings in spindles and wheel rims, testing springs front and rear, broaching brake levers.

EASTERN PRODUCTION COMPANY

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Branch: 120 Wisconsin St., Milwaukee, Wis.

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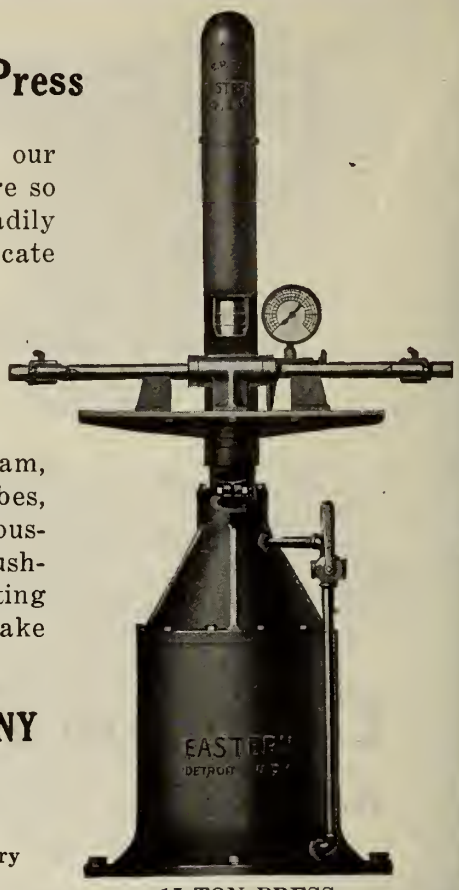

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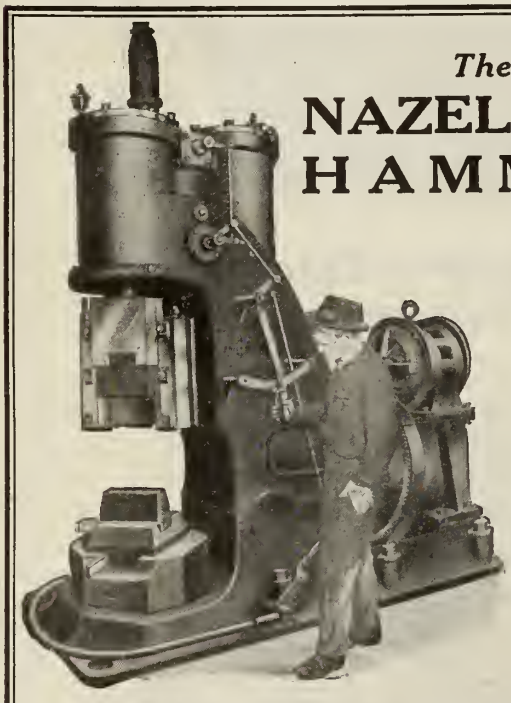
The

NAZEL AIR HAMMER



NOTED FOR ITS BLOW AND CONTROL

A self-contained unit, built in three types, six sizes, arranged for belt or direct motor drive, with capacities up to 7-inch square, for all manner of jobbing, manufacturing and certain classes of die forging.

Write for catalogue.

NAZEL ENGINEERING & MACHINE WORKS

DEPARTMENT F

PHILADELPHIA, Penna.

Manufacturers:

The Sheffield Twist Drill & Steel Co.

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HIGH SPEED TWIST DRILLS

High-class Drills with IRRESISTIBLE PIERCING FUNCTIONS that stand the WEAR and TEAR — in other words, the DRILLS that are EFFICIENT and ECONOMICAL — are the DRILLS with the "DORMER" Brand.

We are manufacturing SPECIALISTS—Carry large STOCKS — Give PROMPT deliveries, and rely upon our products for REPEATS.

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ALL SIZES
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Crucible
AND
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"ARGO" BRAND *HIGH-SPEED* STEEL

The John Illingworth Steel Co.
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New York Office 217 Broadway

RALPH B. NORTON, AGENT
124 Craig St. W.
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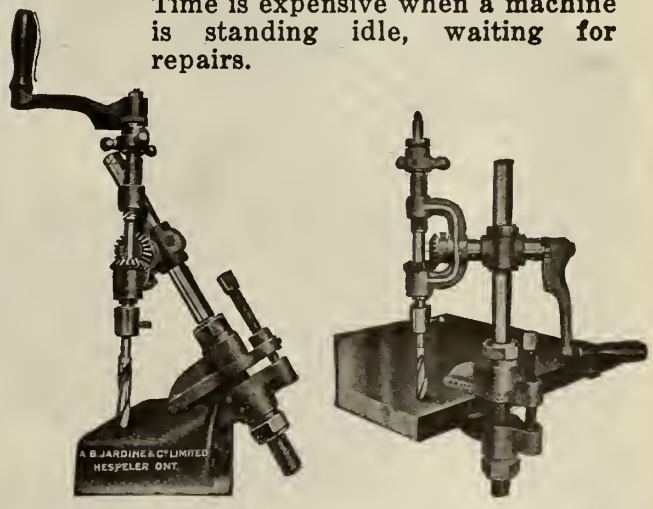
Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.



On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

Weight, 40 lbs. Price, $26.50 net.
Sold by all Machinery and Supply Houses

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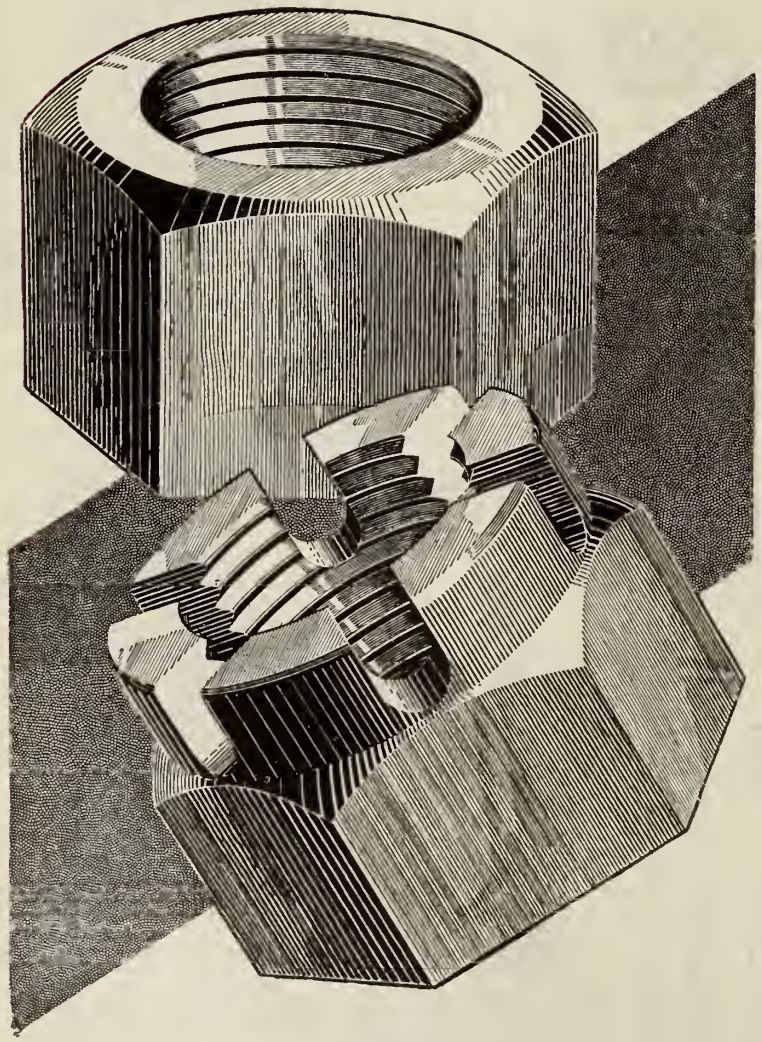

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V. U.S.S. and S.A.E. Cap Screws

V. and U.S.S. Set Screws

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SPECIAL

Screw machine product up to 2¼" diameter to customers' specifications.

Owing to the market shortage of raw material, it is to the customers' advantage that they anticipate requirements as far ahead of use as possible.

The National Acme Company

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Buyers should instruct their representatives in the United Kingdom to communicate with D. B8 Canadian Export Department, Ministry of Munitions, Whitehall Place, London, S.W.

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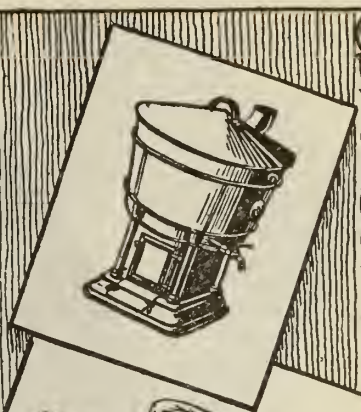
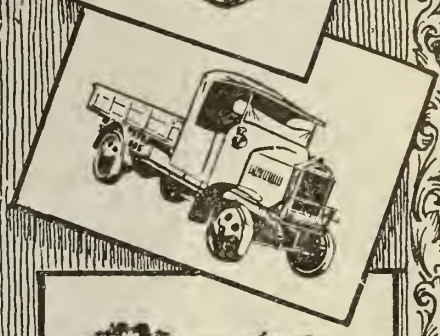

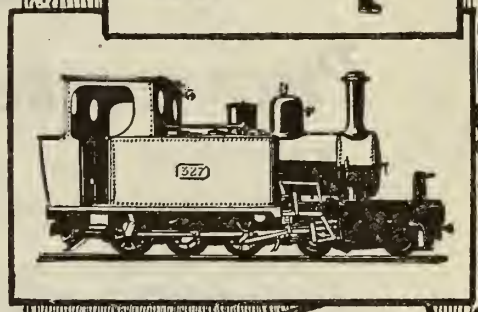
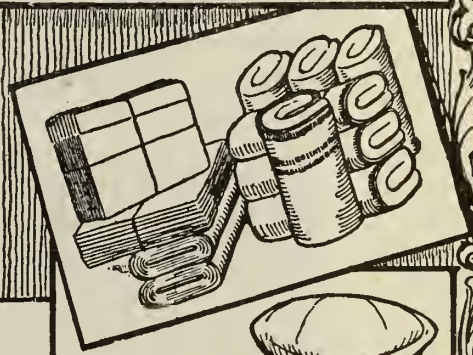

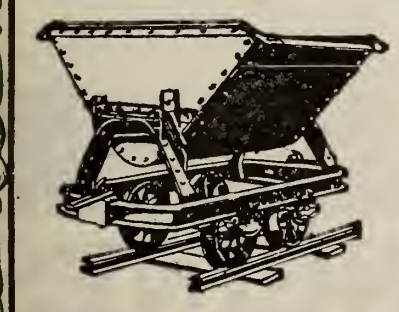
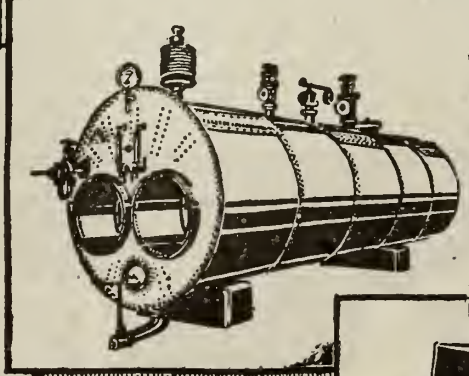
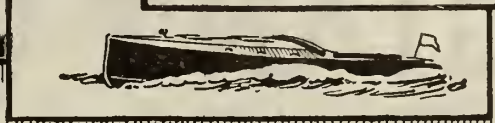

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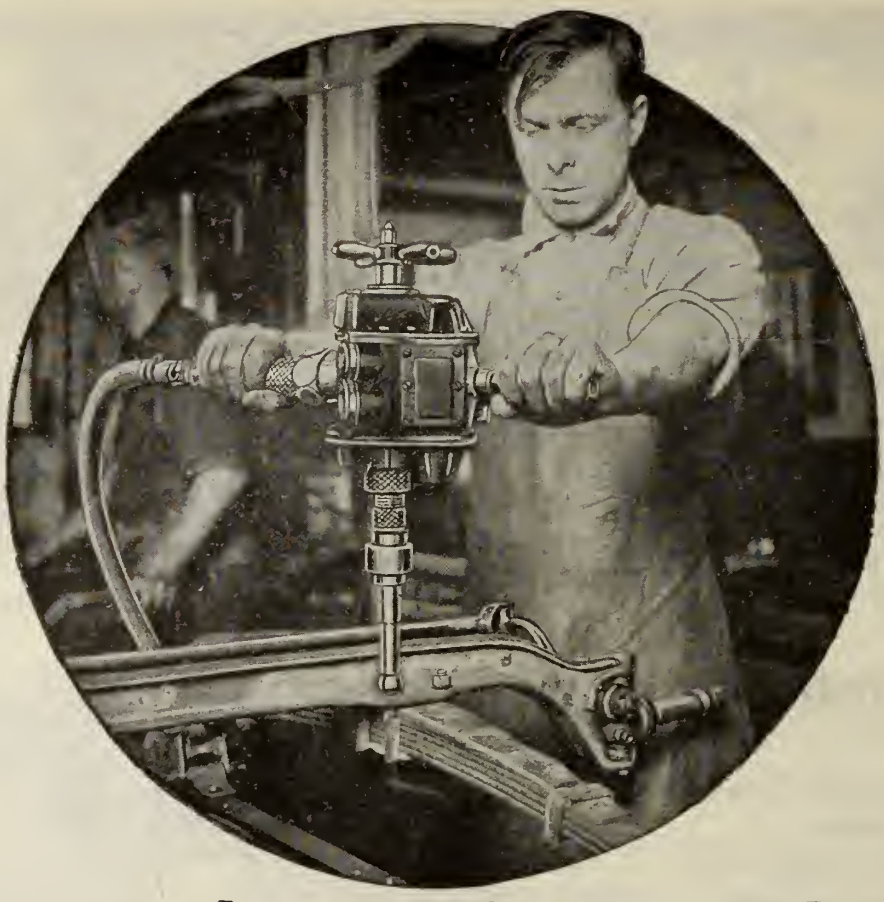

Piece workers prefer Little Giants

BECAUSE "they can push them harder and earn more."

Piece workers demand the speediest drill manufactured; the foreman of the assembly shop requires both maximum output and quality work.

Good reasons why Little Giant Air Drills are now standard in hundreds of shops and plants.

Another reason—the toggles of Little Giants are equipped with quickly *renewable* bearings. No need to scrap an entire toggle because of a minor worn part.

Little Giants are ready to stand comparative test in *your* plant and become *your* standard drill. Prompt delivery can be secured from the Company Branches listed below.

Sales Representatives

The Holden Company, Limited

354-356 St. James Street, Montreal, Canada

Sales and Service Branches: TORONTO, 342 Adelaide Street, West WINNIPEG, 150 Princess Street VANCOUVER, 81 Pender Street

Canadian Factory: Canadian Pneumatic Tool Company, Montreal

P-51-H

BOYER PNEUMATIC HAMMERS · · LITTLE GIANT PNEUMATIC AND ELECTRIC TOOLS
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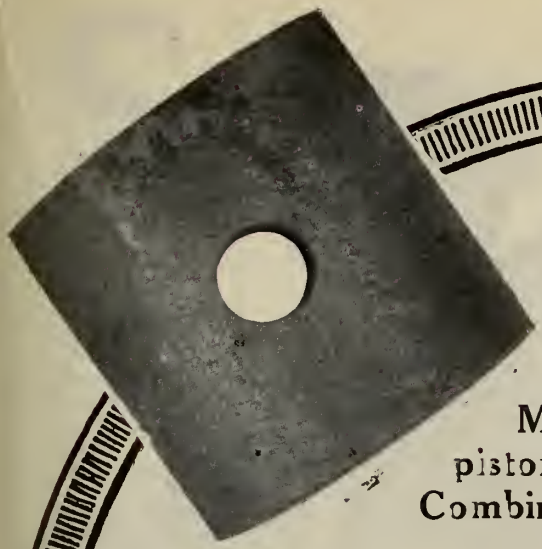
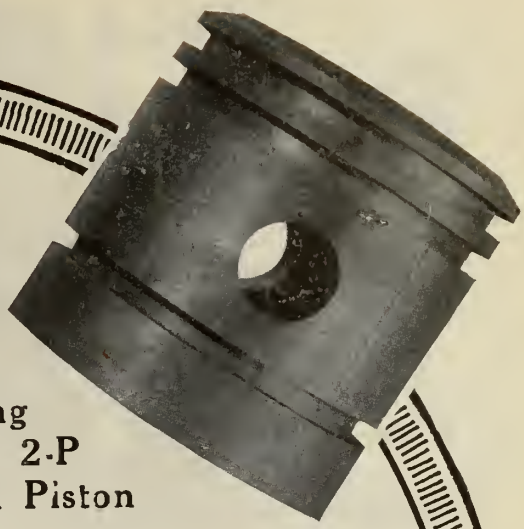
GIANT ENGINES

Dependable Power at *Less Cost Per Hour*





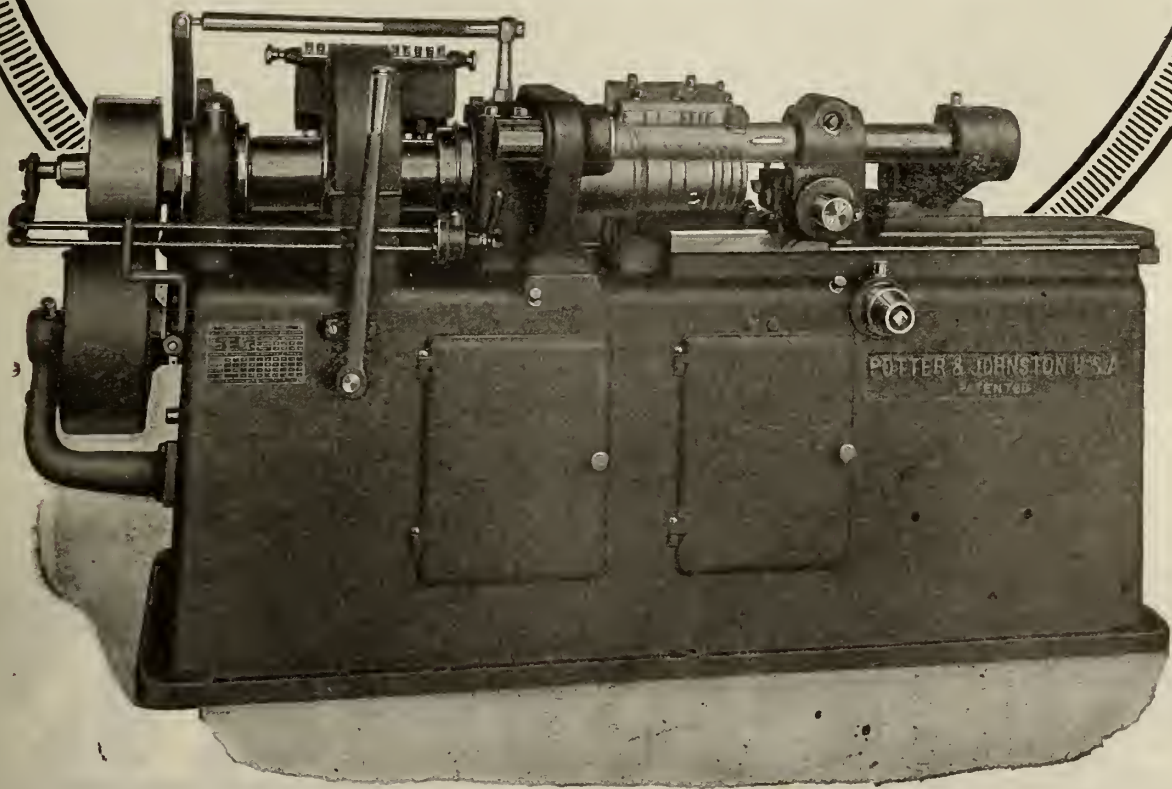
PISTONS

Before and After

Method of machining pistons on the P & J 2-P Combination Piston and Piston Ring Machine

AUTOMATICALLY

Piston is held on air operated drawback arbor, turning tools are piloted and grooving and facing is taken care of with tools in block on cross feeding arm.



Canadian Office: POTTER & JOHNSTON MACHINE CO.

ROELOFSON MACHINE & TOOL CO., LIMITED

Head Office: 1501 Royal Bank Building, Toronto, Canada
Works and Warehouses: Galt, Canada

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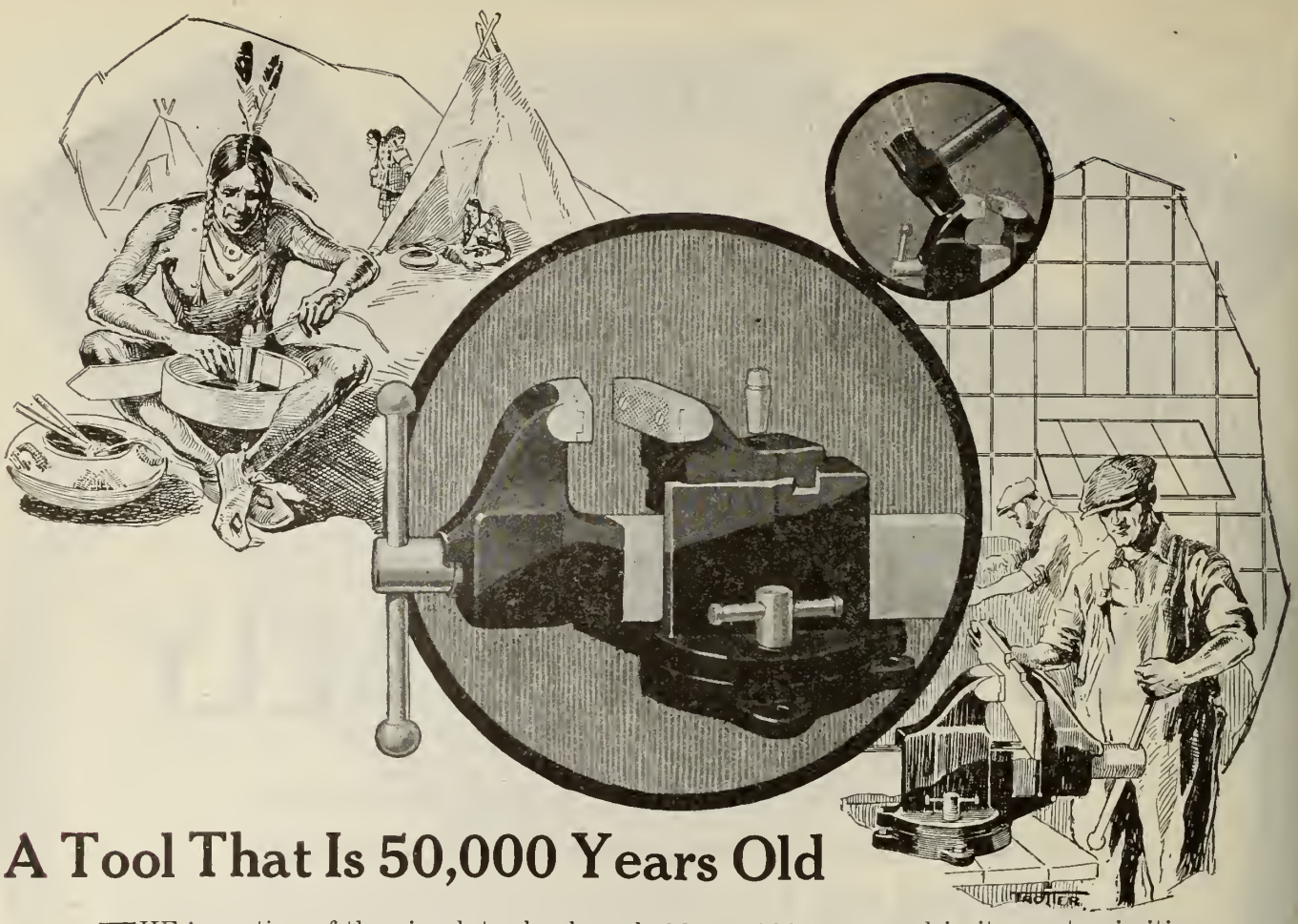


A Tool That Is 50,000 Years Old

THE invention of the vise dates back probably 50,000 years and in its most primitive form was made of a forked branch bound with wet root or bark which contracted as it dried.

From the very earliest times the vise has been one of the fundamental tools of industry—but it is only within a very recent time that industry has realized that every possible improvement in vises was of far-reaching importance.

Columbian Sledge-Tested Vises are the most highly improved vises made to-day. They are the only machinists' vises that are made of malleable iron—and the use of malleable iron instead of cast iron is the greatest single improvement made in vises in hundreds of years.

The removable jaw-faces of Columbian Vises are made of high-grade tool steel and are separately tempered. The corrugations are formed by cutting in two directions on a shaper.

The screw is self-aligning by means of a cone bearing. The depth and width of the beam and its accurately machined bearing surfaces insure absolutely parallel jaws, yet the front jaw works freely all the time.

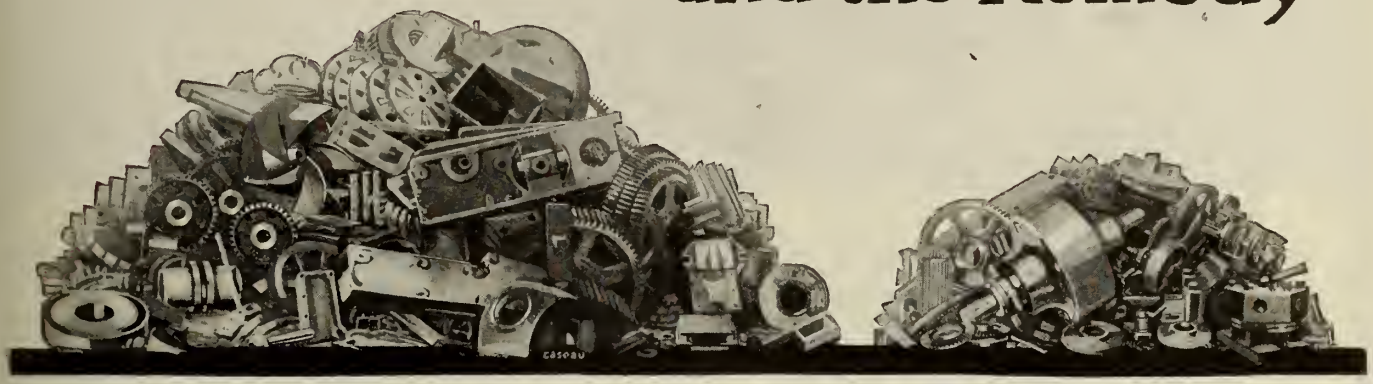
Columbian Sledge-Tested Vises are sturdy, rugged and durable. Yet they are so carefully made that they are the best vises for fine work. When you order vises specify "Columbian."

Columbian Hardware Division
of **The Consolidated Iron-Steel Manufacturing Co.**
World's Largest Makers of Vises and Anvils
CLEVELAND

COLUMBIAN
Sledge-Tested VISES

Scrap Piles

and the Remedy



"An Economic Necessity"

"While visiting a manufacturer in this district who had recently completed a contract for several million rounds of ammunition, the conversation centered on the percentage of his product that had been scrapped. He claimed that his scrap in the last two years, while working under the Limit System, was 80 per cent. less than the scrap accumulated in the two years prior to his war work and prior to the establishment of the Limit System of Inspection throughout his plant.

"I believe this voices national sentiment. Manufacturers are being educated to the fact that your products (Johansson Gages) are an economical necessity."

Thus writes a supervisor of tool inspection whose observation has been broad and who believes that the ammunition instance was but a typical one.

Johansson Gages fix the plus and minus limits with exactness. They eliminate the personal elements sure to be found when tools and output are *measured* rather than *gaged*. They enable workmen to use the full limit and to avoid unnecessary finishing. They save for both employer and employe.

Let us send you a book of general information about gaging systems and the Johansson Gages

Canadian Representatives :

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Johansson
ACCURACY

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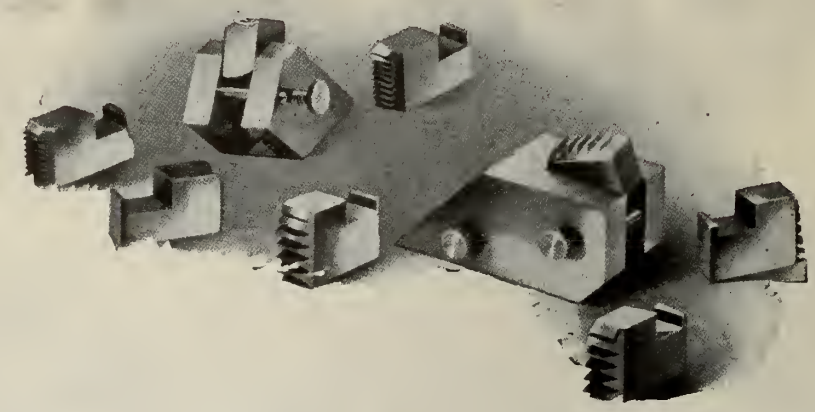
Chasers for HARTNESS Dies are easily ground

These Jigs



And any small Grinder will grind Hartness Chasers quickly and correctly.

These Jigs are sent **Gratis** with new dies, and are sold separately at modest prices. Full instructions for Grinding Chasers are sent with chasers.
A special Grinder for this purpose **is not required.**

Jones & Lamson Machine Company

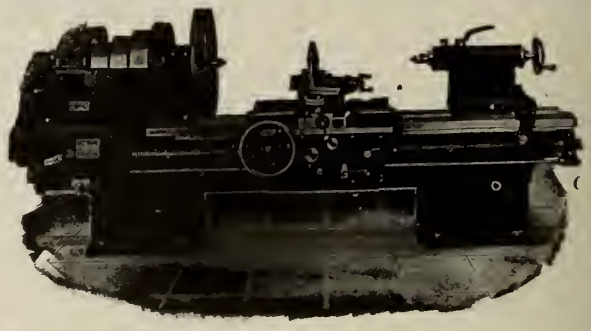
(AUTOMATIC DIE DEPARTMENT)

901 Queen Victoria St., LONDON, ENGLAND. SPRINGFIELD, VERMONT, U.S.A., 503 Market St. SAN FRANCISCO

American Agents for Dies and Chasers:
Boyer, Campbell Company, Detroit.
E. L. Essley Mchy. Co., Chicago, Milwaukee and Moline.
Robinson, Cary & Sands Co., St. Paul and Duluth.

Foreign Agents:
France, Spain, Belgium, F. Auberty & Company, 91 Rue de Maubeuge, Paris, France.
Holland, Spliethoff, Beewukes & Company, Rotterdam, Holland.
Australia, McPherson's Pty., Ltd., Melbourne, Australia.
Japan, Manchuria, Korea, Formosa, Mitsui Bussan Kaisha, Ltd., Tokyo, Japan.

Power to Do Big Jobs



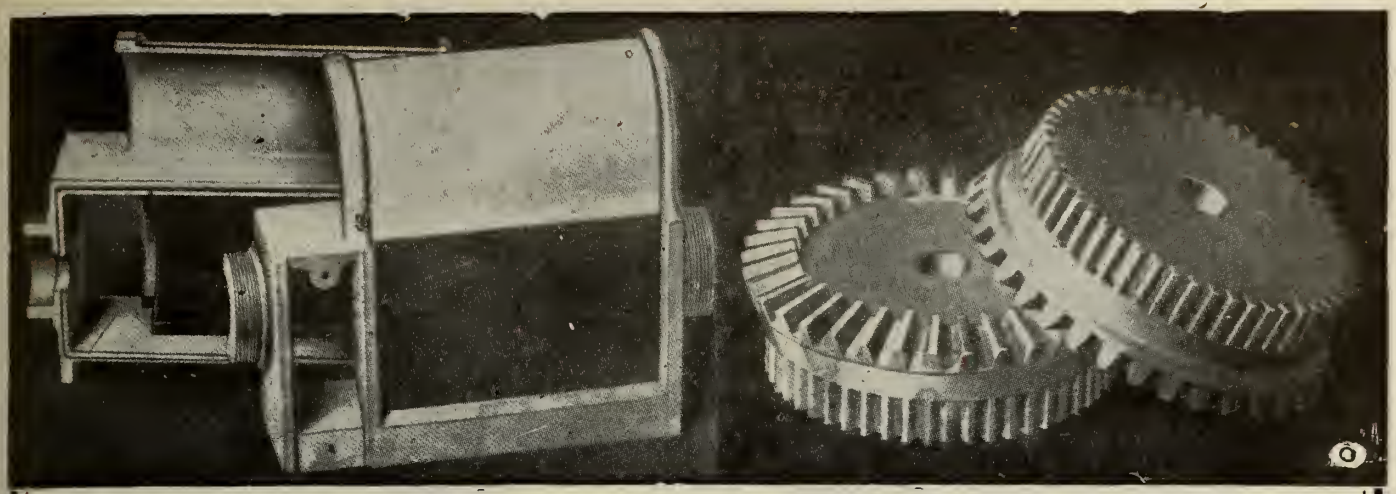
SIDNEY

For Service

Great emergencies can only be met, or big deeds accomplished by the aid of efficient tools.
Sidney Heavy Duty Lathes are designed particularly for the "Big Job." The surplus strength and rigidity of the Sidney makes it a lathe to be depended upon.
The 25 inch Quick Change Sidney shown here is the last word in lathe construction. Every possible improvement is embodied in this late model. Bed lengths of 10, 12, 14, 16, 18 and 20 feet are available. Also built with a 27-inch swing.
Full particulars of Sidney-for-Service Lathes will be found in our new Bulletin. Write for a copy.

The Sidney Tool Company, Sidney, Ohio, U.S.A.

Canadian Agents: **H. W. Petrie, Limited, Toronto; Yeates Machinery & Supply Co., Montreal**



Die-Castings are Ideal for Parts Like These

The manufacturer who had the parts die-cast as shown above saved a good deal of expense when he made the change from ordinary castings. Die-Cast parts cost less than other castings—THEY REQUIRE NO MACHINING. Yet they are well finished and perfectly accurate. Try them.

Largest Manufacturers of Die Castings in Canada.

Die-Casting Chat No. 9

Complicated shapes have no limit for the Die-Casting process. Shapes almost impossible by any other method can be perfectly and accurately performed by our die-Casting machines.

We are willing to prove this statement to any who are inclined to be skeptical. Have you some complicated casting that we can help you make by our Die-Casting process?

THE FISHER MOTOR CO., LIMITED
ORILLIA, ONTARIO

(ALLOYED UNDER THE STANLEY PROCESS)

LIONROYAL BABBITT

for general use

also *Sterling* and *Sovereign Genuine*

for extraordinary service

BABBITTS
SOLDERS
PHOSPHOR TIN
PHOSPHOR COPPER
ETC.
LEAD, COPPER, TIN,
SPELTER, ALUMINUM,
& OTHER METALS

BRITISH SMELTING & REFINING CO. LIMITED
DRUMMOND BUILDING MONTREAL

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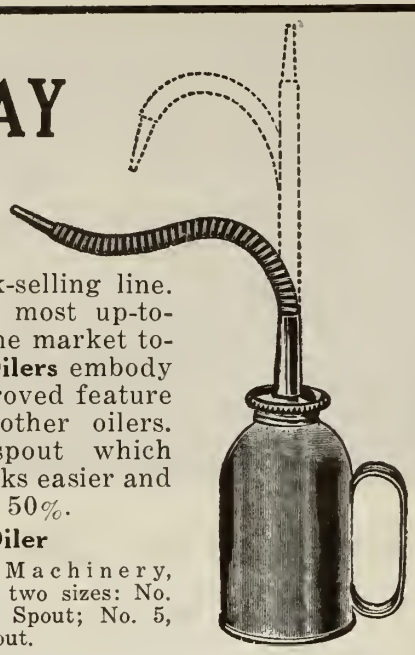
ALL-WAY OILERS



Here is a quick-selling line. The latest and most up-to-date oilers on the market today. **All-Way Oilers** embody a new and improved feature not found in other oilers. The flexible spout which makes oiling tasks easier and reduces oil bills 50%.

R.R. Oiler

For Locomotive, Machinery, Threshers, etc. In two sizes: No. 4, 1 Pint and 10" Spout; No. 5, 1 Quart and 11" Spout.

Canadian Fairbanks-Morse Co., Ltd., Montreal; Wood, Alexander & James, Hamilton; Caverhill, Learmont Co., Montreal; Auto Supply Company, London; Great West Electric Co., Winnipeg; Wood, Vallance & Leggatt, Vancouver; Walker, Vallance, Ltd., Hamilton; Wm. Stairs, Son & Morrow, Ltd., Halifax; Summer Bros., Moncton, N.B.; Canadian Specialty Co., Moose Jaw; Rice Lewis & Co., Toronto; Whites, Limited, Collingwood; J. H. Ashdown & Co., Winnipeg; D. Ackland & Co., Winnipeg; Miller Morse Co., Winnipeg; Wilkinson-Kompass Co., Winnipeg; D. H. Howden & Co., London.

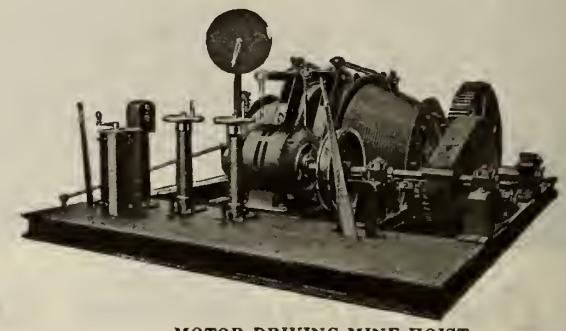
If your Jobber cannot supply you, write us

THE ALL-WAY MFG. COMPANY

196 KING ST. WEST, TORONTO, ONT.

LANCASHIRE MOTORS

HAVE WORLD WIDE REPUTATION FOR "RELIABILITY"



MOTOR DRIVING MINE HOIST

Specialists in Motor Manufacture and Application

SEND YOUR ENQUIRIES TO

The Lancashire Dynamo & Motor Co., of Canada, Limited

Head Office and Works
45 NIAGARA ST.
TORONTO

Branch Office
602 NEW BIRKS BLDG.
MONTREAL

Thor ELECTRIC DRILLS

Universal motor for direct or alternating current, 110-220 volts. (Licensed under Buche Universal Motor Patent.)

No. 00

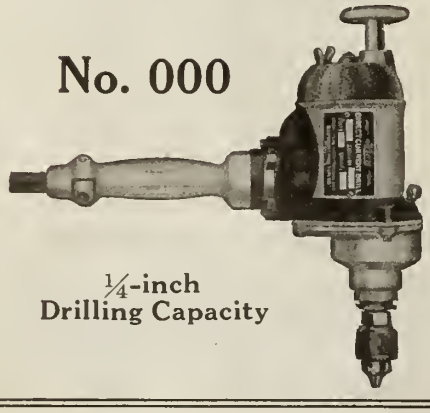
5/16-inch Drilling Capacity

No. 01

½-inch Drilling Capacity

Jacobs Chucks, Regular equipment.

No. 000



¼-inch Drilling Capacity

Points of Superiority:

Light weight—The internal gear driver permits the use of smaller gears and gear case—3 teeth in contact instead of one.

Small and compact—Due to the distributed pole motor construction and small gear and gear case.

Most Powerful—The method of winding the field and armature, and the use of ball and roller bearings result in greater power.

Extreme Durability — Interlocking commutator bars; fully tapped and insulated coils; large brushes; and perfect automatic brush holders insure long life.

Highest Efficiency — Results from the unique motor construction and elimination of all friction.

Safety — The Thor switch breaks both sides of the line, leaving no current in the drill when idle. It would be impossible to make a switch insuring greater safety.

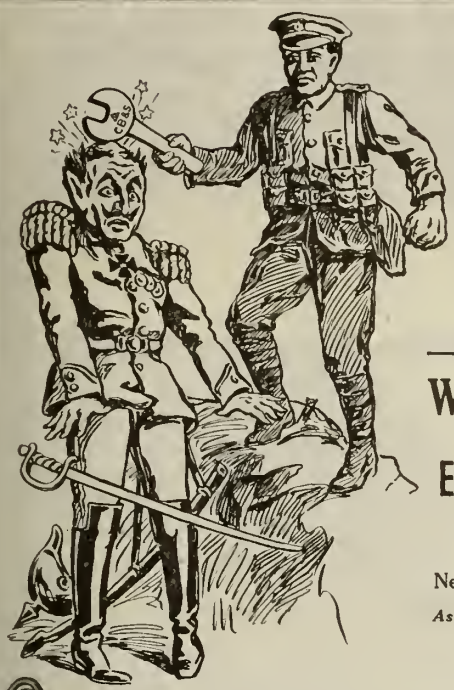
These features are used in Thor Electric Tools exclusively, and will not be found in any other make. Their compact construction, neat design and high grade finish is unsurpassed.

INDEPENDENT PNEUMATIC TOOL COMPANY

334 St. James St., MONTREAL

TORONTO, 32 Front Street West **WINNIPEG, 123 Bannatyne Ave. East**
VANCOUVER, 1142 Homer Street

CANADA
FOUNDRIES & FORGINGS
LIMITED



If a Bad "Nut" Gets Loose

—Use a Wrench

Endurance Brand

Never Wear Out

Ask You Jobber

Canadian Billings & Spencer Plant
WELLAND, ONTARIO

Harris Heavy Pressure

The Babbitt Metal that's at the Front in Efficiency and Economy

Order a Box from our nearest Factory

Our Guarantee is Back of Every Pound of Babbitt Metal We Make

Manufactured by

The Canada Metal Company, Limited

TORONTO - CANADA
HAMILTON WINNIPEG
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STAR LATHES

Small Accurate Work Requires Small Accurate Tools

There is no reason for using large, expensive machines on small lathe work—tying up the big jobs, wasting floor space, using extra power.

Get a "Star" Lathe for those small jobs—it will save power, worry and expense.

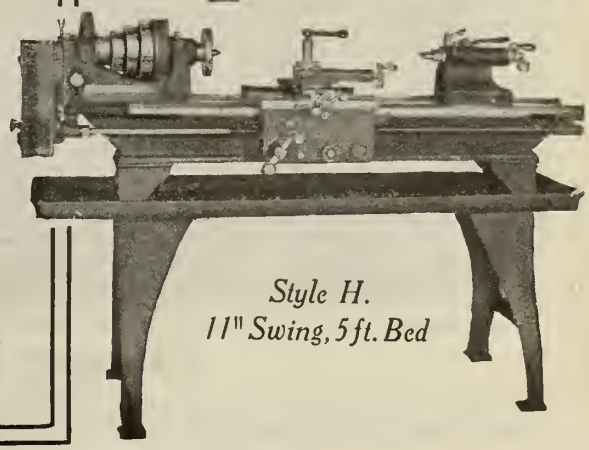
"Star" Lathes are fast, accurate and durable—you can safely trust your most exacting work to them. Thirty-five years' experience guarantees the results.

Send for your copy of the "Star" Catalog to-day.

Seneca Falls Mfg. Co., Inc.

366 W. Falls St., Seneca Falls, N.Y.

Style E.
9" Swing,
4 ft. Bed



Style H.
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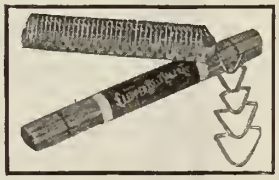

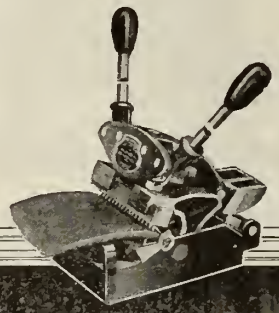

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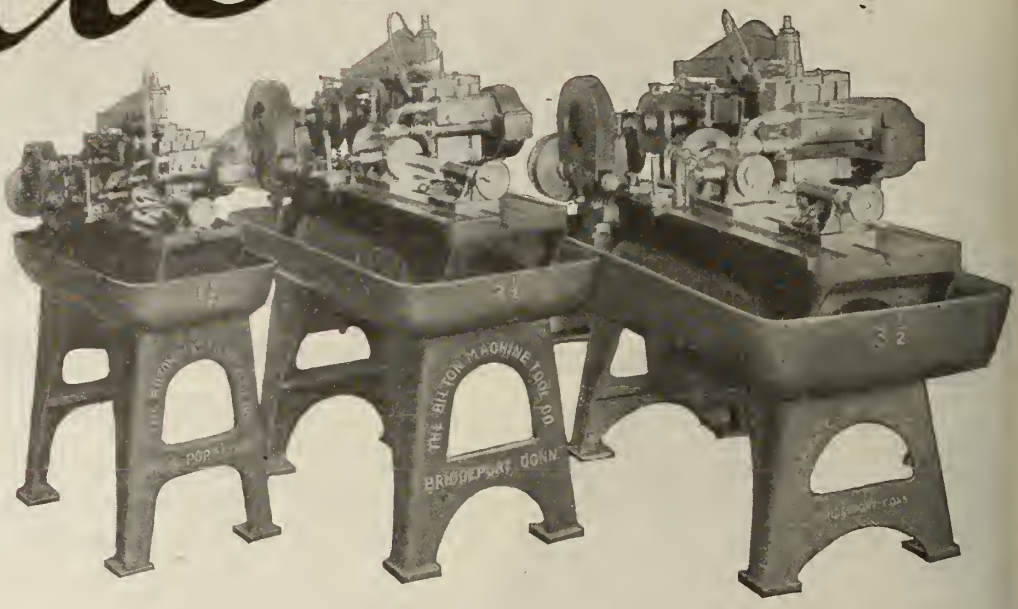

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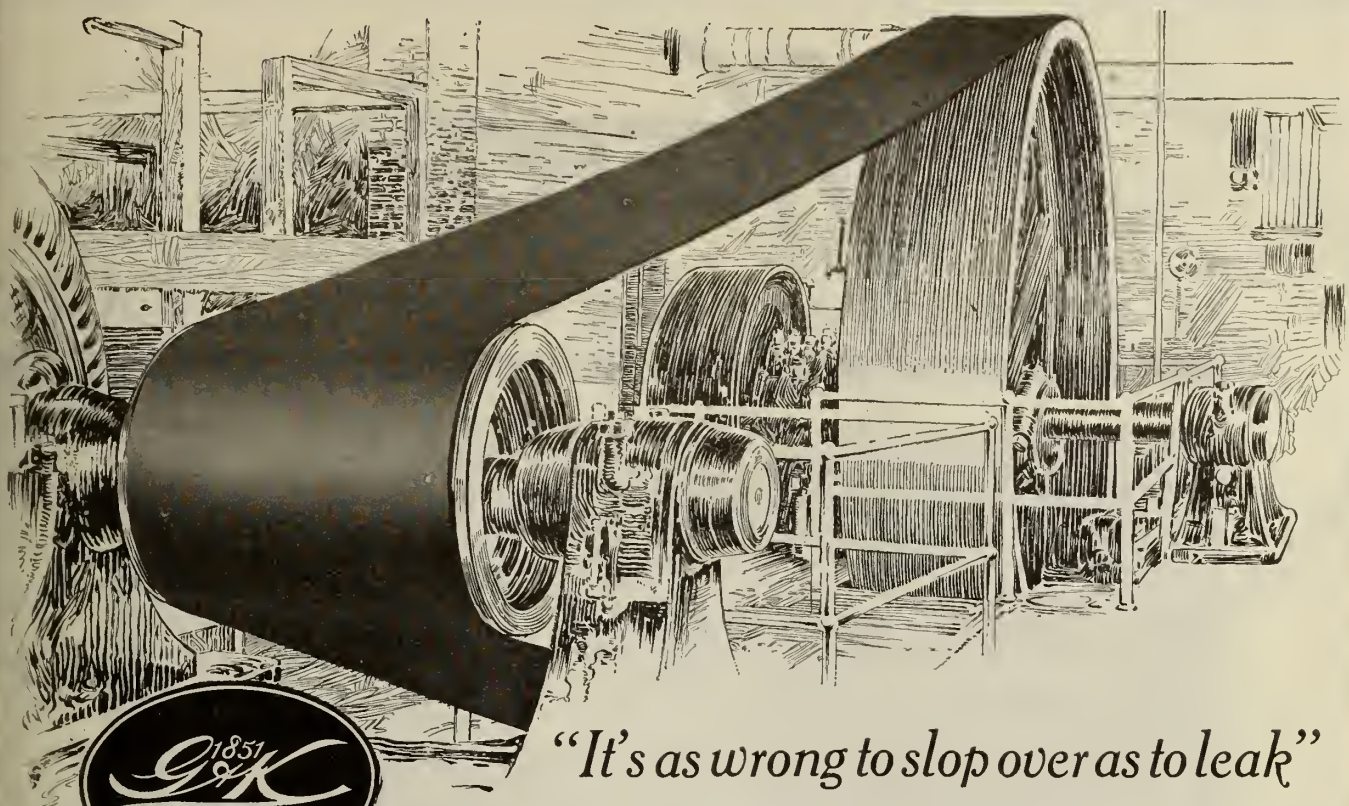

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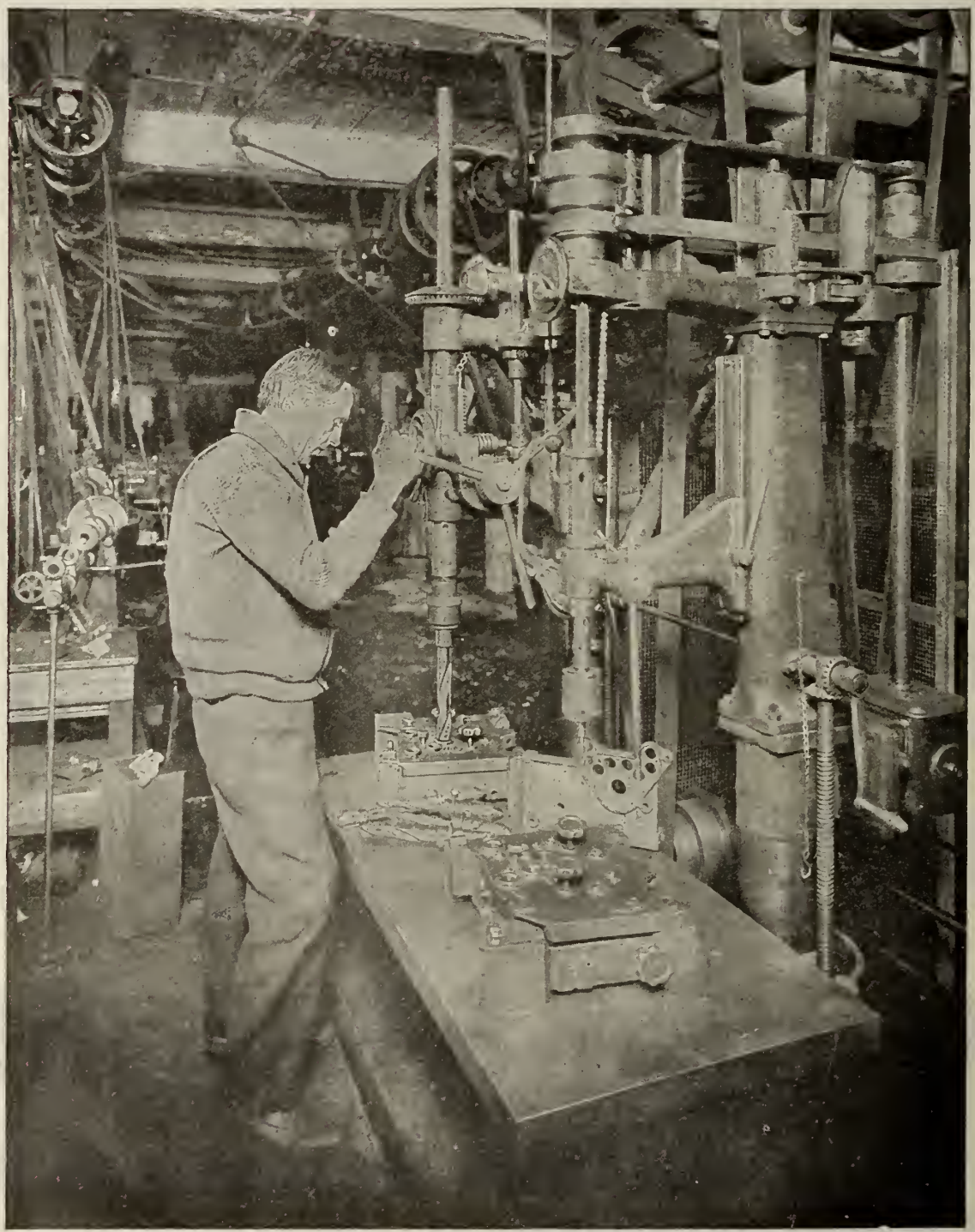

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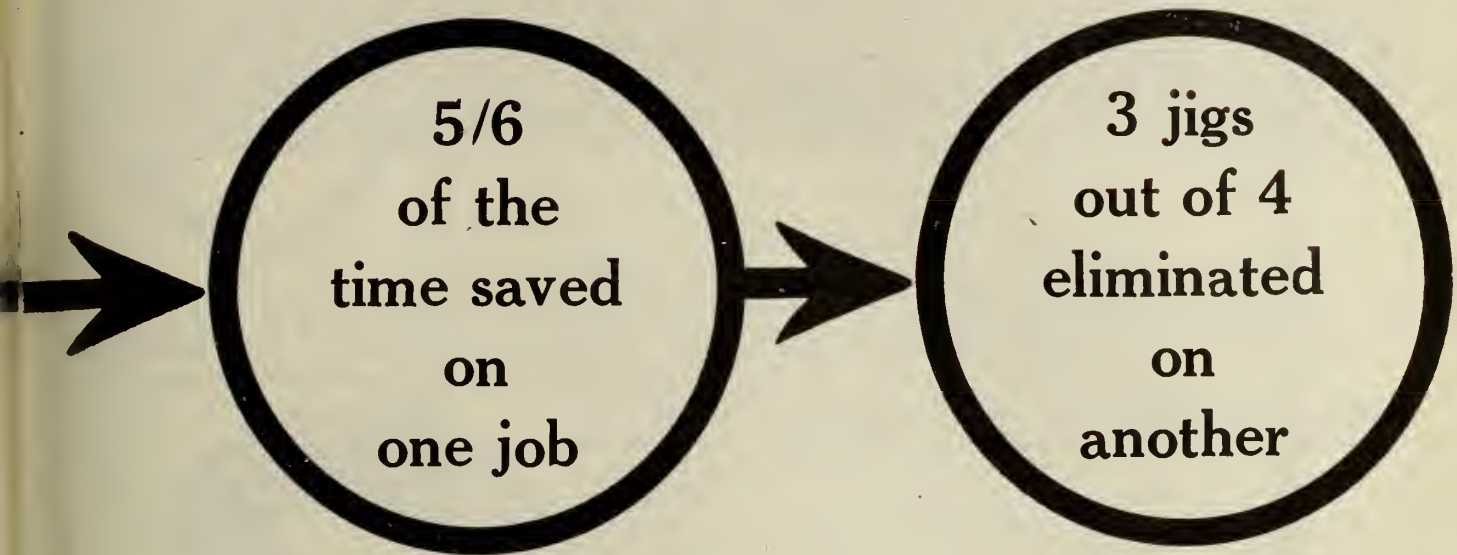

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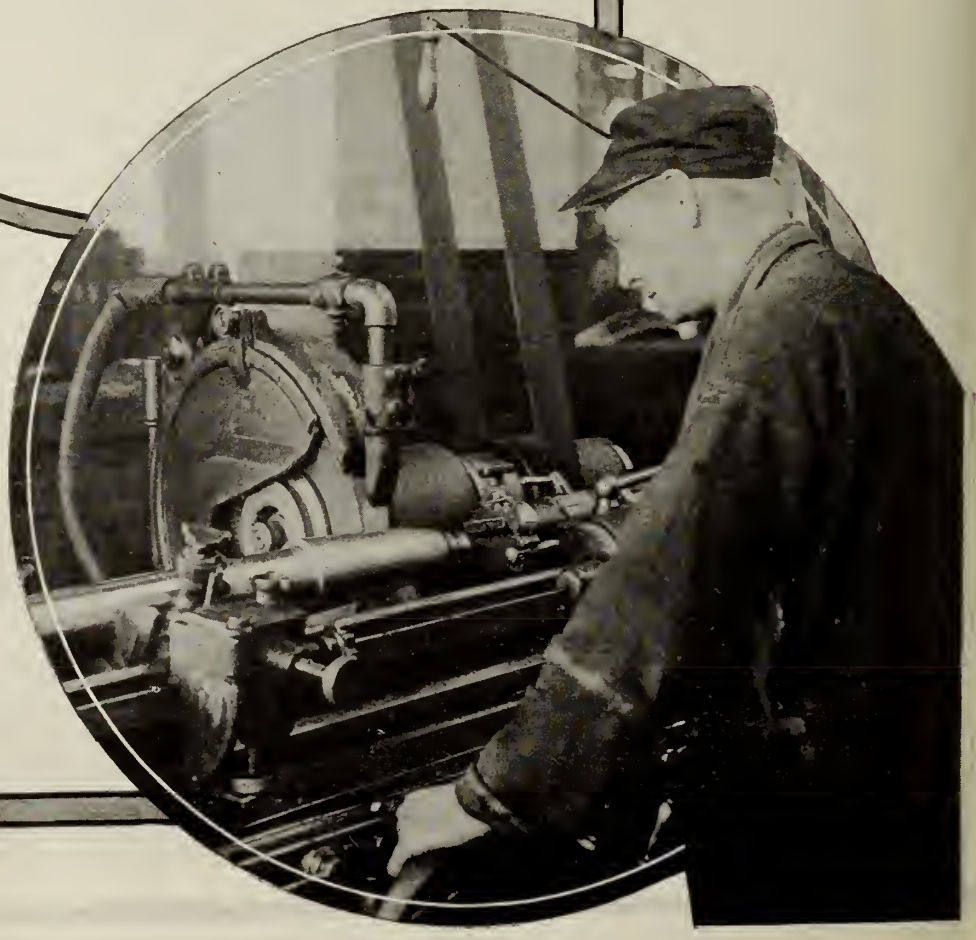

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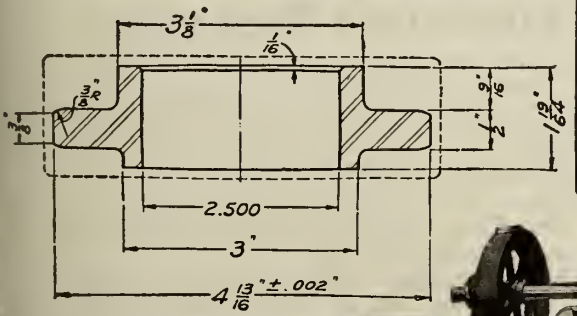

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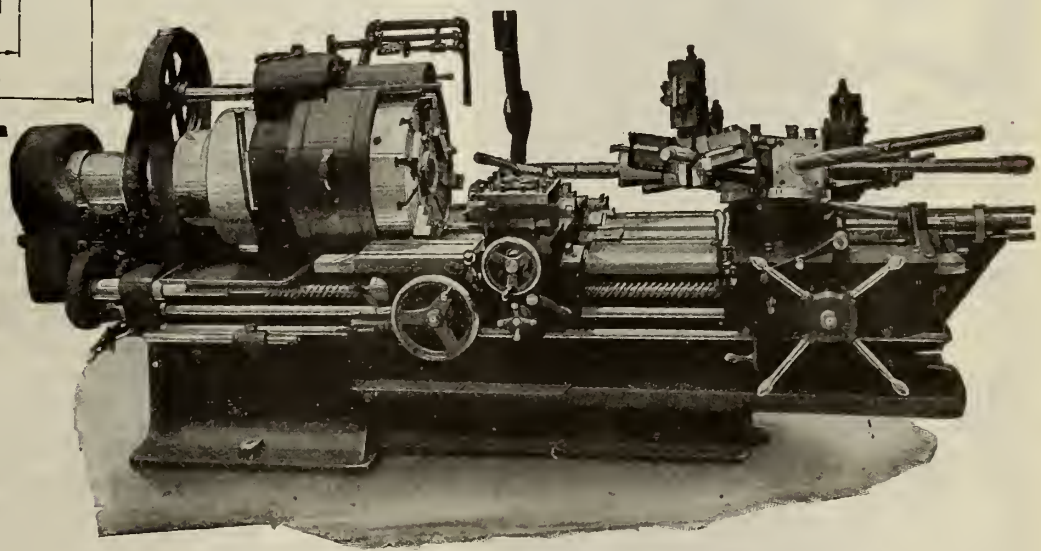

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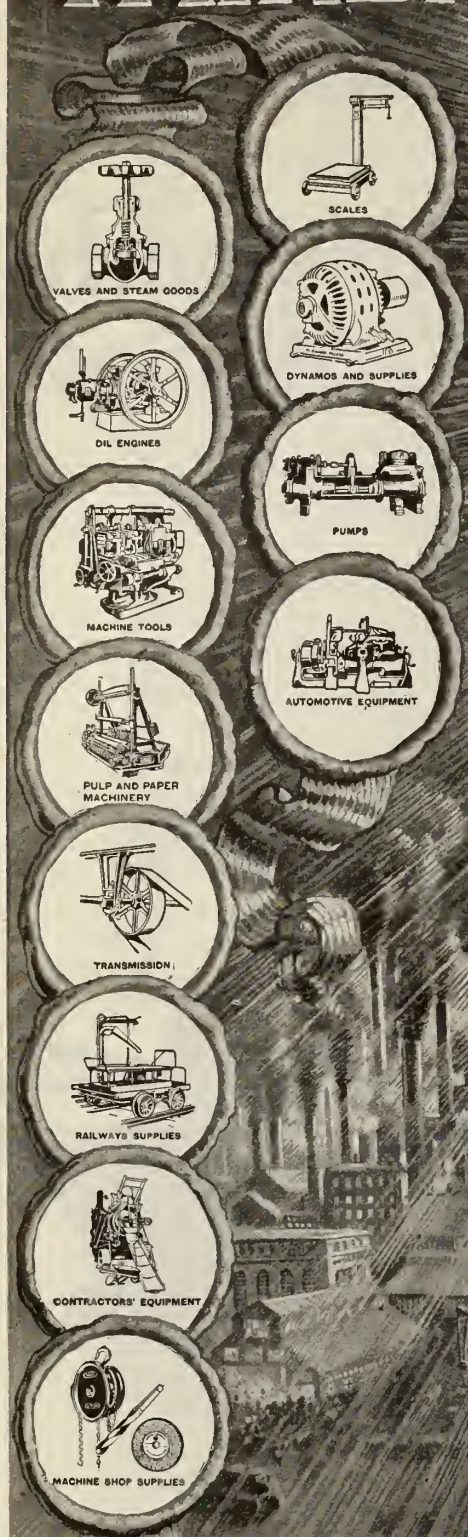

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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

Vol. XXIII., No. 22 May 27, 1920

Interesting Examples of Sheet Metal Dies

Designers and Practical Men Alike Will No Doubt Welcome This Article—Some Very Good Hints Can be Derived From a Study of the General Design of These Dies

By J. H. Moore

WHEN we speak of the art of punching sheet metal we mean this in every sense of the word, for the efficient working and punching of sheet metal is indeed an art. To efficiently cope with the peculiar problems arising from such a class of work requires years of experience.

The International Harvester Co., Ltd., Hamilton, Canada, are especially fortunate in this respect, for their experience is not only a matter of years but of varied classes of work. It is a well-known fact that a great number of parts used on agricultural implements are made from sheet metal, and it is this fact that prompted us to secure photographs of the dies illustrated in this article.

Before going into the question of the dies themselves, let us consider a few features that make the sheet metal department itself worthy of note.

On entering the department one is first struck with the orderly appearance of all presses, shears, etc. Every machine is laid down according to a well-thought-out plan, and sufficient aisle space is allowed for trucking purposes.

Every machine is painted at certain portions with aluminum paint. The object is obvious, namely that the aluminum paint catches the light and reflects it back on the work. By so doing there are no dark corners to any machine and the value of this idea is not as fully realized in the machine shop of to-day as it should be.

At present some 1,100 to 1,200 different styles of work pass through the department. The need of a proper system to keep track of the dies is at once apparent. This is accomplished in two ways. For the smaller dies, special shelves are made, and these shelves being divided into certain sections. Depending on the nature of the die, it goes into its proper section, and in every case the symbol number of the piece is painted on the die itself. There is no possible chance for error and all dies are easily kept track of. The larger dies are stored in a room specially set aside for the purpose.

Having explained these little details, which are so important to any well-conducted department, we will proceed to the question of the dies themselves.

Revolving Oil Cover Die

The first to be considered is that of a revolving die used in producing the oil hole cover shown at Fig. 1. We not only illustrate the dies but show the stock itself, from the flat shape to the finished product. The first operation is that of piercing the two small holes, cutting the peculiar shaped form of the bosses around these holes and the blanking of the pieces itself. This is done by the die shown at A and B. At A is

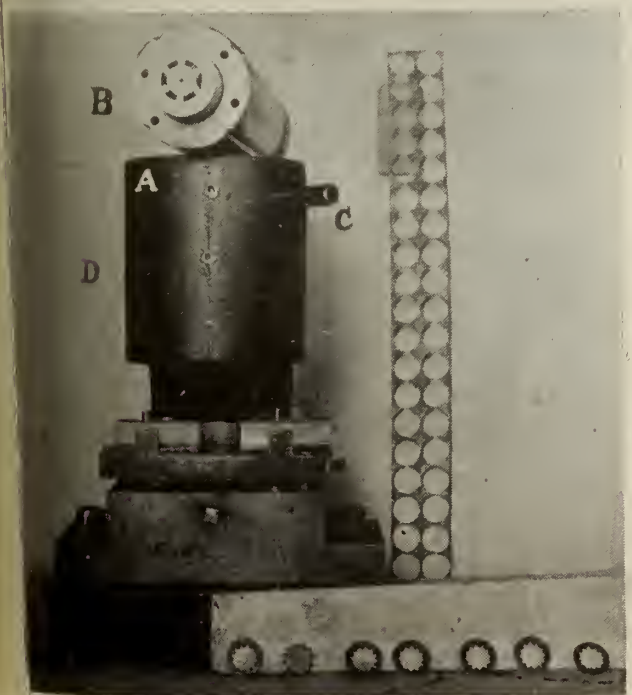


FIG. 2—THIS DIE IS USED FOR SERRATING WASHERS AS SHOWN.

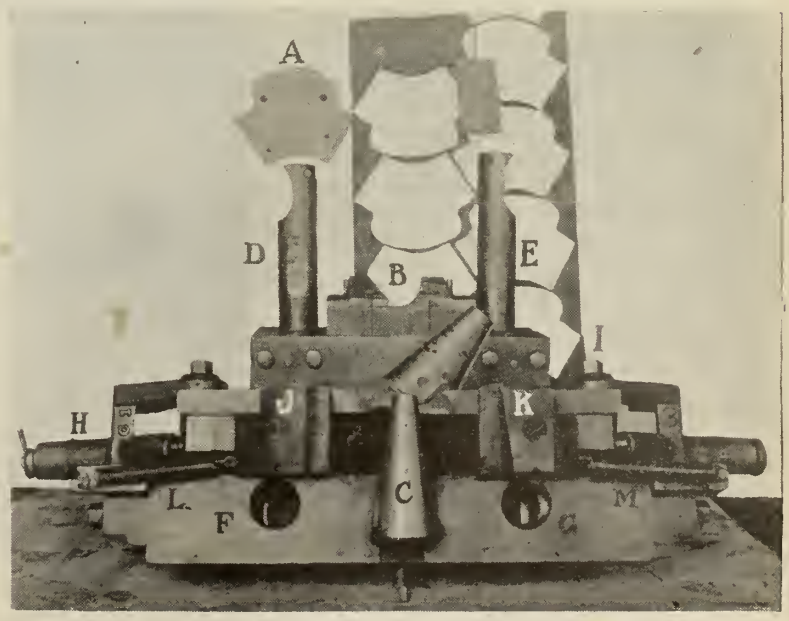


FIG. 3—A DIE FOR FORMING TUBE SPOUT.

FIG. 1—A GOOD GENERAL VIEW OF A REVOLVING OIL COVER DIE.

shown the upper punch block, while B illustrates the lower part of the die. It will be noticed that guide pins are employed for the work, and it might be well to state that guide pins are practically standard for all dies of this type, that is, as far as this plant is concerned. After the die has performed its duty the piece looks as shown at C. Next comes the work of the revolving die. This die has six stations, each being indexed in the following manner. The operator loads at station D, or perhaps we had best say at position D, as the stations are continually revolving. Down comes the punch and forms the cover to the shape shown at E. The plunger F kicks a trip and releases the friction trip on the table, causing it to revolve to the next station. All this movement has occurred while the plunger has been ascending, so that by the time the press is ready for the down-stroke the next station is indexed and in position for the following piece to be formed.

By this method production is uninterrupted, as the trip lever of punch press is depressed in down position to make the strokes continuous. It will be noticed that guide pins are also used in this die.

The table receives its circular motion through a belt driven over the pulley G, which in turn operates the friction device. A point of interest regarding work passing through this department is the fact that a sample strip of every piece is kept on file. This strip is shown for illustrative purposes, and as will be noticed is clearly tagged with its proper symbol number.

We do not wish readers to imagine that all the stock shown at centre portion of strip is going to waste, for such is not the case. The only reason this large space was allowed to exist was in order to make the sample strip of sufficient strength to prevent bending.

Serrated Washer Die

The next die we will consider is that shown at Fig. 2. Here we have what is known as a washer serrating die. We again show the sample strip alongside the die. The process of manufacture is also shown at A. The die is constructed on the sub-press principle, or in other words it is really double in its action.

The plunger illustrated at B contains both the blanking punch and the serrating punch. A spring and thrust pin at the top of this plunger does the operating. This pin is shown partially out at Co. Briefly here is the action: The ram of press descends, presses down the plunger B, and blanks out and serrates the washer at the same stroke. It will be noted that there are twelve serrations in the washer. To prevent the plunger B revolving, the keyways shown slide up and down on pins in the interior bore of portion D of the die. The plunger is also arranged to strip each washer automatically.

Tube Spout Die

We will next discuss the die shown at Fig. 3. This is what is known as the dies for forming spout, or tube end for seed tube. It is constructed on the kicking principle and actually kicks the piece into its form in the following manner:

The blanked piece, shown at A, is placed in position B, and is gauged from the pins, which are clearly shown in photograph. The ram of press, carrying the upper bolster, descends, pressing the nose punch C into position, causing the tube to take a U-shaped form. The two pins, D and E, in the meantime have engaged with a trip in the holes F and G, which releases the side kicking arms H and I, the result of course being obvious. These arms come in and operate the side dies J and K, completing the form of the tube.

While this description takes some time in telling, the actual operation is accomplished very fast indeed. The action is really so speedy that one has to watch a few pieces being formed before they can thoroughly grasp the principle.

The springs shown at L and M bring back the side dies after each piece is formed. This arrangement is so out of the ordinary run of dies that readers will do well to study it carefully.

Large Punching Die

The fourth and last example is shown at Fig. 4. The work being performed is that of punching the various holes in the binder deck of a harvester binder. There are a total of 32 holes in this piece and for explanatory purposes we have

FIG. 4—THIS DIE PUNCHES A TOTAL OF 32 HOLES

shown one of these decks resting on the floor at the front of the die. One can readily see the variety of holes, which include 7-32 in. dia., ½ in. dia., ⅝ in. sq., 1 in. sq., and the two peculiar shaped holes noted at the left-hand side of the deck.

The upper of these holes is made up of sists of a ¼ in. wide strip enlarged to gether with a semi-circular portion of an 8 in. diam. hole.

The other hole is 9 in. long and consists of a ½ in. wide strip enlarged to 1½ in. width at top and bottom. From these dimensions it is readily seen that these holes are no sinecure to blank out.

As is usual with all of this nature in the sheet metal department, guide pins are provided, and these pins being grooved for good lubrication when the ram is ascending and descending. On a close examination of the photograph it will be seen that the ram of press is of white color. This is because the ram is coated with aluminum paint. The added amount of reflected light obtained through this means is surprising, and other plants would do well to try this method.

From the form example given one can form at least a slight idea of the variety of pieces passing through this particular department, and in a later issue we will touch on other points of interest in connection with this plant.

How Should We Lubricate Ball Bearings?

Ball Bearing Lubrication is a Subject of Which Little is Known —This Article, Presented at the American Society of Mechanical Engineers, Touches on Some Interesting Points on This Subject

By H. R. TROTTER

AN investigation of existing literature on the subject of ball-bearing lubrication reveals the fact that up-to-date a comprehensive study of this particular phase of lubrication has not as yet been published. The efficient lubrication of the plain sleeve-type bearing presents few difficulties, as the engineering world is in possession of an accumulation of data acquired during many years of patient study, experiment and practice.

In 885 Beauchamp Tower completed a series of experiments which he had made to obtain data regarding the behavior of a lubricant under various loads and speeds. These experiments were made at the request of the British Institute of Mechanical Engineers, and were later made the subject of a very thorough mathematical analysis by Prof. Osborne Reynolds. The outstanding feature of these experiments was the discovery of the wedge-shaped film of oil. Prof. Reynolds gave the rue for efficient lubrication, which is that where two surfaces are in sliding contact a satisfactory film of oil cannot be maintained unless the surfaces are a slight inclination to each other.

The formation of such a wedge-shaped film of oil can be described as follows: In Fig. 1 is shown a pan or tray A containing a small amount of oil. A at plate B is loaded with weights C. When in a stationary position the surfaces of the plate and pan are parallel to each other, but if the plate is now pulled along the surface of the pan the leading edge will rise and the plate will flow on an oil film with the surfaces at an inclination to erach other. The oil film assumes the shape of a wedge, as shown in Fig. 2.

The iMtchell thrust bearing, which is manufactured in Great Britain, and the Kingsbury thrust bearing, made in this country, are designed to take advantage of this phenomenon and both have proven very successful. The main features of a bearing of this type are shown diagrammatically in Fig. 3. A is the rotating member. B is the stationary member. The parts C are supported on pivots D. A bearing of this type with a diameter of 18 in. will successfully accept a thrust load of 160,000 lbs. at a speed of 35r.p.m. Loads of approximately 10,000 lbs. per square inch of bearing surface at a mean surface speed of 54 ft. per sec. have been carried successfully on short tests on a bearing of this type. At this load the babbitt facing of the blocks owed in all directions without temperature rise, thus showing that the pressure limit is controlled by the strength of the metal, and not by the breakdown of the oil filmfi.

The oil grooves of a sleeve type bearing should be of such shape as to allow the formation of this oil wedge. Fig. 4 shows a correct groove and Fig. 5 an incorrect groove. When forced feed lubrication is used, the oil should enter the bearing at a point of low pressure and not at the bottom of the bearing which is near the point of maximum pressure. The oil grooves in a sleeve-type bearing are generally made wedge shaped and not of semicircular section, as experience shows that this is necessary to the formation of the lubricating film. The oil inlet in a force-feed bearing is placed at a point which is approximately the point of lowest pressure and not at the bottom of tmhe bearing. Successful bearing operation is a problem shat should be solved by the designer and not by the lubrication engineer who acts in an advisory capacity after the bearing is in service. It must be admitted, however, that the average engineer is not in possession of the necessary data which would enable him to select the proper type of lubricant for his partncular use, nor has he the instruments or appliances to analyze a lubricant both physically and chemically.

The final choice of a lubricant is at best the result of a compromise between the engineer and the chemist. The compromise is very often unsatisfactory and due in part to the chemist's inability to thoroughly comprehend the engineer's

With increase of	Where the viscosity is effective the coefficient of friction	Where the body is effective the coefficient of friction
Pressure	Decreases	Increases
Speed	Increases	Decreases
Temperature	Decreases	Increases

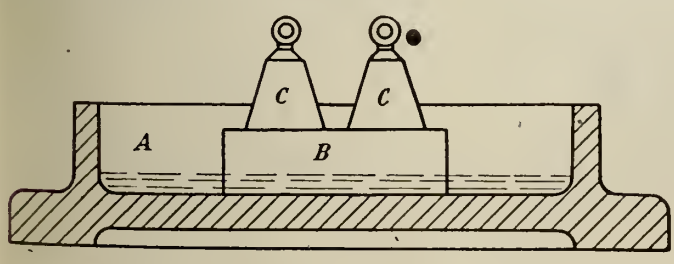


FIG. 1.

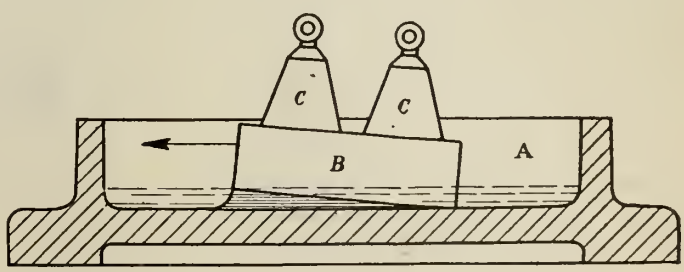


FIG. 2.

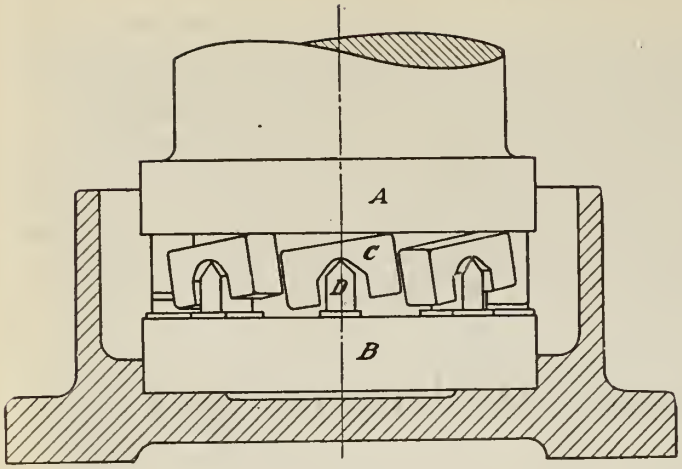


FIG. 3

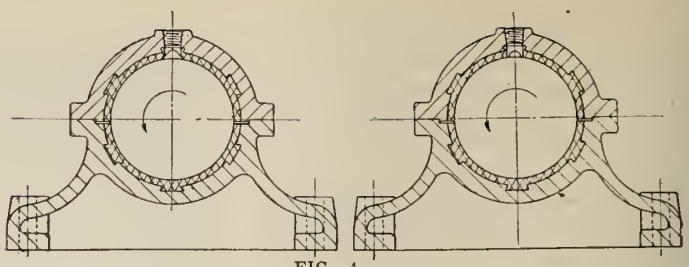


FIG. 4

problem and in part to the engineer's lack of chemical knowledge.

The Testing of Lnbricants

At the present time there is, unfortunately, no instrument which will accurately indicate the true lubricating value of an oil or grease, and until such an instrument is devised, the selection of a lubricant must be more or less a matter of guesswork. A viscosimeter gives a comparative reading of the inertia of a liquid, but it does not indicate the value of a lubricant under working conditions. Furthermore, all authorities are not agreed on the desirable qualities of a lubricant. Many claim that a high surface tension is a requisite and others lay great stress on adhesive qualities. All are agreed, however, that a lubricant should have the minimum of internal friction. Generally speaking, the requirements of a lubricant for the plain sleeve type of bearing are a certain amount of adhesive quality to enable it to adhere to both the revolving and stationary surfaces. It should have sufficient body to withstand the pressures. The lubricant film will therefore consist of three layers, which in operation approximate the features of a ball bearing in that one element is stationary, one rotating and one an intermediate layer consisting of globules similar to the balls in a ball bearing. From this description the importance of body in a lubricant will be realied, and as thez best and toughest material is required in the balls of a ball bearing, so is body required in the intermediate layer of a lubricant.

Body in a lubricant cannot very well be defined. It seems certain that its effects are opposite to those of viscosity. Professor Kingsbury gives the following relations of viscosity and body (Trans. Am. Soc. M.E.., Vol. 24, 1903, page 147):

The author has designed an instrument which may possibly be the means of obtaining data of value regarding lubricants. This instrument is shown diagrammatically in Fig. 6. The appliance consists of a revolving element driven by a small motor and a stationary element similar to a block used in a Mitchell or Kingsbury bearing with suitable means of obtaining readings of the inclination angle of the block to the revolving element.

At one time it was considered necessary to support the blocks in a Mitchell or Kingsbury thrust bearing at a point behind its center of figure in order to secure the wedge of oil between the opposing surfaces. Furthermore, it was assumed that if such a block was centrally supported, it would possess no load-carrying capacity. Independent experiments by Professor Kingsbury and Sir Charles Parsons established the fact, however, that a centrally pivoted block could carry considerable load. This was an important discovery, as most of the applications of Michell and Kingsbury thrust bearings have been on marine propeller shafts where reverse rotation is necessary. It was later found that with a centrally supported block the wedge-shaped film of oil was due to the change of viscosity of the lubricant when passing through the block. It will thus be seen that the ankle which the block assumes to the rotating member gives an indication of the change of viscosity in a lubricating film when in operation.

Referring again to Fig. 6, "A" marks a casing consisting of an inner chamber which contains the lubricant to be tested and an outer chamber containing oil which is electrially heated and which transmits its heat to the inner chamber. At "B" is shown a small electric motor with a shaft extension on which is placed a flange, the face of which is highly polished. The motor swings on a pivot "C" which allows the flange to take various positions withrelation to the block, thus enabling readings to be taken at various rubbing velocities. By means of the lever "D" various pressures may be obtained. The movement of the block is magnified by minimeters and transmitted to the dial indicator. Holes are drilled in the block and can be connected to a manometer to obtain pressure readings, or as there is practically no pressure difference, the holes can be connected to each other in such a manner that there will be practically no velocity through them. Temperature maybe obtained at the leading and trailing edges of the block. Readings may be taken at constant speed with varying loads or with constant loads at varying speeds. While the author is not certain as to the practical value of such an instrument, it is at least a step in the right direction.

Operating Characteristics of Ball Bearings

The two cardinal points of successful sleeve-bearing operation are:

A design of such a type as will permit of the formation and preservation of an oil film.

Selection of a lubricant that will provide a fim of maximum strength with a minimum of internal friction.

With a ball bearing, however, the problem is not so easily understood,

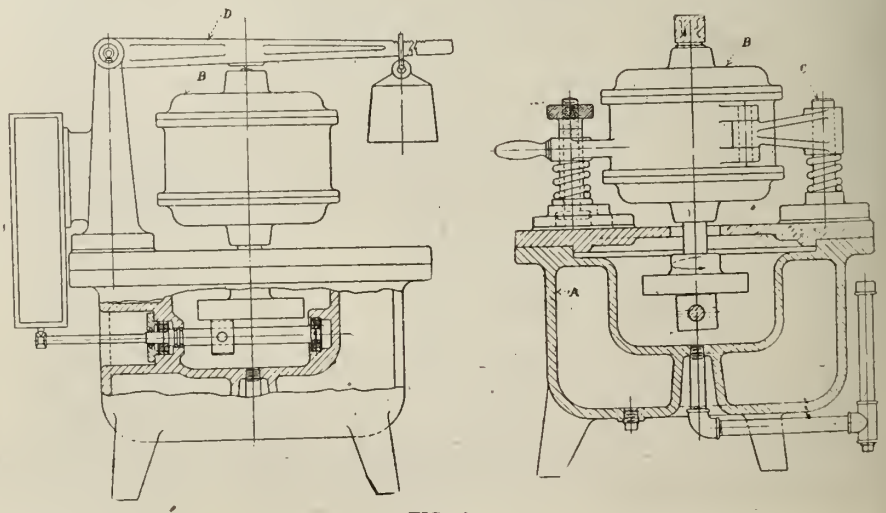


FIG. 6

but the important points to be remembered are:

The coefficient of friction is practically constant throughout wide ranges of loads and speeds.

Metal-to-metal contact (an oil film only possible at very high speeds when slippage may take place).

The coefficient of friction is lower in an unlubricated ball bearing (at light loads and moderate speeds).

The first point is, of course, generally known, but the connclusion to be derived from this point has not been stated before to the author's knowledge, namely, the impossibility of an oil film between balls and races.

In Fig. 7 curve "A" shows the change of friction coefficient of a plain bearing under constant load and varying speed. This curve is self-eplanatory and shows that a satisfactory oil film is not formed till a certain speed is reached. In the same figure curve "B" gives the friction coefficients of a well-made ball bearing, and shows that the friction loss of a ball bearing is practically constant throughout wide ranges of speed. If an oil film were formed between balls and races, curve "B" would possess the same general characteristics as curve "A."

The difference between the friction coefficient of a lubricated and unlubricated ball bearing is shown in Fig. 8. This property of a ball bearing is not generally known and should not be used as an argument in favor of operating ball bearings without lubrication. From the foregoing statements it should be evident that plain bearings and ball bearings possess such radically different characteristics that a true comparison is impossible. It naturally follows, therefore, that practically all the accumulated experience of the lubricating engineer is of little value when analyzing ball-bearing operation.

Requirements of a Ball-Bearing Lubricant

The use of a lubricant with ball bearings is necessary to protect the highly polished surfaces of the balls and raceways and to minimize the slight friction between the balls and ball retainer. The small amount of friction between balls and retainer can also be minimized by careful design. The principal requirement of a ball-bearing lubricant is chemical neutrality. The lubricant used must not contain over 0.10 per cent. acid or alkali. There are many commercial lubricants on the market which come within this limit, but very few are acceptable because of their tendency to develop acid with age or when operating at high temperatures.

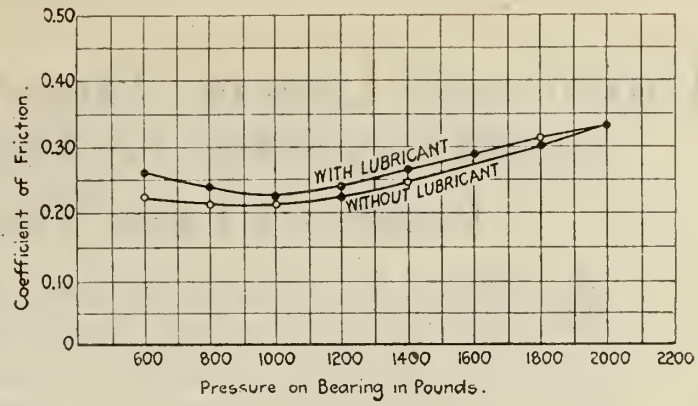


FIG. 8

Most of the high-grade oils can be used with safety, but many of the lubricating greases, while suitable for general purposes, are a positive menace to successful ball-bearing operation, not because of poor material used in the manufacture of greases, but because of the lack of scientific mixing methods. The manufacturer is in no way to blame for this condition because he is making grease for general commercial use and not for ball bearings. There are now on the market a few greases manufactured especially for ball bearings, but, with one exception, all those tested by the author have proven worthless and clearly indicate the maker's ignorance of the requirements.

Experience shows that the most satisfactory lubricant for ball bearings is a highly refined mineral oil having the proper viscosity and cold test for the installation. Greases should be used only where operating conditions require viscosities greater than can be obtained with a mineral oil.

Whenever a ball bearing is operated at high speeds it is not advisable to run it submerged in a lubricant, and provision should be made to supply the oil from a pressure system. If such a system is not available, good results may be obtained by a large sight-feed oil cup. A few drops of oil per minute is all that is required.

At moderate speeds a heavy oil will generally give better results than a light oil. The substitution of a heavy oil for a light oil will generally result in a decreased operating temperature. This peculiarity may be explained by the fact that when the bearing is running at the actual operating speed, less opposition is offered to the rotation of the balls by the oil because of the inertia of the oil. In addition there is less churning and frothing, with their resultant air pockets. Air pockets in a lubricant act as insulators and prevent the transmission of the heat generated to the outer casing where it can readily be dissipated.

All mineral oils used on ball bearings should be highly refined, filtered, and contain a minimum amount of acid, alkali or sulpho compounds, and in order to insure the use of such oils the following specifications are suggested:

Free acid (calc. as oleic acid), maximum, 0.10 per cent.

Free alkali, absent.

Ash, maximum, trace.

Heat test (15 minutes at flash point), slight darkening, but no sediment.

Flash point (Cleveland open cup), minimum, 300 deg. Fahr.

Fire test, minimum, 350 degs. Fahr.

Viscosity at 100 deg. Fahr., Saybolt Universal:

Light oil	100 to 200 sec.
Medium oil	200 to 300 sec.
Heavy oil	300 to 500 sec.
Extra heavy oil .	More than 500 sec.

Free Acid Test.—The test for free acid should be made in accordance with the method of the American Society for Testing Materials, which is as follows:

Accurately weigh 10 grams of the oil into a flask, add 50cc. of 95 per cent. alcohol which has been neutralized with weak caustic soda, and heat to the boiling point. Agitate the flask thoroughly in order to dissolve the free fatty acids as completely as possible. Titrate while hot with tenth-normal alkali, using phenolphthalein as indicator. Express results as percentage of oleic acid. 1 cc. N/10 alkali $\doteq$ 0.0282 gram of oleic acid.

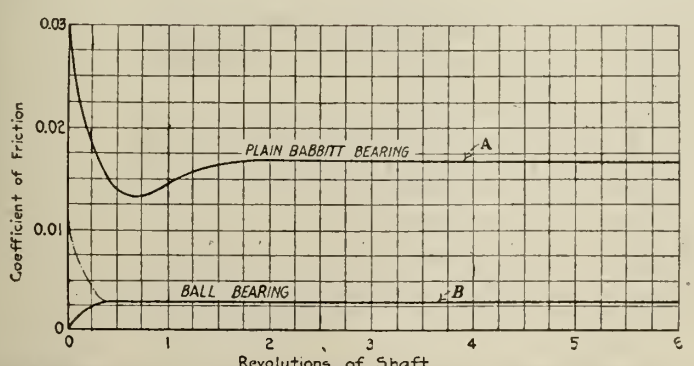


FIG. 7

To be Continued

Unfair and Unwise Proposal for Increase of 300 to 500% to Meet Increased Costs of Less Than 100%

A DRASTIC increase in postal rates, amounting to 300% the first year, and 500% the second year, is proposed in the resolution of Hon. Martin Burrell to increase postal rates on second-class matter from ¼ cent per lb. to 1 cent per lb. in 1921, and 1½ cents per lb. in 1922.

The reason given for this terrific increase of 300 to 500 per cent., is that the railroads have been awarded a higher rate for carrying mail matter. *This increase, however, is less than* 100%. Salaries of postal officials have been increased. *These increases have been less than* 100%.

The Government may need increased revenue, but why inflict a 300 *to* 500% *increase* on second-class matter, when increased costs of salaries and transportation are less than 100%?

A similar percentage increase in first-class mail would increase the cost of minimum rate for letters from 3 cents to 12 cents in 1921 and 18 cents in 1922.

When the Government reduced the rate of postage some 20 years ago on second-class matter from ½ cent per lb. to ¼ cent per lb., and at the same time reduced the letter rate from 3 cents to 2 cents, the result was not a deficit, but a surplus, and the first surplus the Post Office Department had shown for years. These reductions in rate of postage were accompanied by increases in salaries to postal officials, and also by regulations which eliminated much unnecessary waste.

A low postal rate was granted on second-class matter to encourage establishment of Canadian newspapers and periodicals. Is it fair when publishers have invested large sums of money to suddenly reverse the policy and make a drastic increase in rates which will ruin many worthy publications, and cripple the service given by the majority which survive?

Every dollar added to the price of a magazine narrows the circle of readers, and the men who would fail to subscribe are the ones who need information most.

This drastic increase would place a crippling tax on the periodical press, which, next to the schools themselves, is the greatest educational power in the country.

It would seriously retard our development in agriculture, in trade, in manufacturing, in medicine, science and en-

gineering by restricting the spread of information essential to development in these lines. This retardation would result in a tremendous annual loss to the country — a loss far greater than the revenue which the proponents of this measure (erroneously, we believe) expect.

The Canadian publishers of magazines, religious and educational papers, farm papers, trade and technical papers are already working under handicaps not experienced in other lines of business. They are subject to what is equivalent to "dumping" on the part of American publishers of magazines. The very large production by American magazine publishers takes care of the overhead expenses so that each can quite easily provide for an additional 5,000 or 10,000 copies for the Canadian market at relatively small additional expense. This extra run for the Canadian market is dumped into Canada by freight or express absolutely duty free.

The Canadian publisher must provide for his overhead with a much smaller circulation and is subject to additional expense amounting to over 40% represented by the Customs Tariff on equipment and supplies used in the production of his magazine.

Canadian National Magazines circulate to a total of approximately 5,000,000 copies annually. As against this we have a total circulation in Canada of American weekly and monthly magazines of approximately 20,000,000 copies annually. Would it not be in the public interest instead of further penalizing Canadian magazine publishers to provide even greater encouragement such as would tend to promote a much larger circulation of distinctively Canadian periodicals?

Seven years ago Canadian publishers asked for an investigation of cost of carrying various classes of mail matter, but this has not taken place. We believe such an investigation would bring out many ways in which economies could be effected.

The public has always been keenly interested in educational matters. We believe they would object strenuously to any further percentage of increase than is justified by increased expenses. In no case is this higher than 100%.

The work of magazines, business and religious papers should not be crippled to make up deficits in other departments. They should not be penalized to the extent of 300 to 500%. The increase in postal rates on Canadian publications should not be more than 100% at this time, and it would be obviously unfair and demoralizing to enforce the proposed increase of 300 to 500%.

Here is How The Whitthall Co. Produce Tin Cans

It is Reasonably Safe to Assume That the Average Reader Has But a Slight Conception of the Intricate Equipment Necessary to Produce Tin Cans—This Article Tells You How

By J. H. RODGERS

PROBABLY few articles of a domestic character are more familiar to the public eye than the ordinary tin can in which at the present time, so many different foods and household necessities are prepared and distributed for constant use.. It is reasonably safe to assume that few people have but a slight conception of the intricate mechanical equipment that is essentially necessary for the commercial production of the simple tin can in such quantities that enables them to be used, economically. as containers for a great variety of product. The material itself is the greatest factor in the cost of its manufacture.

The modern method of manufacturing tin cans requires machinery that is practically automatic in every detail of its operation, so that when once adjusted for a certain size of container the sequence of production, while the can making process is in progress, is absolutely continuous. To the casual observer the rapidity with which the semi-finished cans travel along the conveyors from one machine to another, is at first a mystifying sight, but closer observation dispels the magic atmosphere and one then sees the mechanical regularity of each and every detail, and can soon follow the progressive steps from the flat sheet to the loading of the finished product in the railroad cars.

Accuracy is the keynote of successful production. This is equally true in the making of a simple tin can as in many other lines where the finished product is of much greater value. The dependence of one machine upon another makes it almost imperative that every semi-finished can shall be perfect and an exact duplicate of the one preceding it, as a short hold-up in a run of ten thousand cans will soon wipe out the profit of manufacturing.

The A. R. Whittall Can Company, of Montreal, is a typical example of the progress that this industry has made in the last decade. The business was started by A. R. Whittall in 1885 and the activities have steadily increased under careful management and supervision. The initiative of the company was shown by the fact that they were the first Canadian firm to start work on a war order, this having been received on August 4th, 1914. The amount of this first order was for one million cans, and the total volume of business for war purposes was 200 million cans of all sizes.

F. R. Whittall is the managing-director of the company, D. S. Whittall is the vice-president, the father of these boys being A. R. Whittall the president and starter of the original business.

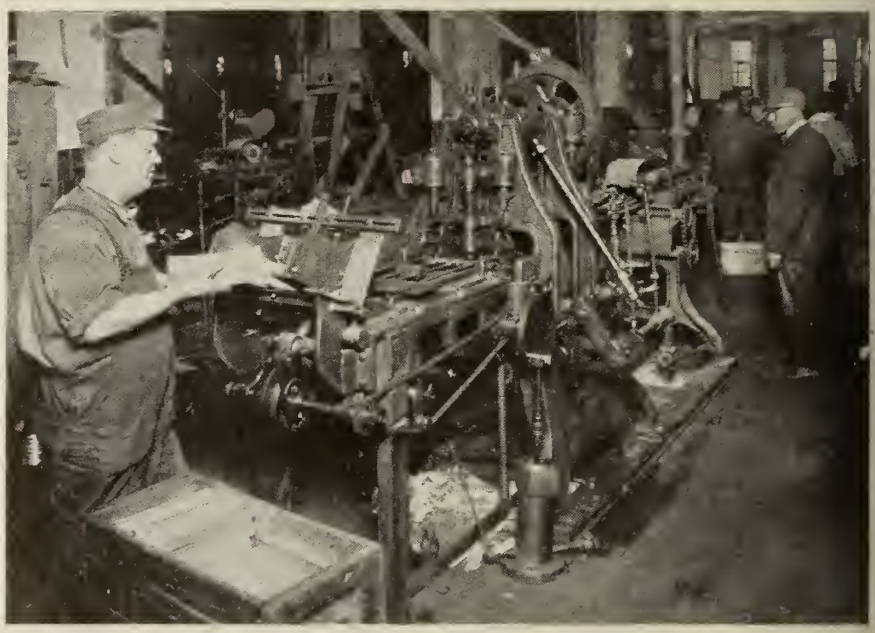


FIG. 2—BODY-MAKING MACHINE FOR THE SOLDERED LINE.

The Soldered Can

Ordinary commercial cans may be made by either of two methods—the soldered or the sanitary—the latter having supplanted the former to a large extent during recent years, by the co

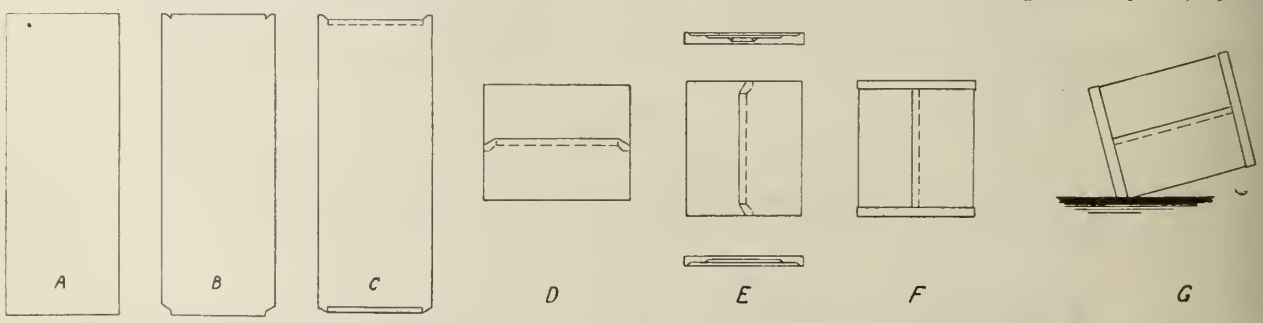


FIG. 3—THE NOTCHING AND FOLDING OPERATIONS.

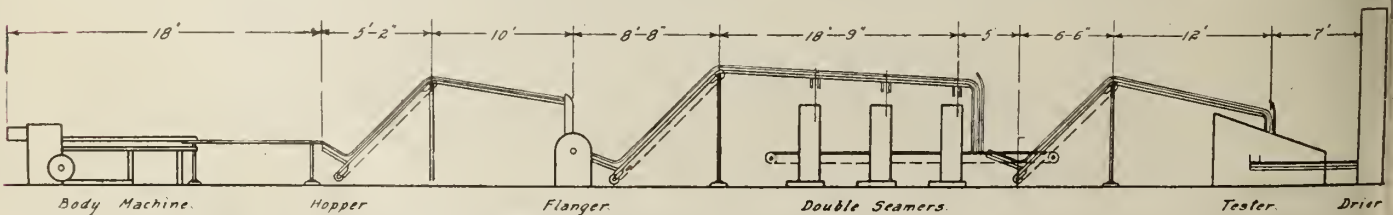


FIG. 1—A SKELTON LAYOUT OF A SANITARY LINE.

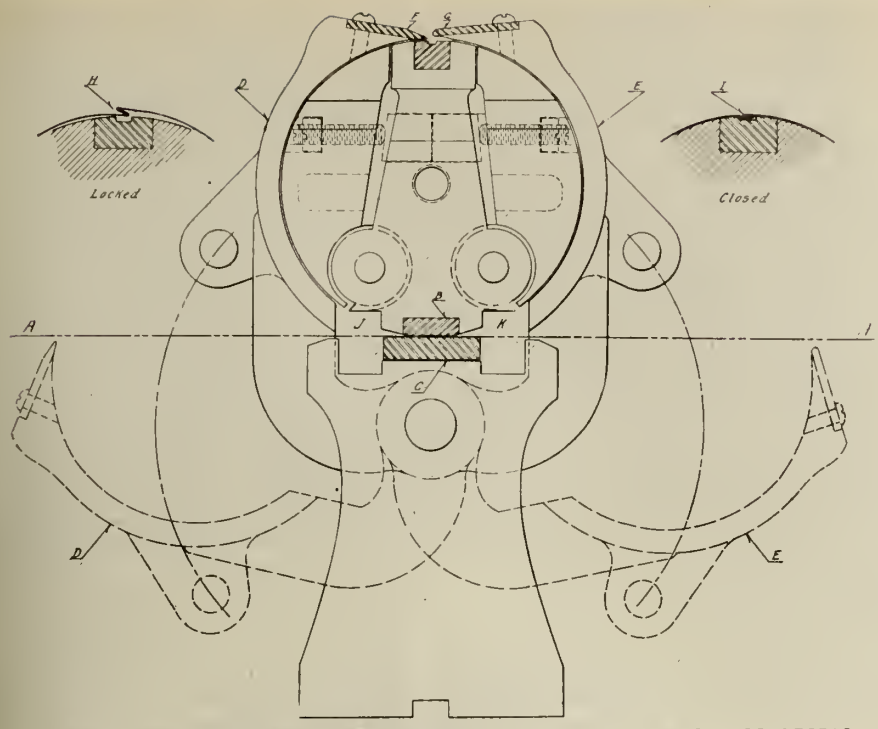


FIG. 4—THE ATTACHMENT FOR BENDING THE FLAT SHEET TO CYLINDRICAL SHAPE.

tinual development and improvement of suitable machinery. The Whittall Company are equipped to manufacture cans of every description, an automatic installation having been provided for each type of can. A skeleton layout of a sanitary line is shown in Fig. 1. The arrangement of the soldered line is quite similar to this, with the exception that the header replaces the flanger, and the corresponding position of the double seamers is occupied by the "floater" that solders the heads to the bodies.

With such a large variety of cans manufactured no attempt will be made to describe any particular size or make, as the process in every case is almost identical. In a product of this nature the factor of waste is a serious problem, and careful supervision is necessary in the selection of the different sizes of sheets from which the various cans are to be made. The cutting of the body blanks would appear to be a simple undertaking, and in fact it is, but the greatest care is required on the part of the operator in the adjustment of the gages and the spacing of the slitting cutters, so that absolute uniformity is attained. The smoothness of all succeeding operations depends, very largely, on the accuracy of the setting of the slitting shears. From four to six bodies may be cut at the one passing of the sheet; any two blanks thus cut must be of such exact dimensions that when laid upon one another they will not vary in the slightest degree.

Making the Cylindrical Body

After the body blanks are cut to size they are placed in a hopper at the receiving end of the Slayman body-making machine, shown in Fig. 2. This hopper is adjustable to different sizes of blanks and is set on an angle of about 30 degrees so that the force of gravity keeps the pile pressed against the side stops at the lower end of the incline. When the machine is in operation, a bell-crank, fitted to a shaft underneath, swings upwards and a small rubber cup secured to the upper arm, presses against the blanks in the hopper, and by the vacuum created a single blank is removed and lowered to the table, where it is carried along by fingers to an oscillating slide. The blanks are carried forward to a position where the corners are notched out, as shown at B in Fig. 3.

When this operation is performed the blank is moved along to the next stationary position, where the edges are folded as shown at C in Fig. 3. The next movement brings the blank to the forming blocks, where the flat sheet is bent to a cylindrical shape and the edges locked. A sketch of this attachment is shown in Fig. 4. When the blank is moved into position it coincides with the line A-A, passing below the mandrel and between the steel blocks B and C, with the swinging arms in their lowest position, as indicated by the dotted outline. When the blank has been carried to the proper position the pushing fingers are withdrawn and by the action of a crank and connecting link, the swinging arms D and E are moved upwards, thus forcing the blank around the mandrel. When in a closed position the steel strips F and G force the locking of the seam. This is shown in detail at H. Immediately the arms swing outward the seam is bumped from above and finished as shown at I. The mandrel is adjustable so that any slight variation in size can readily be obtained. The cylindrical body

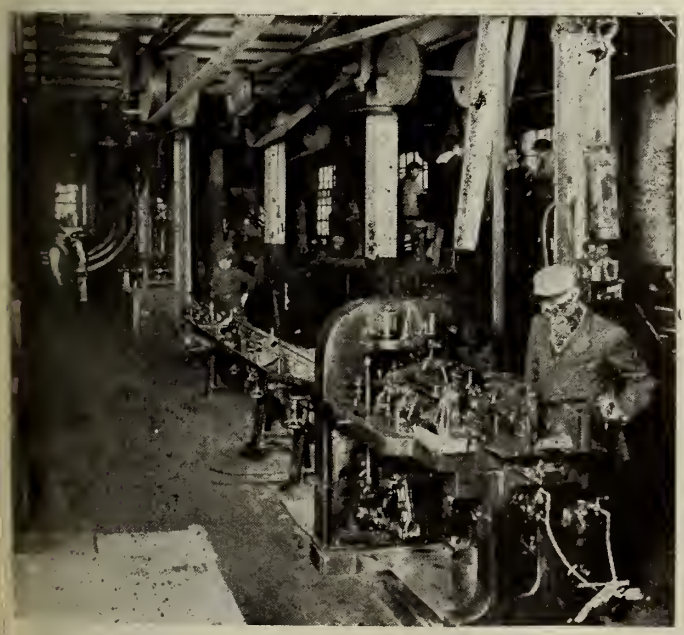


FIG. 5—BODY MAKING MACHINE ON THE SANITARY LINE.

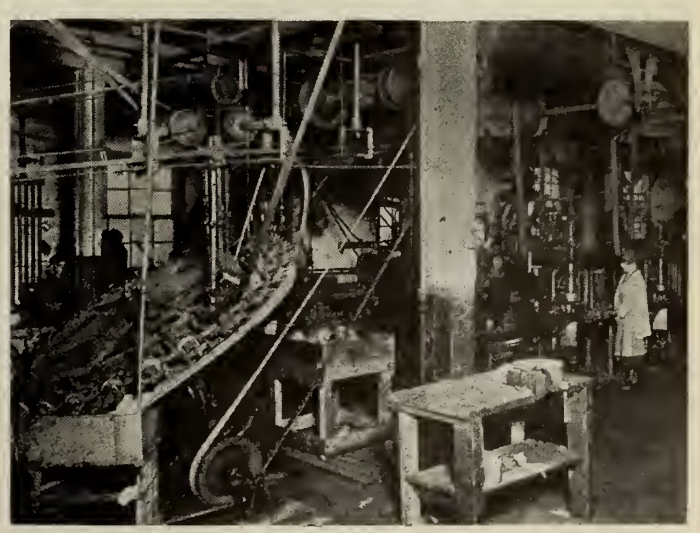


FIG. 6—TESTER AND DOUBLE SEAMERS ON SANITARY LINE.

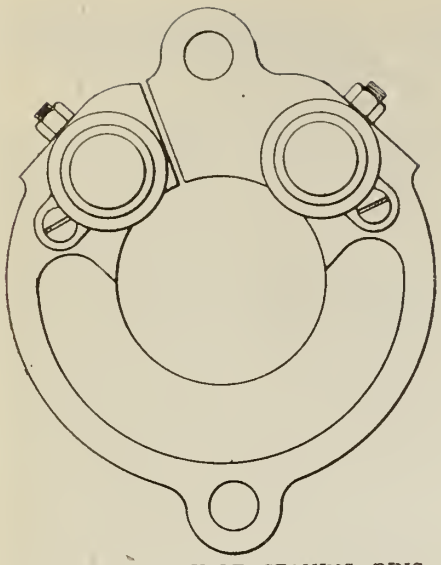


FIG. 7—THE DOUBLE SEAMING RING.

is then pushed off the mandrel by fingers operating in the spaces J and K, and is carried over an arbor and beneath a gas jet, where the joint is soldered, wire solder being fed automatically and in just sufficient quantity to provide a well-sealed seam.

The semi-finished can now has the appearance of D in Fig. 3, and is passed along below a pipe from which a low pressure air blast is supplied to cool the tin. The body, now completed, passes from the arbor, and by means of a small finger at the end of the machine, is turned at right angles to its previous position, and rolls into a chute, from which it is conveyed over the fluxing rolls and elevated by means of a conveyor to a gravity runway that leads to the heading machine.

Putting on the Ends

Simultaneous with the movement of the can bodies to the heading machine, is the delivery of the tops and the bottoms. A raised platform is located between the body-making and the heading machines, for the purpose of placing the tops and the bottoms in their respective runways. The platform, with four girl operators, can be seen in the upper right background of Fig. 5. The bodies are delivered down a central chute to the intermittent revolving head of the header, while the tops and bottoms are delivered to either side; the progress at this stage being shown at E in Fig. 3, and that after heading, at F. The top and bottom are now in position and all that is required to complete the actual making of the can, is the sealing of these circumferential joints by soldering.

Soldering on the ends

This operation is accomplished in a machine known as a floater, which is provided with a bath of molten solder, kept at a constant temperature of about 600 degress F. As the tin comes from the header a conveyor carries them to the top of an incline, down which they roll by gravity to one side of the floater, and by the weight of an endless chain travelling over the tops of the cans, the latter are caused to roll at an angle of about 15 degrees, while the corner dipping into the solder bath, similar to that shown at G in Fig. 3.

At the discharge end of the floater the can is lifted clear of the solder and allowed to roll down a short incline and under a rapidly revolving brush that removes all the surplus solder from the joint, leaving it smooth and clean. Continuing in the conveyor, which is now given a half-turn twist, the cans are returned on the opposite side of the floater and the other end given the same treatment as the first, and after again passing through the cleaning brushes, the cans are practically completed.

FIG. 8—THE CURLING ROLLS.

Testing the Finished Cans

While the process, so far, constitutes a description of the actual making of the cans, the efficiency of the various operations has yet to be determined. When the tins are to be used as containers for foods, or as receptacles for liquids of any kind, it is essential that the cans be perfectly air-tight, otherwise leakage will result, and in the case of cooked foods, the contents would undoubtedly spoil. To insure a 100 per cent. perfect shipment from the factory every can for such purposes as stated above is given an air test by passing the cans through a tank of water, the open end of the can being sealed to prevent the water from reaching the interior. The operation of the tester is one of the most interesting of any of the machines in the factory and performs its work accurately and systematically. One of these machines is shown at the left of Fig. 6. The overhead runway will be noted above, with

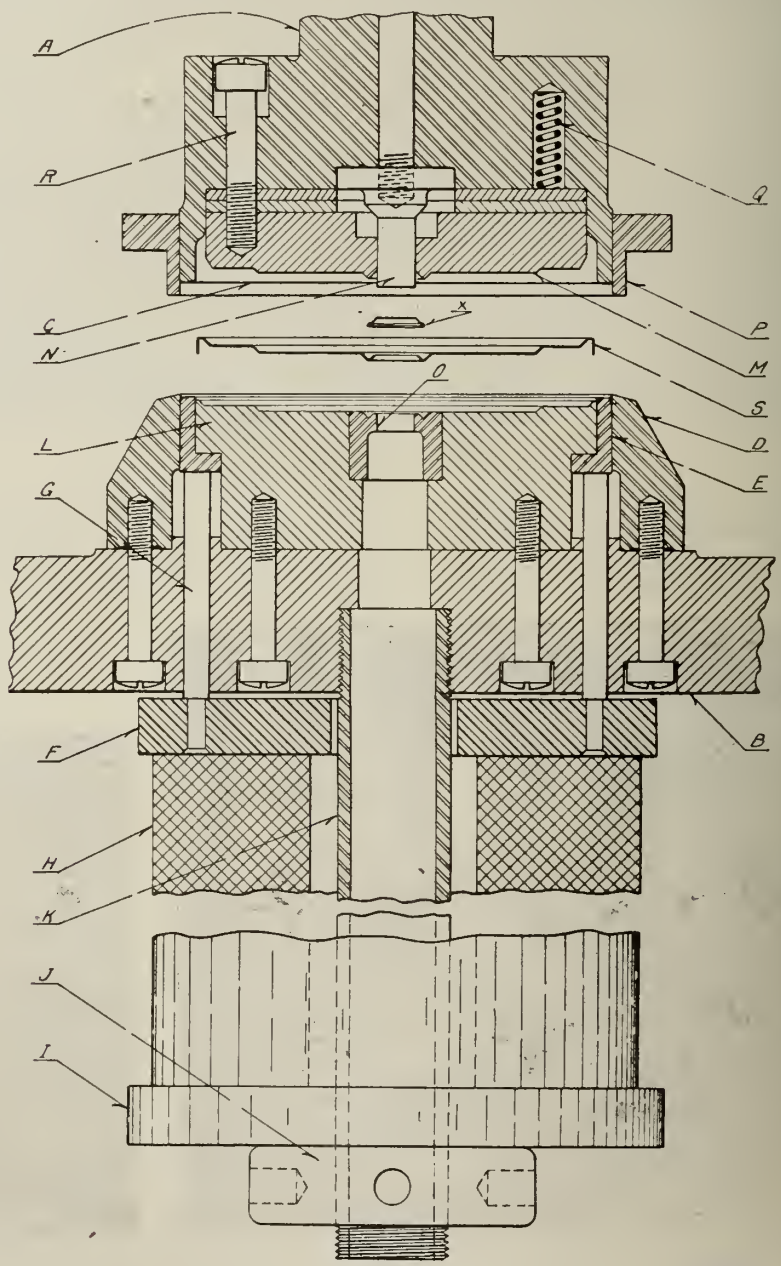


FIG. 9—COMMON METHOD OF MAKING PUNCH AND DIE CAN COVERS.

FIG. 10—GENERAL VIEW OF A PORTION OF PRESS DEPARMENT.

a vertical chute leading down to the machine. The revolving portion of the machine is set at an angle of about 30 degrees and has position for some 24 tins, the lower section being charged at all times. These testers are adjustable to take all sizes of cans up to one gallon.

As the machine revolves a can drops into each position and immediately afterwards the rubber head is pressed against the open end of the can by the action of a cam below the revolving head; at the same time the air valve is turned on, permitting air at a pressure of 15 pounds to enter the can. In this position it passed through the tank of water, and it is the duty of the operator who sits in front of the machine, to watch for the small air bubbles that indicates that the can is defective. Directly back of each sliding head is a small handle which can be turned when a defective can is detected, the result of this action permitting the can to be discharged automatically at a different point from those that are perfect, the latter being released by the disengagement of the roller of the cam and carried by conveyor to a drier, through which they pass before being carried to the waiting cars for shipment. Cut-outs are provided at various points in the conveyors to divert the cans when any of the machines are suddenly thrown out of commission.

The Sanitary Can

In the sanitary made can there is considerable more accuracy required in the various machine operations, owing to the fact that no solder is used in sealing the seams. Apart from the soldering of the longitudinal seam the making of the cylindrical body is identical with the soldered type of tin, a special body-making machine being used for this purpose. After coming from the lock seamer the cans are taken by conveyor to the flanger, where the ends are given a slight flare to facilitate the operation of curling the stock inside the flange of the cover when these are put on in the double seamers. Three automatic double seamers are used in the sanitary line, each machine having an average capacity of 60 cans per minute. A partial view of these machines is shown at the middle right of Fig. 6. Directly in front of the machine is a four-post magazine guide into which the covers are placed, and kept supplied by the operator when the machine is working. The covers, one at a time, are taken from the bottom of the pile automatically, and carried inwards and placed on the bodies as they are fed into a central position beneath the head of the double seamer. By the action of a cam, properly timed, the table, with the can, is raised, thus pressing the cover into the head of the revolving spindle, which trabels at a constant speed of 600 r.p.m. The operation of double seaming is performed by the action of the ring shown in Fig. 7. This ring is secured to the seaming head and by means of an eccentric on the outer sleeve of the spindle, and revolving in the vatio of about 1:30 of that of the main spindle, causes the two rollers to oscillate from side to side, the first roller giving a curl similar to that at A in Fig. 8, and the second or finishing roll completing the seam as shown at B. It will be noted that the ring, which is made of steel, is split alongside the second roll. The clamping screws provide a rigid support to the first roll, while the cut gives sufficient flexibility for the finishing roll when passing over the side seam, at the same time making a good tight joint. By means of a small eccentric bushing in the ring, the position of these rollers is accurately adjusted for any slight variation in the thickness of the stock or the wear of the rolls. The rolls run on roller bearings to insure perfect freedof of action under heavy pressure..

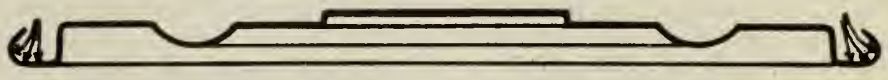


FIG. 11—AN OUTLINE VIEW OF SANITARY COVER AS IT COMES FROM THE DIE

Stamping Out the Covers

In order to complete the description of the manufacture of a tin can it will be necessary to give a few details in

FIG. 12—SPECIAL CAN-MAKING DEPARTMENT.

FIG. 13—VIEW SHOWING PORTION OF TOOL ROOM.

connection with the making of the tops and the bottoms, an operation that is accomplished on one machine, and invariably at one stroke of the press. Dies of the desired shapes and sizes are essential to the production of tin cans; the various sizes to provide for the different characters and volumes of the contents, and of such a shape as to insure strength and stiffness to the ends, and at the same time provide facilities for fastening to the cylindrical portion of the can.

The general principle of circular die construction is quite similar in all cases, although the details of design may vary vary according to the needs of each individual case and the method practised by the designer. The sketch shown in Fig. 9 illustrates a common way of making a punch and die for can covers, this particular one being for a cover of a soldered can with a small central opening for filling. (After filling, the small solder-edged cap X is placed on and sealed with a capping iron, this operation being done at the factory of the manufacturer putting up the contents.)

To describe the operation of making the cover S. The first detail is the placing of the punch and the die in the press; this is done by the die-setter, and great care is required in securing the die to the press bed, as the alignment must be absolutely accurate, to avoid shearing the die, and likewise to produce a perfect cover. The strips of tin, from which the covers are to be made, are cut about 1-8 inch wider than the diameter of the blank cut. These strips are fed over the die and the press set in motion; covers being produced at the rate of about 150 per minute. When the blank is cut it is firmly held between the face of the punch C and the face of the draw ring E. To provide the proper pressure to prevent buckling of the stock when being drawn into shape, the ring F is provided, with pins G extending through the die bed and bearing against the lower part of the ring E. The tension proper is supplied by the rubber cylinder H, surrounding the pipe K and supported on the ring I. Pressure is adjustable by the nut J. The stock is formed with the desired concentric impressions by the contact of the punch plate M and the forming post L, over the outer diameter of the latter the edge of the cover being formed. Just before coming to its lowest position the centre hole is pierced by the punch N as it enters the small die O, the blank passing down through the central opening. The cover is removed from the punch by the reaction of the springs Q, and from the forming post by the pressure ring E.

A view of the press department is shown in Fig 10, the presses on the right being fitted with automatic feeding attachments. The output from one of these presses will approximate 90,000 covers per day of ten hours. Several presses are operating continuously on the making of tops and bottoms. The dies for the sanitary tops or covers are somewhat similar to that in Fig. 9, but modified to meet their specific needs, the presses are adapted to the use of an extra die that gives the additional curl to the end for facilitating the double seaming operation.

It might be stated that for sanitary cans that are to be perfectly air tight, the covers are passed through a special machine where a thin film of liquid rubber is spread inside the curl that is afterwards seamed to the body. This greatly adds to the efficiency of the seam. An outline of a sanitary cover as it comes from the die in which it is made, is shown in Fig. 11, the arrows indicating the portion treated with the film of rubber.

In addition to the section devoted to automatic production of the standard types of smaller tins, a special department is provided to take care of the larger sizes, where considerably more manual labor is required on the different operations. Fig. 12 shows a view of this department.

One of the indispensable factors in the maintenance of a sheet metal working plant is that of the tool room. Generally speaking, every new type or size of can necessitates a complete set of tools for its production. This applies in particular to the tops and bottoms, so that the making of the dies for this purpose is no small detail of the plant requirements. The tool room at the Whittall factory is exceptionally well equipped and amply provided with every facility for effective production of sheet metal dies and all kinds of accessories for can making machinery.

Interesting Facts to be Found in This Week's Advertising Section

A tool that is 50,000 years old.

A remedy for scrap piles.

How to handle a large variety of grinding work.

That it's wrong to slop over.

How to secure continuous operation of belts.

A firm that claims to be a national institution of mechanical service.

That there exists such a thing as a little giant.

How to secure information regarding oil-gas.

That time is expensive.

What to do if desirous of obtaining accurate work.

How to speed up inter-factory transportation.

A tap that is said to be scientifically correct.

A story of a search after originality.

How to prevent idle time.

What other engineers know about repairs, and how I can secure the same information free of charge.

ONE WAY TO LOSE MONEY

It was reported from Buffalo that if scoopers do not return to work within a reasonable time the Lake Carriers' Associatioon in all probability will declare an open shop in grain handling, and proceed to organize for handling the fall grain. There is little possibility of any of the old housemen or scoopers going to work at grain handling this spring, say vesselmen. "The scoopers have lost a good deal of money by having been led into this sympathetic strike. The grain will all have been unloaded in a short time, and these men will not have earned a dollar. They had no grievance against the vesselmen, but quit because the housemen were out," said President T. V. O'Connor of the International Longshoremen's Union.

According to Commerce Reports, copper mining is, next to diamond mining, the most important industry in Southwest Africa, and one which had been steadily expanding for some years prior to the outbreak of the war. Copper deposits occur and have been opened up at quite a number of widely separated localities. Many of these, however, have not proved worth exploiting, and the only properties that have been worked on a profitable scale are those belonging to the Otavi Mines & Railway Co. at Tsumeb, Guchab, Great Otavi, Asis, and Otavi Valley; the Kahn Copper Mine, situated to the southeast of Arandis; and the Sinclair Mine, in the northeastern corner of the Luderitz Bay district.

The Tsumeb deposits are said to be the most important so far discovered. These are found on a limestone hill, where the ore body is 550 feet long and 65½ feet wide. The ore consists of copper glaance and lead ore, and also of carbonates of copper and lead. The ore is concentrated and smelted until a 40 per cent. copper ore is obtained after the separation of the lead.

Although iron ore has been found to exist in a number of localities the only deposit that has been exploited up to the present is situated near Kalkfeld, on the same railway line as the Tsumeb copper mine.

The Chamber of Commerce of Newcastle-on-Tyne, England, is issuing a volume in five languages descriptive of the industries of Durham and Northumberland.

The declared exports from the consular district of Callao-Lima, Peru, included the agencies at Arequipa, Cerro de Pasco, Mollendo, Salaverry, and Paita, amounted to $53,489,799 in 1919 as compared with $39,480,887 in 1918, an increase of $14,008,912. There was a decided increase at Callao and all of the agencies with the exception of Mollendo, where the exports of tin ore, wolfram, and wool decreased considerably.

WHAT OUR READERS THINK AND DO

Repairing a Double Throw Crankshaft

By W. R. GREEN

WHILE in the employ of the company who made the bullwheel described in a previous article of CANADIAN MACHINERY, I, with an elder machinist, was sent to a nearby mine to look over a broken-down engine with the object of locating the trouble and making an estimate of the price for repairs. After getting to the place we discovered that the engine was a two cylinder, end crank, with flywheel centre mounted. We also found that the engine required new cylinder liners, new pistons, and the piston rods turned down, also one new slide valve. The worst trouble, however, appeared to be that the crankshaft seemed to have a slight kink in it near the right-hand main bearing.

The engineer stated that it had been like that for weeks and was caused by the big rope breaking and tangling with the flywheel and jamming between the wheel and the pit wall; instead of the wheel breaking, the shaft kinked. He mentioned that if he had shut down a large number of men would have been out of a job, so, as the engine could still run, although with a slight wobble, he kept it so doing till the season closed and the mine shut down.

Well, Joe and I went all over the parts and sent a letter in to our super, with an estimate of the job, reserving the crankshaft for a daywork job; meanwhile we, with the engineer and fireman, cleaned the dirty parts and dismantled them ready for the ore train to take them to town.

By the time the parts were ready for shipment one of our boilermakers passed us the word to get it down to the shop. After getting back to the shop again my job was to straighten the crankshaft with the aid of the blacksmith, so after cleaning the shaft thoroughly with kerosene and a moulder's steel brush, I took off the split sheaves (eccentric) and the two cranks and hoisted the shaft onto the home-made overhead crane and rambled it down to the big forge where the smith took it in hand. I now returned to the machine shop to secure some tackle ready to jack the shaft into line.

In the meantime the shaft was getting hot and presently the smith called me over to the forge to look at something he couldn't savvy, and to tell the truth I was as badly scared as he was at what I saw in the fire. You will see by Fig. 1 what the shape of the crack was that we saw on the hot shaft, and I presumed that when the wheel got jammed, the shaft (which was very old) cracked, and the peculiar shaped chip wedged in, and later on the space it left on the journal filled with hard babbitt from the bearing, so it was not noticed until the heat melted off.

We decided that we had better show it to the foreman and see what he had to say about the affair, and he, on looking it over, advised us to put it aside and look around for a piece suitable for making another shaft. After wasting two days looking for a large solid shaft suitable for the job, I had to report failure.

There were plenty of pieces of large stock but they were all hollow. I then suggested that the shaft be repaired by reducing the size of it and thread-shrinking a new jacket to it. I had seen a similar job accomplished while working in Woolwich Arsenal, England, as an improver, and it had been a perfect success, although it did not get the strain put on it that a crankshaft does.

He suggested that it be welded, but after talking it over with the smiths he found that the forges were not large enough for that size of work, and also it would require a large power hammer, which we were shy of at that time.

After talking it over with the older men the owner told me to make a good, clear drawing of the shaft as it was, and also of my proposed scheme, which I did. After looking at the drawings the foreman told me to go ahead, and also mentioned that if it was no good I would be presented with the order of the "can."

I now took the shaft to our large screw-cutting lathe, chucked it at one end and mounted it in a steady rest fitted with two hardwood blocks about four inches back of the right-hand end of the wheel mounting. Next I placed a long inch-and-half hole up the centre of shaft giving it a slight outward taper near the end in case I would need a centre later on, in which case I would have fitted a taper plug in the hole. I next run the back centre up with a small pipe centre fitted to it and after taking the weight from the steady rest, I reset the same, as the two-wheel keyways were cutting the blocks. I filled the keyways with babbitt and stopped that trouble. Then I started the real work, by reducing the flange, journal and shaft to 7 inch. dia. and right up to the wheel hub spotting. The crack did not extend clear through, but had the appearance of a flat wedge chip in the steel which had tired or crystallized.

I now tock the shaft to our large and then gave all three steps a final cut, which gave the thread clearance and allowed about one inch under each shoulder for an eight-pitch thread. On the foreman's advice I left the shaft for a time before threading it, taking the centre from it and taking belt off lathe,

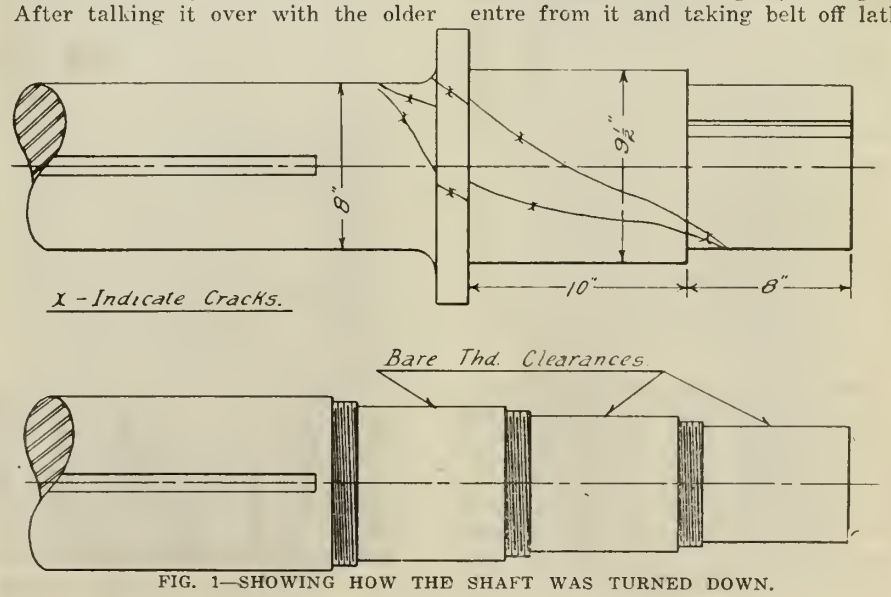


FIG. 1—SHOWING HOW THE SHAFT WAS TURNED DOWN.

this latter precaution to make sure the shaft would not be disturbed.

Meanwhile I took a piece of 12 inch hollow shaft and bored it to suit the male sizes on the other shaft and allowing 5/32 inch for internal expansion on the smallest size, then, after cutting the threads—making sure that each thread started and ended at the same point line on the jacket—all I had to do was to take it out of lathe and heat it when the other shaft was ready. The foreman examined the crankshaft very critically before letting me proceed with the work on it, but as the turning operation had taken out all the wedge crack and had left but a very minute hairline, and the material had not perceptibly changed its lines, he told me to go ahead with the job of threading; I did so, making very sure of the threads in the jacket, so as to get them all started from the same point. With the help of the smith I got the jacket heated after marking the top of it with red kiel and then we slung it in a chain sling and took it over to the shaft. After cleaning out the bore with a steel wire whisk we placed it on the shaft and the threads engaged about ¼ inch from the shoulder and we nearly tore the crane down by using the chain sling as a tongs for the jacket, and turning the shaft into it by pulling the belt which I had replaced; but the main thing to me was, that it went home and after cooling off seemed to be as one with the core.

While it was cooling I made a small plug for the hole in the end of shaft, and while the end was still hot, I placed the plug into it so that it was in to stay. I proceeded to do other work till the shaft was cold, which consisted of cutting off a piece of 16 inch hollow shaft, that I found in the scrap-pile, for a flange. I bored the piece to 10 inch dia. and threaded it with eight threads to the inch as the others were, then faced one side. Next day I carved the shaft end down to the place where the flange had to go and threaded it to suit flange, allowing 13/64 inch. for expansion, then got the smith to heat the piece to a dark red heat and after cleaning the threads we placed that also into position on the shaft, and I may say that this operation was not so easy as the first one was, mainly because neither the smith nor myself had thought about what tools we would need in case the expansion was not enough, but as it turned out it went on far enough that I was able to jam a big roughing tool into the metal on its periphery and by turning the shaft it also went all the way up. After which the rest of the job was a simple turning proposition, to make the new end exactly like the other end.

I might say at this point that the flywheel was 14 feet diam. x 3 foot rim grooved, for 12 ropes, and had a length of hub of 2 ft. 8 in. It was made in two sections, each having its own keyway and key. The sketches, as illustrated, show Fig. 1 as the shaft appeared with crack; while Fig. 2 illustrates the shaft as turned down and threaded.

What has always seemed to me, from my point of view, is the need for a machinist to be able to draw or at least to make a legible sketch, and if he can do that he can necessarily read blueprints without trouble. On the foregoing job, if I had been unable to draw, I should have had a sweet time explaining my method of procedure to either of my bosses. But as it was, they saw exactly what I tried to explain but could not put into words. Also they were convinced that the scheme was at least worth a trial.

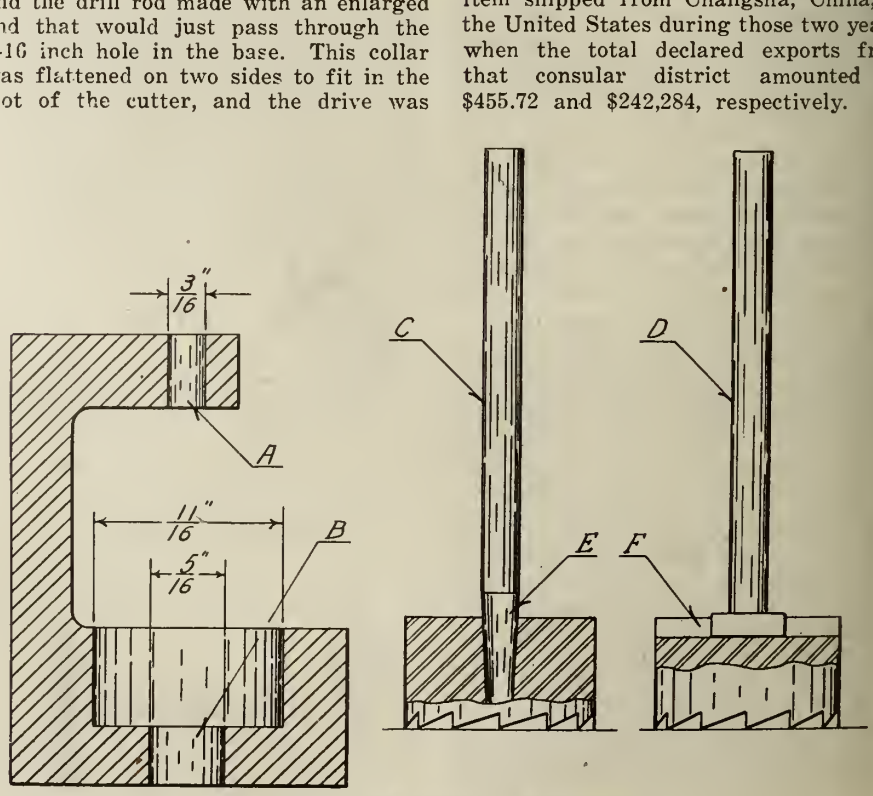
COSTLY DESIGN OF PARTS

By J. H. Rodgers

In the design of special machinery it is not an uncommon thing to have some of the parts of such a shape that the machining of the piece calls for considerable ingenuity on the part of the mechanic who is called upon to build the machine from the drawings furnished. A case of this kind is shown in the sketch herewith. To the left is a section of a small casting that requires to have a hole drilled in as shown. It will be seen that the counter-boring of the hole in the base is no easy undertaking owing to the size of the small hole in the top lug. The drilling of the holes A and B was comparatively easy, and the method adopted for enlarging the bottom hole may be described as follows: The small end-mill cutter shown in the centre was made with a tapered hole to fit the end of the small drill rod C. The taper portion, however, was not sufficiently rigid to drive the cutter, so the method shown at the right was afterwards resorted to. The cutter was slotted across the top and the drill rod made with an enlarged end that would just pass through the 5-16 inch hole in the base. This collar was flattened on two sides to fit in the slot of the cutter, and the drive was amply strong for the purpose, with the result that the job was completed satisfactorily, and eccentricity in the holes being taken care of by the movement of the tongue in the cutter slot.

The booming of the cotton and sugar industries, as well as the increase in railroad activity in Argentina, is causing an increased demand for mechanics of all kinds, says Commerce Reports. The project of the Director of Navigation and Ports to initiate a school of apprentices for the various trades is considered the first step toward general elementary trade schools in the country. Courses will embrace about 25 trades, including those of the carpenter, machinist, boiler maker, steam engineer, electrician, plumber, and radiotelegrapher. Boys who have received primary grade schooling will be apprenticed in the workshops of the Department of Public Works at Riachuelo, Santa Fe, Parana, Concepcion, and Bermejo, where four years of practical work and instruction will be received. Although the amount to be invested in this work is not large, Canadian machinery and equipment manufacturers might well aid in the starting of such schools. Certainly no better advertisement of Canadian goods could be had than their use in the training of the future mechanics of the country. (The office of the commercial attache, Buenos Aires, announces that it is in a position to forward to the proper authorities all literature or offers for school equipment, machinery, etc.)

Antimony, valued at $270,571 in 1918 and $239,116 in 1919, was the principal item shipped from Changsha, China, to the United States during those two years, when the total declared exports from that consular district amounted to $455.72 and $242,284, respectively.



HERE IS THE IDEA IN A NUTSHELL.

DEVELOPMENTS IN SHOP EQUIPMENT

CYLINDER TEST GAUGE

The Federal Products Corporation, Providence, R. I., have placed on the market an interesting cylinder test gauge which is herein illustrated and described. This gauge detects tapered, scored or out of round cylinders, and referring to illustration we note as follows:

The gauge feelers project from casing (A). These feelers are actuated by means of a cone cam (inside the casing) which is directly connected by a steel rod running through the body (B) to a rack and spur movement that operates the dial hand. The button (C) which projects through the knurled sleeve is attached to the steel rod. By pushing down the button, the cone cam is likewise lowered, thus permitting the feelers to recede sufficiently to be inserted in the cylinder. When the feelers are inside of the bore, pressure on the button is withdrawn and the feelers are automatically released against the cylinder walls.

Provision has been made for building up one of the three feelers (D) so that with a set of extensions, measurements can be taken of any diameter between 2½ inches and 6½ inches. This is accomplished in the following manner: Nipples (G) are made in different sizes to cover any fractional part of an inch. These nipples fit interchangeably into the extension rods (E) which vary in length by 1-inch steps, and which are in turn supported by threading bushings (F) to match.

The gauge dial is graduated in .001 in. with sufficient space between calibrations to allow variations of .0005 in. to be easily perceptible and it always remains in plain sight, and is never buried deep in the bore so as to necessitate the manipulation of lights and mirrors to obtain a reading. It can be set to any position with reference to the hand by turning the knurled bezel. The function of the master (H) is to furnish a means for setting the gauge accurately to a standard diameter. We can furnish masters of the type illustrated, to any diameter specified.

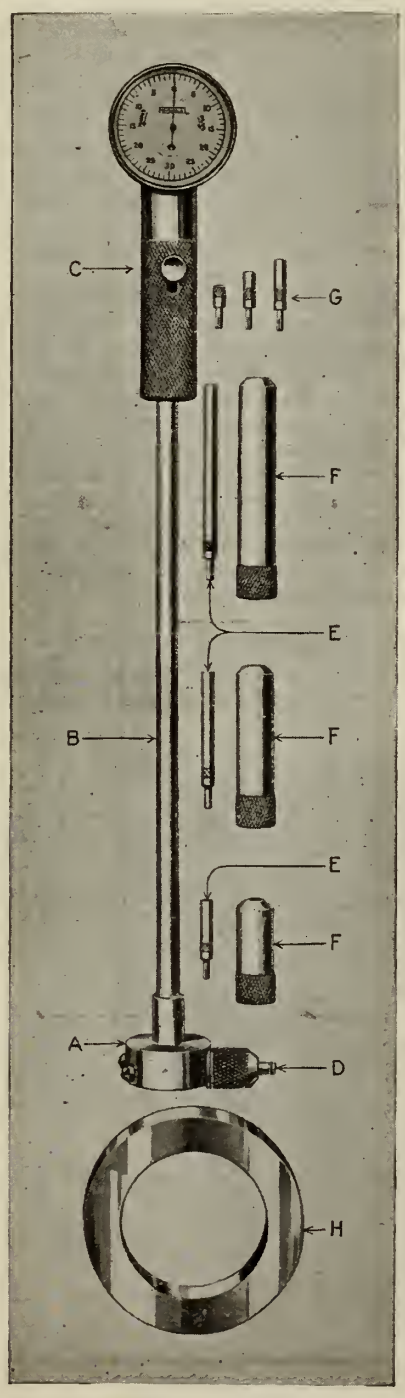
Where the gauge is to be used to measure the variations from one standard diameter as is the case with motor manufacturers and many service stations, extensions (G), (E) and (F) will ordinarily not be required. In such instances, the feeler D is made solid.

Method of Operation

In practice the feelers before insertion in the cylinder are set to a master (as illustrated by cut H), while at the same time the face of the dial is turned until the hand is coincident with the zero. The feelers are then introduced into the cylinder bore and applied to any part of the cylinder wall desired.

The instrument is rocked from side to side, in a fashion similar to that employed with inside micrometers. The position of the hand at the high point records the plus or minus variation from the standard diameter.

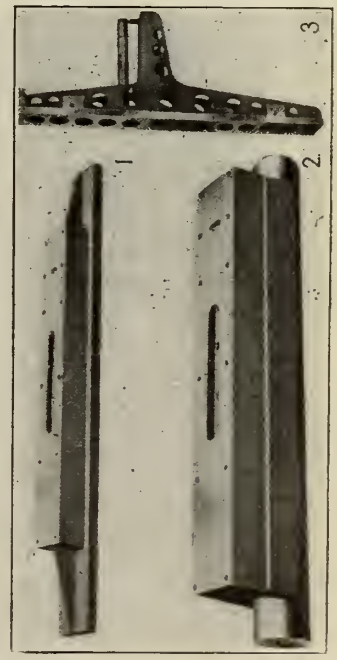
The feelers always bear with uniform pressure on the sides of the cylinder walls, so that readings are in no way dependent on the human touch and are thus accurate and positive. An added advantage is also derived from the fact that the gauge can be applied regardless of the position of the cylinder block.



DETAILS OF GAUGE

LEVELLING INSTRUMENTS

The Ricker Instrument Co., 1919-21 Fairmont Ave., Philadelphia, have placed on the market a line of precision levels for machine shop use. At Fig. 1 on top of cut is shown a machinists' level, while Fig. 2 (at bottom) is an instrument designed for use in levelling shafting. Fig. 3 is a plumb level used for plumbing planer uprights and other



THE THREE STYLES OF INSTRUMENTS

vertical surfaces. The vials of these levels are ground and graduated, and it is claimed that the bubbles will be deflected 0.10 inch for every 0.001 inch. The work is out of level in one foot. To further ensure accuracy the cases are put through a heat-treating process to prevent warping.

DOUBLE SPINDLE DISC GRINDER

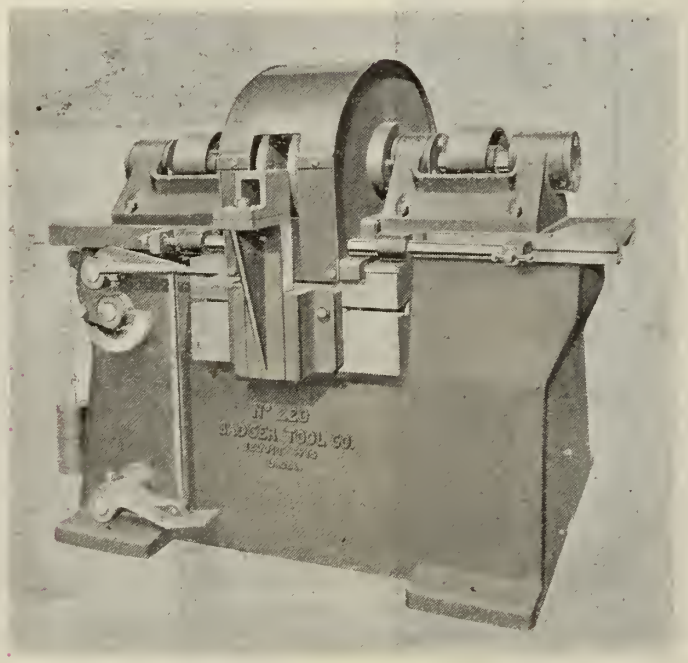
The Badger Tool Co., Beloit, Wis., have recently put on the market their new double spindle type disc grinder, known as their No. 220 type. This machine is of unusual rigidity and weight, and is intended for finishing the two opposite parallel faces of work within its scope, such as drop forged wrenches piston rings, nuts, etc.

Abrasive cylinders held in chucks are interchangeable with the disc wheels, making it possible with extra equipment which they furnish to use water or grinding compound.

This particular grinder is designed to carry two 20-inch disc wheels or two 16-inch abrasive cylinders. The 2-3/16-inch. diameter spindles are mounted in both radial and thrust ball bearings. The spindle pulleys are 8½-inch diameter by 6-inch face. The ways on base are 10-inches wide by 20 inches long; bottom of sliding head, 10 inches wide by 26 inches long.

The machine incorporates numerous features, the most prominent of which are the provision for excluding all dust and grit from the sliding ways; the positive micrometer stop screw, and the rigid construction of work supports.

The machine is made in both belt and direct motor drive, and the height of spindle from floor is 38 inches and the extreme overall length 70 inches. The entire equipment weighs 4,700 pounds.



GENERAL VIEW OF THE GRINDER.

NEW THINGS IN MACHINE TOOLS

The Sebastian Lathe Company, of Cincinnati, has designed a new type of 13 and 15 inch lathe with a semi-closed headstock. These machines are also furnished with a gap if desired.

PORTABLE JOINER

A small portable bench joiner has recently been brought out by J. D. Wallace & Co. of Chicago. The power required for operation is a ½ h.p. motor, which is fitted direct to the frame of the machine. The joiner is so designed that it may be operated from a lighting circuit.

INDICATOR HOLDER

A device for the holding of indicators when used on large square with blade of from 2 to 3 inches in width, has recently been brought out by Guldager and Jantch Co., of Detroit. Easy adjustment is obtained by the use of small balls that have contact on the edge of the square blade. The slide is locked in position by means of a thumbscrew at the back. The indicator is not included with the holder.

ELECTRIC AIR COMPRESSOR

A new departure in the way of air compressors has been made by the Black and Decker Manufacturing Company of Baltimore, Md. The machine is electrically driven and made in two types, high and low pressure. Both types are identical with the exception of the bores, the high pressure machine having a bore of 2¾ inches and the low pressure machine having a bore of 3¾ inches. The larger machine will work up to a pressure of 200 pounds per square inch.

SHARPENING MACHINE

The Ingersoll-Rand Company, of New York, has recently developed a compressed air operated drill steel sharpening machine. This machine has been designed to sharpen the points and form the shanks of drill rod of different shapes and up to 2 inches in diameter. This machine can be fitted with special attachments for the forging of bolt-heads, pins, etc. One control lever is sufficient for all the operations of the machine, and this lever is provided with a safety locking device. The throttle is of the balanced spool type, operates easily and quickly, is positive and instantaneous in action.

NEW BENCH LATHE

The Package Machine Company, of Springfield, Mass., has recently placed on the market a new precision bench lathe that has several interesting features of design. The headstock is fitted with ball thrust bearings, a split nut clamp in the tailstock, and adjustable nuts in the compound rest feed screws. The large pulley on the countershaft is of aluminum for minimizing inertia. The bed has a length of 36 inches, with 16 inches between centres. Swing over the bed 8 inches. Six changes of spindle speed are provided ranging from 350 to 1,200 h.p.m. Bench space 6 x 39 inches.

ROTARY SHEAR

An interesting and serviceable type of rotary shear for sheet metal work, has been placed on the market by the Southwark Foundry and Machine Company of Philadelphia. The upper cutter is carried in a turret that can be revolved about its own axis and likewise the lower cutter, so that circular, oval, or odd-shaped holes may be cut out of a sheet without slitting in from the side. Control of the machine is obtained by means of a foot treadle operating a sensitive clutch, and the cutter can be stopped or started within 1-32 inch of the feed. The machine is built in five sizes for gauges from No. 18 upwards. The throat depths range from 18 to 36 inches.

HAND MILLER

The Superior Machine and Engineering Company of Detroit are now manufacturing a hand milling machine that has been especially designed for accurate work, being rigidly constructed and easily handled. Both spindle head and knee are adjustable, being fitted to flat guiding ways on the column. The spindle runs in bronze bearings that are adjustable for wear. The machine has been designed to be driven direct from the main shaft, or, if desired, the machine may be supplied with a 1½ h.p. motor that can be secured to the base of the machine. The spindle has twelve changes of speed ranging from 150 to 600 r.p.m. Table surface is 22 by 4¼ inches. The floor space is 34 by 41 inches, and the net weight is about 860 pounds.

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The Outlaw Strike

SOME months ago an outlaw strike of switchmen was started in the United States. At first the only persons affected were the switchmen themselves.

It was not long before others were touched. It was a comparatively short time before hundreds, then thousands of workers were thrown out of employment because traffic had ceased to move on account of the first strike.

The others who were thrown out of work had no quarrel with the people for whom they were working. They probably had working arrangements that were quite satisfactory.

They were forced into idleness because a set of outlaws broke out and tied up traffic.

The loss of wages and the decreased purchasing power as a result are so large by now as to be past analyzing. And this loss is going to go on for some time to come, as it will take weeks to straighten out the mess that has been left as a monument to the selfishness of the outlaw strikers.

There is a dependence between men that cannot be successfully shoved to one side.

When one set of hot-heads get the idea that they can live unto themselves, or arrive at the stage of mental callous where the sufferings and inconvenience are of supreme indifference to them, they are putting so much grease on the skids that the slides are dangerous and often disastrous.

And when things start to slide it is no easy matter to reach around and find a man big enough and powerful enough to put a peg in.

Decent labor organization has got to take a hand in this thing. If it does not want to get tied up in reputation with the lawless element, it must get busy and hit the thing on the head.

An attitude that amounts to no more than an official slap-on-the-wrist for the rebels is as truly wasted as trying to put Vesuvius out with a tea kettle.

The New Tariff

TRIBUTE is paid to the essential character of the lines dealt in by the machine tool trade, and by the steel and iron business in general, in that in no instance will they be called upon to pay the luxury tax. We are not referring to some of the products manufactured by these tools and material, but to the materials and equipment themselves.

The new tariff regulations make it clear that the Government considers that many people are troubled with the habit of dollars burning holes in their pockets. Hence the way to save the pockets is to rid them of the dollars.

Inasmuch as the new taxes aim at curbing extravagance and buying beyond the limit of what they are able to pay for, they will serve a good purpose. Money has been coming easily of late, and it has been going in the same manner.

When the war was on no sacrifice was too great for people to make in order that the men at the front should be backed to the limit of our ability. We took on great big national obligations then, and we have got to discharge them now, and the money has to come from the people.

The method of taxation now, which is more direct than anything we have been used to, will bring home to many people for the first time the realization that taxes and levies are real, and that in their own attitude lies the ability to increase or decrease them.

Speaking of Brave Men

WHEN this here season rolls around between the spring and summer, when one day's wet and dreary, the next a six-foot hummer—'tis then I like to watch the crowds and see the changing style, they cause a chuckle for to come and stop with me a while.

'Tis then I see one miss go by, with fur wrapped round her neck—another one stripped off, by gum, as passin' through a wreck.

Some men have coats wrapped 'round their chest to cover up their hide, while others go a-sailin' past, their vests and jackets wide.

Here comes a chap with old felt hat, its vintage we can't trace—it rests upon his ears, it does, and sprawls upon his face. It is a mean and tacky thing, it has not style nor class; in fact, my boy, it soundeth like a shapeless, time-worn mass.

But here there comes the man I love, the folks turn round to squint—he savors of the new mown hay and hunks of savory mint. There beameth from his jaw a grin, another loops his ear, he's walkin' 'round, by gum, he is, to radiate good cheer.

And on his dome there sitteth now a brand new hat of straw—it is a new and nifty thing, and built without a flaw. He cares not for the chap who stops and stares to beat the band, at the man who's brave enough to wear the first straw in the land.

So let us toast this first straw hat, and sing to it a verse, it took five plunks, by heck it did, from out his skinny purse. He is a brave and fearless soul, he is a valiant kid, the man who leadeth from the store the first new straw-made lid.—Ark.

The average man is dead anxious to see prices drop until it comes his turn to put his pay envelope on the skids and see it slide. Of course, the ideal condition would be to take deflation out of everything except wages. It generally works out, though, that prices and pay cheques get on the toboggan together.

In Kingston, a Mr. Sudds has lost a schooner at one of the city docks. All of which will cause some of the thirsty ones to heave a sigh and ponder on other schooners and suds that lived in the golden age.

MARKET DEVELOPMENTS

Traffic Conditions Showing No Improvement

And Material Is Being Piled at the Mills—Canners Facing the Season With Much Needed Materials Not Moving—Trade Not Much Bothered Over the New Tariff Regulations

THE way in which traffic has been held up from United States points for weeks past may mean that some Canadian buyers will save the war tax on shipments of material, such as various lines of steel and machinery. Dealers will be only too ready to pass on anything that looks like a measure of relief to the trade, but there is a certain amount of stock in the warehouses, and on this there will be no reduction. There is such a scarcity of material now that 7½ per cent. does not make much difference, when compared to the big problem of getting the shipments through at any price.

Pittsburgh reports that steel is becoming more and more congested, and promises nothing better. Canners are facing a serious time of the year, with the preserving season not far off and their supply of tin plate not moving. It is estimated that right now it would require 3 500 box cars to move the tin plate necessary for the canning season, and the movement has not started yet.

Inquiries are not particularly numerous just now. Large projects in several instances are held up, waiting to see if there will be any decreases in the building prices, as the price of plants for housing new equipment is a serious problem.

Most of the larger buyers of iron and steel scrap are out of the market for the present, and their continued absence is having the effect of making trade dull. Little exporting business is being done in either copper, brass or steel scrap.

MONTREAL BUYERS CONSERVATIVE UNTIL NEW CONDITIONS ARE CERTAIN

Special to CANADIAN MACHINERY.

MONTREAL, May 27.—The handing down of the budget and the possible effect that the various taxes will have on business and industrial activity is one of the chief topics of interest at the present time. It is a little early yet to make any reliable prediction as to how the new regulations will affect the different branches of the metal-working industries, but between the uncertainty of this and the apparent wave of price deflation that has become increasingly pronounced during the past week, particularly in the States, the attitude of many business men and manufacturers is one of marked conservatism. The present movement may only be a temporary relaxation from the erstwhile strain of the high cost of living, and a general stabilization may return in a very short time, but the firm stand of the banks on the credit question has tended to reduce the speculative character of business transactions, so that hope is entertained that some adjustment may shortly be made whereby the factor of doubt will be largely removed and a more orderly condition established.

The condition of the wire market may be stated as acute as the scarcity of supply is apparent in a marked degree. Dealers in wire goods claim that it is very difficult to obtain material and virtually impossible to secure sufficient to satisfy the normal requirements of present demand. One manufacturer here stated that he could obtain orders for hundreds of miles of fencing but owing to the inability of get the wire he had to forego the business.

The wire situation has not only resulted in the curtailment in the making of wire products, but in some cases these manufacturers have engaged in other activities to tide them over until normal conditions return in the wire market. Some dealers in steel commodities are anticipating better shipments in the near future as local shortage is due more to the inability of the railroads to transport than any actual shortage of material. American mills have been producing more than could be taken away, the result being that stocks have accumulated at the mills or stored in nearby warehouses, but with little hope of relief until railroads are in a better position to handle the goods. Local consumers of plates and sheets are getting anxious as to early future supply, but are interested in the apparent tendency toward easier conditions, not only in supply but likewise in prices.

Railroad Congestion Affects Trade

While the trading in machine tools is comparatively good, the bulk of present business must be credited to resale of used equipment. The demand in this direction emphasizes the user's need for tools, and it is only the high prices of new machinery and the uncertainty of delivery that keeps the sales of new tools down. The congested railroad condition in the States is the prime reason of deferred shipments as it is very difficult to get the raw material to the plants and equally difficult to have the finished product delivered to the customer. Rail transportation just now is so uncertain that shipments by steamship have an advantage. and as a consequence a good business is carried on between English houses and Canadian consumers.

Dullness in Scrap

No features of special interest have developed in the old material situation and the market here is rather listless, with prices tending to decline. Conditions in the States are not favorable to ship to American points and Canadian mills are not heavy buyers. The foundry troubles here have lessened the demand for machinery scrap, with the result that the buying has declined, but while the general market is less active dealers are

holding to old prices. The tendency, however, is of a downward nature.

The Blashill Wire Maachinery Company of Montreal, has opened an uptown office and show room at 307 St. James Street, and will carry on, in addition to their present line of wire machinery, a general dealer business in new and used machinery and engineering equipment. The plant at 182 Shearer Street will be utilized for the repairing and rebuilding of used machinery.

The Standard Equipment and Tool Works of Montreal, have removed their offices from 179 St. James Street to 307 St. James Street, where they will have an office on the ground floor, and will share the adjoining showroom with the Blashill Wire Machinery Co.

NOTHING IN THE LUXURY LINE HERE

But Trade Has Hardly Had Time to See How New Regulations Will Work Out

TORONTO.—The trade has not had time to see how the new tariff arrangements work out in detail, although it is not a very hard matter to apply the new ruling to any branch of the trade. There is practically nothing, to begin with, that is touched by what may be termed the luxury tax, and the biggest item, of course, will be the elimination of the war tax of seven and a half per cent.

Customers will get the benefit of this at once on any machinery they are getting from the makers, and the recent traffic tie-up in the U.S. may be the means of some buyers getting a saving of at least six and a half that they were not looking for, which, on an expensive bit of equipment, will run into quite a nice little saving.

There is a feeling in the machine tool trade that there must be an end to price increases. Manufacturers know that there is a limit past which they dare not go in making investments that have to be accounted for in years to come on the yearly turnover.

There are no very large propositions definitely in the market at the moment, although some are hung up in the meantime waiting for a turn in the tide of rising prices. In some cases it is urgently necessary to go ahead with the building and the placing of equipment but the price is an obstacle that is too high. Building charges are far more extreme than the increase in equipment, and it is too great a handicap to put up an expensive house for machinery at the present schedule. Firms that are making additions to existing equipment, for which they already have floor space, are still in the market in fairly good numbers, and deliveries to them are improving.

Machine tools coming into Canada from United States are, in most cases, under the general tariff of 27½ per cent. Of course there are several exceptions, especially where the machine is not to be had in this country. But tariff item No. 453 will cover the great bulk of imports in this line. It reads:

'Telephone and telegraph instruments, electric and galvanic batteries, electric motors, dynamos, generators, sockets, insulators of all kinds, electric apparatus, n.o.p.; and all machinery composed wholly or in part of iron or steel, n.o.p.; and iron or steel castings, and iron or steel integral parts of all machinery specified in this item, British preferential tariff, 15 per cent., intermediate tariff, 25 per cent., and general tariff, 27½ per cent."

United States products come in under the general tariff, viz., 27½ per cent., while the British machine tool houses can ship in at 15 per cent., or a difference of 12½ per cent.

The Steel Market

The manner in which a large tonnage of steel of all sorts has been strung up by the poor shipping facilities on the other side of the line will mean some saved money to customers on this side of the line, but whether it will make up for the trouble they have been put to in waiting for the shipments to arrive is rather doubtful.

Material used in manufacturing boilers, for instance, now comes in free. One item covers a lot. "Wrought or seamless iron or steel tubes for boilers, n.o.p., under regulations prescribed by the Minister of Customs; flues and corrugated tubes for marine boilers, free."

Then boiler plate comes under the following regulation: "Item 380: Boiler plate of iron or steel, not less than thirty inches in width, and not less than one-quarter of an inch in thickness, for use exclusively in the manufacture of boilers under regulations by the Minister of Customs, free."

A great deal of the tonnage coming through the jobbers is taken in under this item: "Rolled iron or steel sheets or plates, sheared or unsheared, and skelp iron or steel, sheared or rolled in grooves, n.o.p., British preferential tariff, per ton, $4.25; intermediate, $6, and general tariff, $7."

Some of the larger importers report that service in the matter of delivery is not improving. If such a thing could be possible they would be inclined to state thta conditions in this regard are worse than ever. Some buyers have received their first tonnage in weeks, whilst others have almost given up hopes of ever hearing of their consignments.

The Scrap Market Dull

Most of the larger buyers are still out of the market, and as a result all classes are sagging. As in other lines the buyer is paying the one per cent. tax on sales. It is simply added to his bill. As a general thing there is not much scrap brought into this country except by some of the larger melters, who find it convenient to make contracts outside. The tariff item covering such a case is No. 374: "Iron or steel scrap, wrought, being waste or refuse, including punchings, cuttings or clippings of iron or steel plates or sheets, having been in actual use; crop ends of tin plate bars, or of blooms, or of rails, the same not having been in actual use, per ton, British preferential, 50c; intermediate tariff, 90c, general, $1." The regulations go on to state further in explanation that nothing shall be deemed scrap iron or cast steel except waste or refuse iron or steel fit only to be remanufactured in rolling mills or furnaces: provided that articles of iron or steel, damaged in tranasit, if broken up under customs supervision and rendered unsaleable except as scrap may be entered for duty as scrap. Scrap copper and brass are free of duty.

POINTS IN WEEK'S MARKETING NOTES

Pittsburgh reports that shipping conditions are even worse than a week ago, but hopes are held out for something better following the action of the Interstate Commerce Commission.

—

Canning season is coming on, and makers of tin cans are in poor shape owing to the shortage of tin plate.

—

The tax of one per cent. is being passed on to the consumer.

—

Some firms are likely to make a saving because shipments of material, such as steel, tubes, sheets, etc., have been held up. Meanwhile the 7½ per cent. war tax has been removed.

—

It would require 3,500 box cars to move the tin plate now stored for the canners.

—

Some critics are predicting that the first decline in steel will be when the premium operators get down to Industrial Board prices.

—

The big buyers are still out of the market for scrap iron or steel, and as a result business is dull, with prices inclined to sag.

Strike Against Prices.—The 16,000 employees of the Cambria Steel Company, a subsidiary of the Midvale Steel Company, are on strike against the high prices which the merchants have been charging, and are threatening to form a co-operative store which shall deal in all of the necessities demanded by a worker and his family. The workmen are willing enough to give their trade to the merchants, but only on condition that prices are reduced. The announcement of the new policy of the workmen is made by the committee which represents the workers in dealing with the Midvale employees.

TRAFFIC CONDITIONS CONTINUE TO GET WORSE AND STEEL SHIPMENTS LAG

Special to CANADIAN MACHINERY.

PITTSBURG, May 27.—At the time the last report was written traffic conditions, growing out of the rail strike, were becoming worse rather than better, and the trend has continued in the same direction. Meanwhile, however, the Interstate Commerce Commission has begun to exercise the powers given it by the Transportation Act of last February, and strong hopes are entertained that conditions will now improve. The commission was urged to act by leading railroad officials. The orders of the commission, which are being issued from day to day as the way is made clear, include many things, such as abrogation of car service rules, disregard of original routings of shipments, establishment of priorties for various commodities and direct routing of trainloads of empty cars to points where cars are particularly needed.

It must be understood that the object of these activities is not primarily to relieve the congestion as a whole, but to facilitate the movement of the most important commodities, foodstuffs coming first and then coal. Iron and steel products in general cannot of course be regarded as entitled to any priority, except in special instances, and one noteworthy case is that of tin plate. The canning season is just beginning, and if tin plate is not moved to can factories, and cans to canneries, food will be lost. The Interstate Commerce Commission has gone carefully into the tin plate situation, having had leading representatives of the industries of tin plate making, can making and canning with it in conference last week. The tin plate manufacturers reported that about 2,500,000 boxes of tin plate lay in the warehouses of the tin plate mills, which would be enough to make one billion two-pound cans (a rule easy to remember is that approximately 2½ boxes of tin plate make 1,000 two-pound cans), for the movement of which 3,500 or 3,600 box cars would be required. The commission would not undertake to interrupt the movement of box cars West, for moving grain, but efforts are being made to find the box cars by other means.

The real strike itself is still on, though it has waned somewhat. There is divergence of opinion as to haw much of the trouble is due directly to there not being enough men to work on the railroads, and how much is due to the congestion that has been produced by the strike, which is now about eight weeks old. Practically, the point at issue would be whether the termination of the strike itself would right matters, for if the present trouble is due chiefly to congestion ending the strike would not end the congestion. There were traffic difficulties and car shortages in the first three months of the year, before the strike. The better opinion seems to be that the strike really is an important factor at this time, so that its entire settlement would help very materially. It is accepted in most quarters, apart from this, that the present work, directed by the Interstate Commerce Commission, will tend to relieve the congestion very considerably, even though the immediate object is better movement of foodstuffs and fuel in particular.

Accumulation of Steel.

A rough estimate of the quantity of steel that has accumulated at steel mills may be made in thismanner. One starts with the March production, which was at the rate of 45,200,000 gross tons of steel ingots a year, as indicated by the monthly report of the American Iron and Steel Institute. The March rate had been the highest since October, 1918. Finished rolled steel products run normally about 76 per cent. of the ingot production (on account of scrap and scale losses in rolling and heating) and applying this proportiono and passing from the gross to the net ton the March rate of production appears to have been about 750,000 net tons of finished rolled steel per week. Thus far the computation is substantially accurate. Now one may make a careful guess, rather than a precise estimate, that production since April 1, when the strike began, has been at 80 per cent. of the March rate, averaging the whole country, and that shipments have been 65 per cent. of the production, whereby shipments would be 52 per cent. of the March production, and the accumulation would be 28 per cent of the March production, 28 per cent. of 750,000 tons being 210,000 tons. For eight weeks this would be 1,680,000 net tons. There were some accumulations before the strike started, due to the previous car shortage, though those accumulations were diminishing late in March. Then there is a large tonnage of steel that has been "shipped" but is simply stalled en route. The grand total of steel made but not received by consumers and not actually moving as it should, is probably in excess of 2,000,000 tons. All the steel made, of course, has been on order, and none of it is for sale. The market is stagnant at present, and if one desires to forecast what sort of a steel market there will be when the traffic situation is righted he should take into his reckoning this extra 2,000,000 tons of steel, which eventually wil reach the buyers.

All branches of the iron and steel market are stagnant, and while producers are disposed to argue that the quietness is due to the rail case it is difficult to put all the responsibility on that head. If a quiet market is a natural result of consumers not receiving deliveries the active and advancing market of early in the year has to be explained. At that time consumers were doubling up in their purchases. When they received poor deliveries against old contracts they bought afresh, at premiums, for early deliveries. Again, if the present quietness is due to buyers not receiving deliveries, will the buyers become eager to make fresh purchases by the resumption of heavy deliveries?

It is a reasonable inference that buyers of pig iron and steel products are influnced by the unsettlement in Wall Street and by the general talk that commodity prices in general are coming down. Probably in many quarters too much is expected in the matter of price declines, but it does look as though some movement has begun. As to steel products, a disappearance of the premiums over the Steel Corporation or Industrial Board prices does not seem too much to expect, in the course of a few months. It is quite improbable that the market would go beyond that. Whatever readjustment is needed in the economic situation there does not seem to be any basis for predicting that the adjustment will require a long time.

As to pig iron, it must be remembered that it is too high relatively to finished steel products. The prices are not in line with each other, hence pig iron may easily come down more than finished steel, but there is hardly likely to be any slump. While pig iron in all markets is now well above $40, furnace, except in the case of Birmingham, it must be remembered that no very great tonnages were sold at about $35, and a decline to that level would not make a great deal of difference.

BUYERS STAYING OUT OF NEW YORK MARKET

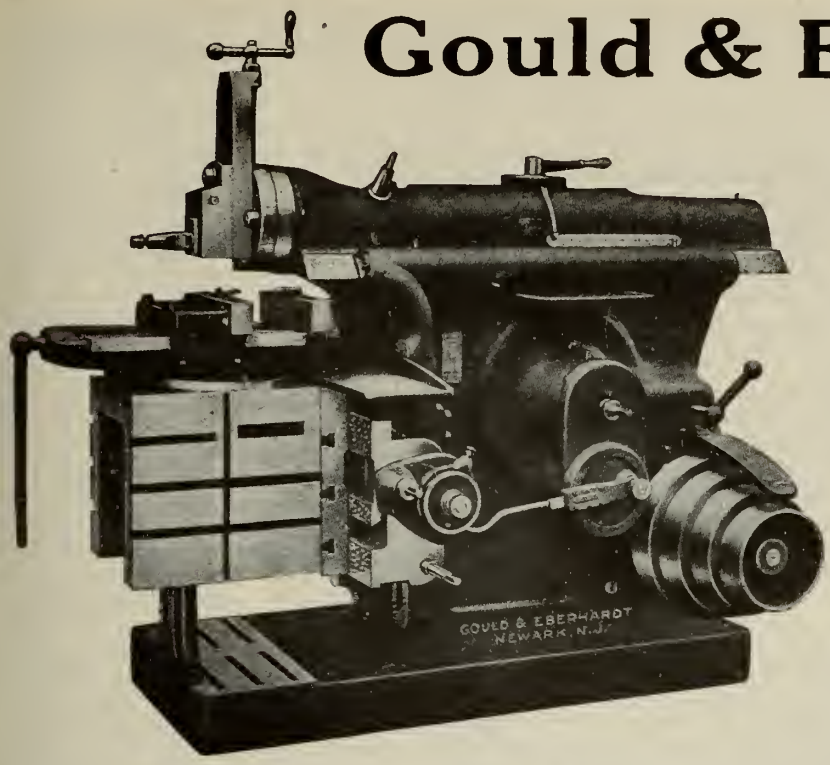
Credits, But Tool Builders Have Plenty of Orders

Special to CANADIAN MACHINERY.

NEW YORK, May 27.—The slump in machine-tool business, which made itself felt two or three weeks ago, coincident with the pinch of the credit situation, due largely to the railroad tie-up, has progressed to a point of marked inactivity. Machine-tool sellers assert that many of their customers are willing to buy, but see no use in doing so until the present credit strain and the difficulties of railroad transportation have been overcome.

That the machine-tool trade does not fear any permanent ill-effects from a business depression was indicated by A. E. Newton, of Worcester, Mass., president of the National Machine Tool Builders' Association, before the spring meeting of that body at Atlantic City last week. Mr. Newton stated that if the country is to have a business depression it cannot be of long duration. He admitted a falling off in new orders, but said that nearly all machine-tool builders have a large volume of unfilled orders. He said he looked forward to a resumption of good business in a few months. Meanwhile, he does not look for any change from the present level of prices because of the shortage and high price of labor and materials.

Most of the sellers of machine tools



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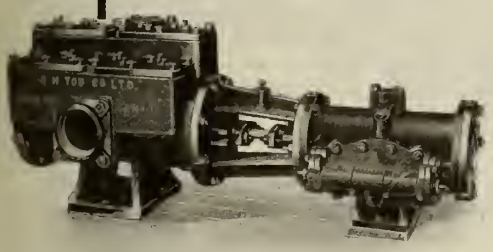

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in this country have protected themselves against possible cancellations by inserting non-cancellation clauses in their bills of sale. Such clauses may not absolutely prohibit cancellations but they will provide penalties in cases of cancellations that will protect the manufacturers and dealers against loss in the event of declining prices.

Buying of machine tools in the past week has been confined mostly to a few large companies, which are completing purchases begun some time ago. For example, the Willys Corporation has covered on a large number of tools required to round out the equipping of its new automobile plant at Elizabeth, N.J., and the General Electric Co. continues to buy for its Bridgeport, Conn., plant, otherwise the market has been exceedingly quiet.

Montreal Notes

The immediate result of the release of ocean tonnage from the control of the British Ministry of Shipping, which has just been effected, is the increased cargo space that is available for Canadian exporters, and port officials here are anticipating this will give added impetus to the season's business. The final report of the British Ministry of Shipping shows that, under their control, the total expenditure was in the neighborhood of $2,300,000,000; the total deficit being approximately $925,000,000.

The Montreal Administrative Commission have given out the contracts for the additional equipment that will be installed at the low level pumping station of the city waterworks. Two 30,000,000 gallon electrical-driven pumps will be installed; one of these will be supplied by the Fraser Chalmers Company at a cost of $50,250, and the other will be built by E. Laurie and Co., the price for this unit being $45,200. The installation of the electrical transformers, etc., will be carried out by the Canadian General Electric Company at a cost of $48,840.

* * *

Clarence I. de Sola, Belgian consul at Montreal since 1904, and a prominent business man in financial and shipping circles, died last week at Boston after an acute attack of indigestion. He was sixty-one years of age. For many years Mr. de Sola was president of the Canadian Zionists, a society which was started through his own personal efforts. In recognition of his services during the war he was knighted by King Albert of Belgium and created a Chevalier of the Order of Leopold. In business life he was largely interested in shipbuilding, bridge construction and hydraulic liftlocks. He was Canadian representative for Swan, Hunter and Wigham-Richardson, Limited, and he built a great number of ships for the Canadian upper lakes and ocean trade, introducing the first two oil fuel combustion ships that ever crossed the Atlantic, the Toiler and the Calgary. As managing-director of the Comptoir Belgo-Canadian, he carried out some noteworthy works in Canada, among which were some of the locks in the Soulanges and Trent canals, thus introducing in Canada the hydraulic liftlock. He also took part in the retracking of a portion of the Intercolonial Railway and the Prince Edward Railway Company. He established a steamship service between Montreal and Antwerp. He was on the directory boards of many of the local shipping companies.

* * *

Extensions to the extent of about a quarter of a million square feet of floor space has been planned for the Angus shops of the Canadian Pacific at Montreal The cost of these additions is expected to approximate $1,000,000. The division of these extensions may be roughly stated as follows: Locomotive shop, 58,000 sq. ft.; freight car shop, 42,400 sq. ft.; pattern storage, 12.000 sq. ft.; pasenger car shops, 71,000 sq. ft.; car electrical shop, 23,000 sq. ft.; planing mill shelter, 18,000 sq. ft.; dry kiln, 7,400 sq. ft. In addition to the new buildings a new heavy service tapered floor track scale will be installed at the west end and sufficiently large to weigh locomotives. A number of track changes will also be made at both ends of the yard to provide extra car capacity. Provision is also made for the installation of a 50-ton mechanical coaling plant.

FOOD PRODUCTS ARE LIKELY TO STAY HIGH ?

New York Financial House Can See No Reason For Hoping For Lower Values Yet

IN THEIR weekly business letter, Hayden, Stone & Co., investment brokers, New York, have the following to say regarding general conditions:—

Whether due to a change in the psychological atmosphere, owing to reports of cancellations and to reductions in price by large merchandise retailers, or to badly crippled transportation facilities or to both, it has now become quite evident that there is a distinct recession in many lines of business. While such an interruption to progress of business as has been occasioned by the outlaw railroad strike is most regrettable, it has also furnished a greatly needed object lesson, which could, perhaps, be supplied in no other way—that no body of men employed in such a vital industry can quit work without seriously affecting great numbers of other wage-earners. The men who, without cause, went on strike, are to-day very justly most unpopular with men who have thereby been wholly or partly thrown out of jobs. The loss of wages, and, therefore, of purchasing power which this has caused, are beyond computation. The fact is that the transportation system of this country is at the best so inadequate, and has been still further so crippled by the action of these men, that even were all other conditions favorable, this alone would make it impossible to continue business operations at anything like the volume necessary to show the best results. Nor is this a condition that, even if the roads generally could command the necessary capital, could be remedied in a week or a month. It would take years to supply the equipment to put the railroads on a basis where they could adequately serve the business of the country.

The point has been well made that there has never been an instance of any serious financial depression when there has been such a general scarcity of goods, but the difficulty in securing goods, owing largely to transportation conditions, is apt to blind one to the fact that productive capacity is probably well up, and, perhaps, in some lines exceeds consumption. The productive capacity of steel in this country to-day must be fully 50,000,000 tons. This is much greater than has been actually consumed in any one year. It seems doubtful if this great capacity could at the moment be profitably employed—certainly not at prices now ruling. The same is true of articles entering into clothing and manufactures generally. Unfortunately, it is not true of food products. The movement of labor away from the farms has become alarming. This will in time be corrected by the lessening of pressure for labor in manufacturing industries, but this will take time, and, meantime, food products are bound to remain high.

The one outstanding and controlling factor to-day—not only in this country but throughout the world—is the shortage of capital. This is due to three causes: the destruction of capital in the war; the tremendous expansion of industry as evidenced by the great outpouring of securities in the last few years, and, finally, by the absorption in taxes of profits that would otherwise be available for enlarging business facilities. The fact is being brought home that there is a vast difference between currency and capital; that inflating currency does not increase the supply of loanable capital. It seems to us that this shortage of capital, which, after all, is but a synonym for accumulated wages or savings, is bound to result in continued high rates, which of itself is a restrictive and deflating influence. This process of deflation through which we are now passing is disagreeable, but vastly to be preferred to the experience which Japan, for instance, has recently undergone. It will in time bring about its own cure, and, meanwhile, will present opportunities to those in position to take advantage of them.

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"YOU CAN'T BEAT 'EM" DIE HEADS

It is not the manufacturers of Geometric Self-Opening Die Heads who make this statement, but the users of the tools.
This is the reason that besides being the originators, we are known as the

LARGEST AND BEST KNOWN MANUFACTURERS OF AUTOMATIC THREADING TOOLS

The big question is: Have you applied Geometric Screw Thread Cutting Tools to your threading work?

THE GEOMETRIC TOOL COMPANY
NEW HAVEN CONNECTICUT

Canadian Agents: Williams & Wilson, Ltd., Montreal; The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg, and St. John, N.B.; The Canadian Fairbanks-Morse Co., Ltd., Manitoba, Saskatchewan, Alberta.

If interested, tear out this page and keep with letters to be answered.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$42 40
Lake Superior, charcoal, Chicago	57 00
Standard low phos., Philadelphia	50 00
Bessemer, Pittsburgh	43 00
Basic, Valley furnace	42 90
Toronto price:—	
Silicon, 2.25% to 2.75%	52 00
No. 2 Foundry, 1.75 to 2.25%	50 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 50
Steel bars, base, Toronto	5 50
Iron bars, base, Montreal	5 50
Steel bars, base, Montreal	5 50
Reinforcing bars, base	5 00
Steel hoops	7 00
Norway iron	11 00
Tire steel	5 75
Spring steel	10 00
Band steel, No. 10 gauge and 3-16 in. base	6 00
Chequered floor plate, 3-16 in.	9 40
Chequered floor plate, ¼ in.	9 00
Staybolt iron	9 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	4 00
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 90
Small shapes under 3"	3 62

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points	C.L.	L.C.L.
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

	Gross. Montreal	Toronto
Lake copper	$25 00	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	72 00	75 00
Spelter	12 00	12 25
Lead	11 50	12 00
Antimony	14 50	14 00
Aluminum	34 00	35 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$ 7 25	$ 7 25
Plates, ¼ up	6 50	6 50

PIPE—WROUGHT

Price List No. 44—April, 1920.

STANDARD BUTTWELD S/C

	Steel Black	Steel Galv.	Gen. Wrot. Iron Black	Gen. Wrot. Iron Galv.
⅛ in.	$6 50	$ 8 50	....	....
¼ in.	5 13	7 26	$ 5 43	$ 7 56
⅜ in.	5 13	7 26	5 43	7 56
½ in.	6 84	8 42	7 27	8 84
¾ in.	8 45	10 58	9 03	11 16
1 in.	12 50	15 64	13 35	16 49
1¼ in.	16 91	21 16	18 06	22 31
1½ in.	20 21	25 30	21 59	26 68
2 in.	27 20	34 04	29 05	35 89
2½ in.	43 00	53 82	....	....
3 in.	56 23	70 38	....	....
3½ in.	71 30	88 32	....	....
4 in.	84 48	104 64	....	....

STANDARD LAPWELD S/C

	Steel Black	Steel G lv.	Gen. Wrot. Iron Black	Gen. Wrot. Iron Galv.
2 in.	$30 90	$37 74	$34 60	$41 44
2½ in.	45 34	56 16	51 19	62 01
3 in.	59 29	73 44	66 94	81 09
3½ in.	73 14	90 16	82 34	99 36
4 in.	86 66	106 82	97 56	117 72
4½ in.	0 98	1 23	1 24	1 49
5 in.	1 15	1 44	1 44	1 73
6½ in.	1 49	1 86	1 87	2 25
7 in.	1 94	2 43	2 42	2 90
8-L in.	2 04	2 55	2 54	3 05
8 in.	2 35	2 94	2 92	3 51
9 in.	2 81	3 52	3 50	4 21
10-L in.	2 61	3 26	3 25	3 90
10 in.	3 36	4 20	4 18	5 03

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.

4½" and larger 50%.

4" and under, running thread, 30%.

Standard couplings, 4-in. and under, 30%

Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds. Montreal	Toronto
Copper, light	$15 00	$14 00
Copper, crucible	18 00	18 00
Copper, heavy	18 00	18 00
Copper wire	18 00	18 00
No. 1 machine composition	16 00	17 00
New brass cuttings	11 00	11 75
Red brass cuttings	14 00	15 75
Yellow brass turnings	8 50	9 50
Light brass	6 50	7 00
Medium brass	8 00	7 75
Scrap zinc	6 50	6 00
Heavy lead	7 00	7 75
Tea lead	4 50	5 00
Aluminum	19 00	20 00
	Per Ton	Gross
Heavy melting steel	18 00	18 00
Boiler plate	15 50	15 00
Axles (wrought iron)	22 00	20 00
Rails (scrap)	18 00	18 00
Malleable scrap	25 00	25 00
No. 1 machine east iron	32 00	33 00
Pipe, wrought	12 00	12 00
Car wheel	26 00	26 00
Steel axles	22 00	20 00
Mach. shop turnings	11 00	11 00
Stove plate	26 50	25 00
Cast boring	12 00	12 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜-in. and less	10
Carriage bolts, 7-16 and up	Net
Coach and lag screws	25
Stove bolts	55
Wrought washers	45
Elevator bolts	Net
Machine bolts, 7/16 and over	Net
Machine bolts, ⅜-in. and less	15
Blank bolts	Net
Bolt ends	Net
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square, blank	add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 50
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	25 and 5
Sq. and hex. hd. cap screws	22½
Rd. and fil. hd. cap screws	plus 17½
Flat but. hd. cap screws	plus 30
Fin. and semi-fin. nuts up to 1-in.	20
Fin. and Semi-fin. nuts, over 1 in., up to 1½-in.	10
Fin. and Semi-fin. nuts over 1½ in., up to 2-in.	Net
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$60 00
Open-hearth billets	60 00
O.H. sheet bars	76 00
Forging billets	56 00-75 00
Wire rods	52 00-70 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 70
Cut nails	5 85
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 35½
British Manila rope	0 28
New Zealand hemp	0 28
Transmission rope, Manila	0 47
Cotton rope, ¼-in. and up	0 88

POLISHED DRILL ROD

Discount off list, Montreal and Toronto net

ATKINS

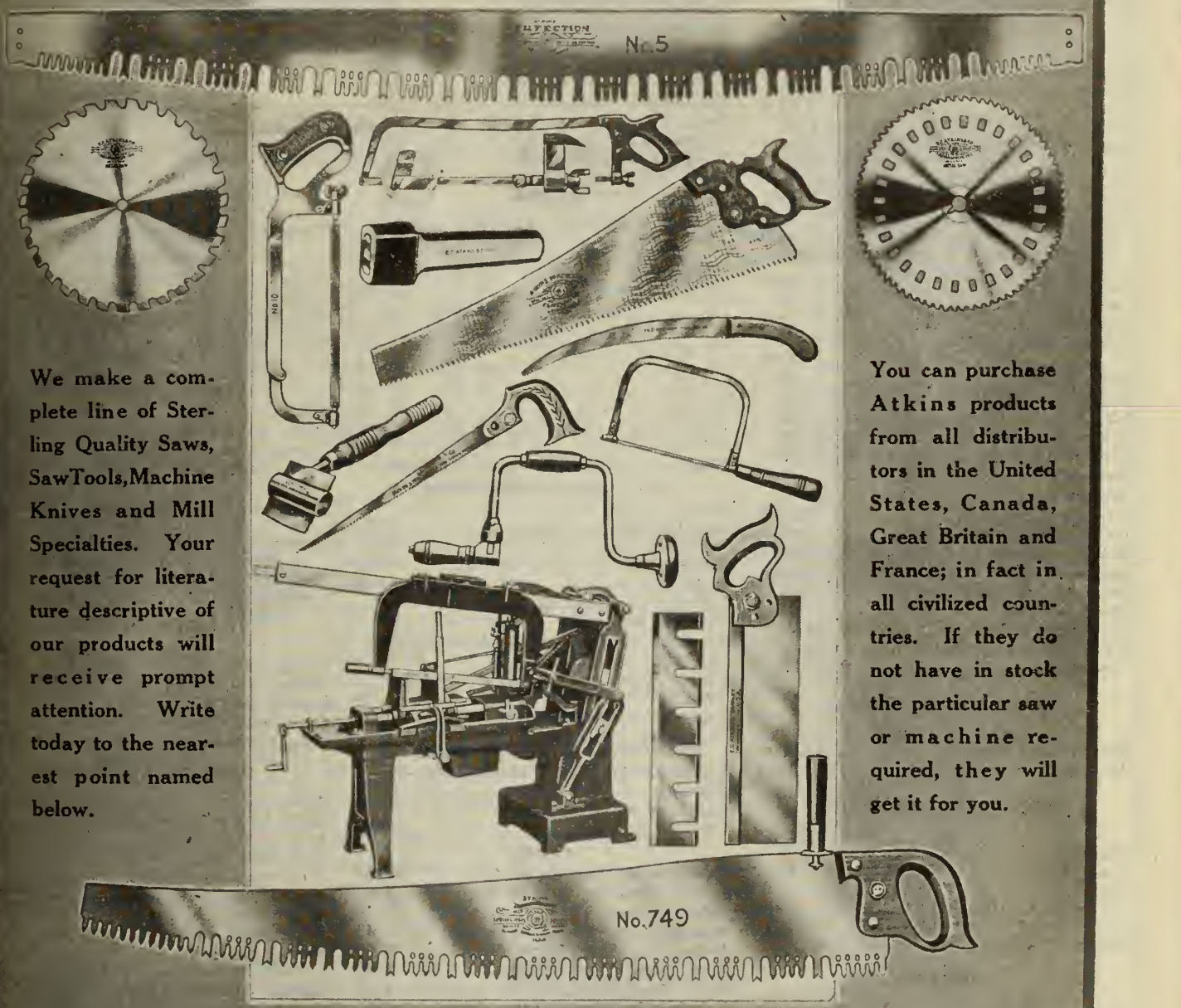
STERLING QUALITY

SAWS and TOOLS

A Perfect Saw for every Purpose

"Finest on Earth"

"Finest on Earth"



We make a complete line of Sterling Quality Saws, SawTools, Machine Knives and Mill Specialties. Your request for literature descriptive of our products will receive prompt attention. Write today to the nearest point named below.

You can purchase Atkins products from all distributors in the United States, Canada, Great Britain and France; in fact in all civilized countries. If they do not have in stock the particular saw or machine required, they will get it for you.

If you have difficulty in obtaining Atkins Saws and other products through your regular service, write

E. C. Atkins & Company

Established 1857

Canadian Factory: HAMILTON, ONTARIO

Branch: VANCOUVER, B. C.

If interested, tear out this page and keep with letters to be answered.

MISCELLANEOUS

Solder, strictly	$ 0 40
Solder, guaranteed	0 43
Babbitt metals	18 to 70
Soldering coppers, lb.	0 62
Lead wool, per lb	0 16
Putty, 100-lb. drums	8 30
White lead, pure, cwt.	20 00
Red dry lead, 100-lb. kegs, per cwt.	16 50
Glue, English	0 40
Tarred slater's paper, roll	1 30
Gasoline, per gal., bulk	0 35
Benzine, per gal., bulk	0 35
Pure turp., single bbls., gal.	3 60
Linseed oil, raw, single bbls.	3 00
Linseed oil, boiled, single bbls.	3 03
Sandpaper, B. & A.	List plus 43
Emery cloth	List plus 37½
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin, "D," per lb.	0 14
Borax crystal and granular	0 14
Wood alcohol, per gal.	2 70
Whiting, plain, per 100 lbs.	2 75

CARBON DRILLS AND REAMERS

S.S. drills, wire sizes	32½
Can. carbon cutters, plus	20
Standard drills, all sizes	32½
3-fluted drills, plus	10
Jobbers' and letter sizes	32½
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	net
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus 20 to	40
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At warehouse]

Rounds and squares	$7 base
Hexagons and flats	$7.75 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	60	75
Class B	27	37
Class C	18	27

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 8 50	$ 9 50
Sheets, black, No. 10	8 50	9 00
Canada plates, dull, 52 sheets	8 50	10 00
Can. plates, all bright	8 60	9 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	11 00	....
Fleur-de-Lis, 28 B.W.G.	10 50	....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28.	....	....
Premier, No. 28, U.S.	11 50	10 50
Premier, 10¾-oz.	11 50	10 90
Zinc sheets	16 50	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	29 50
1¾ in.	31 50	30 00
2 in.	30 00	30 00
2¼ in.	35 00	29 00
2½ in.	42 00	37 00
3 in.	50 00	48 00
3¼ in.	.. ..	48 50
3½ in.	63 00	51 50
4 in.	85 00	65 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	24½
Palacine	27½
Machine oil, per gal.	43½
Black oil, per gal.	18½
Cylinder oil, Capital	82
Cylinder oil, Acme	70
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	$2 60
Union thread cutting oil, antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil, bbls., net	13½

BELTING—No 1 OAK TANNED

Extra heavy, single and double	10%
Standard	10%
Cut leather lacing, No. 1	2 75
Leather in side	2 40

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 60
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	09
Pumice, ground	06
Emery glue	30
Tripoli composition	09
Crocus composition	12
Emery composition	10
Rouge, silver	60
Rouge, powder, nickel	45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE

XXX Extra	.24	Atlas	.20
Peerless	.22½	X Empire	.19½
Grand	.22½	Ideal	.19
Superior	.22½	X Press	.17½
X L C R	.21		

Colored

Lion	.17	Popular	.13
Standard	.15	Keen	.11
No. 1	.15		

Wool Packing

Arrow	.35	Anvil	.22
Axle	.28	Anchor	.17

Washed Wipers

Select White	.20	Dark colored	.09
Mixed colored	.10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades... 15%

ANODES

Nickel	.58 to .65
Copper	.38 to .45
Tin	.70 to .70
Zinc	.18 to .18

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6 x 4 base	45 00	44 00

LEAD SHEETS

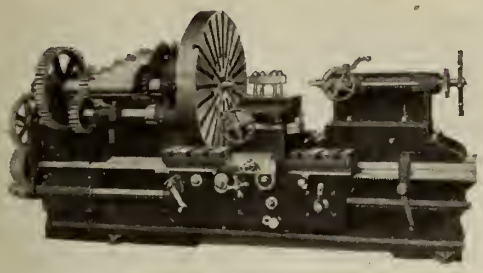
	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 75	$14 50
Sheets, 3½ lbs. sq. ft.	10 50	14 00
Sheets, 4 to 6 lbs. sq. ft.	10 25	13 50

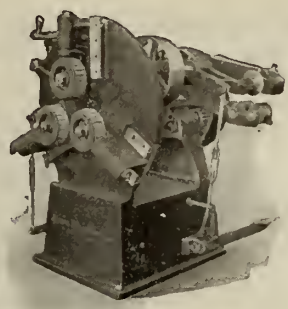
Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

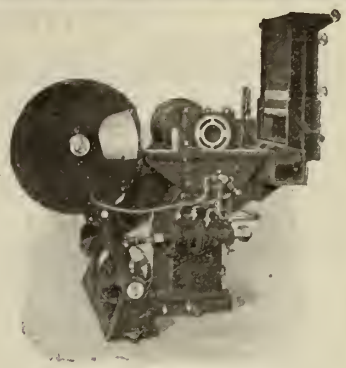
PLATING CHEMICALS

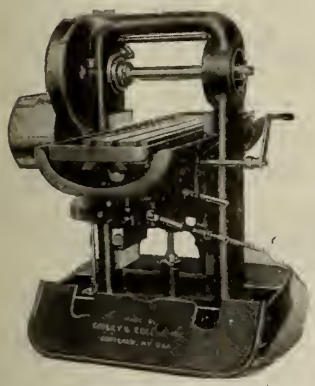
Acid, boracic	$ .23
Acid, hydrochloric	.03¼
Acid, nitric	.10
Acid, sulphuric	.03¼
Ammonia, aqua	.15
Ammonium, carbonate	.20
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.14
Copper, carbonate, annhy.	.41
Copper, sulphate	.16
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.08
Nickel carbonate	.32
Nickel sulphate	.19
Potassium sulphide (substitute)	.42
Silver chloride (per oz.)	1.25
Silver nitrate (per oz.)	1.20
Sodium bisulphate	.11
Sodium carbonate crystals	.06
Sodium cyanide, 127-130%	.38
Sodium hyposulphite per 100 lbs	8.00
Sodium phosphate	.18
Tin chloride	1.00
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated



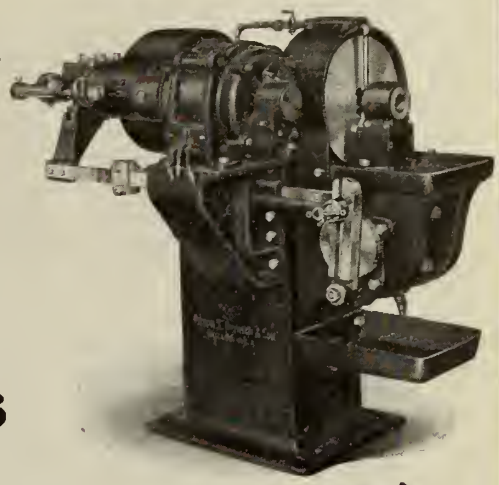






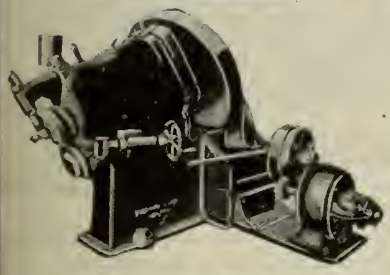
Metal Working Machinery

For Any Operation



Machine Tools

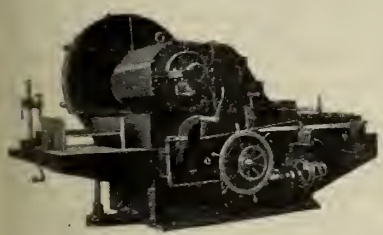
New or Used

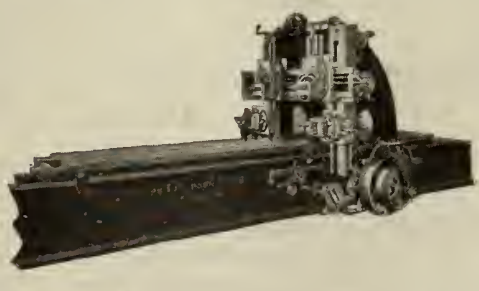


Complete equipment for Boiler Shops, Structural Steel Works, Railroad Spring Shops, Flue Shops and Woodworking Machinery of any kind.

You are undoubtedly from time to time buying new equipment. You will profit by giving us an opportunity to submit specifications.

Illustrations show a few of our machines for immediate shipment.





Garlock-Walker Machinery Company, Limited

32 Front Street West

MONTREAL TORONTO WINNIPEG

"Everything in Woodworking and Metal Working Machinery"

If interested, tear out this page and keep with letters to be answered.

NOW IS THE TIME FOR CANADA TO DEVELOP BRITISH BUSINESS

NORMAN D. JOHNSTON, Canadian Trade Commissioner at Bristol for the western and southern sections of the British Isles, has been in Canada for some months. He is particularly impressed with the fact that now is the time to develop Empire trade. "The present," he said, "is the golden opportunity for the laying of foundations for future trade. I have been through Canada on my present trip from Halifax to Vancouver, and have found the manufacturers generally loaded up with orders for home consumption. What I would like to say is that the indications are that this condition of affairs, the abnormal position after the war, will not continue indefinitely, and that the wise manufacturers will be those, who now that the time is ripe, take advantage of circumstances and lay the foundations for future Empire trade abroad, so that when the home market is supplied they will have overseas connections that will keep their works going."

Mr. Johnston had been at Bristol as Canadian Trade Commissioner for the past four years, and now, during the transition period between war activities and peace work, has come to Canada in order to give the manufacturers here every information he could to help them develop their export trade to the United Kingdom, and to find out what they were able to do in the way of supplying British dealers with manufactured goods.

"Opportunities for trade with England are better than ever," said Mr. Johnston. "During the war the British people got to know the Canadians as never before. They are now keen on buying goods within the Empire, other things being equal, and, so far as I have seen, they are specially anxious to improve the existing good trade relations with Canada.

"Of course adverse exchange conditions affect trade just now, but such firms as carry on at present will be the firms which will have the openings when conditions become normal and sterling gets back to its real value.

"I found that many Canadian firms were filled up with orders for home consumption," said Mr. Johnston. "But these conditions are abnormal, and Canadian firms would be wise to lay aside a proportion of their output for export to Great Britain, in order to pave the way for future export business when the home market will not be so much in evidence. Those who get the trade connection now will probably be those who will hold it later on when world trade conditions get more normal."

As to the demand in England, Mr. Johnston said it chiefly concerned the finished or semi-finished products of the Canadian natural resources, especially wood products, from lumber to wood pulp. There was also a strong demand for asbestos products, and many metal supplies, especially wire for fencing, wire nails, wire rods and similar metal work.

MANY HINDRANCES TO STEEL PRODUCTION

Steel of Canada Has Not Sufficient Coal And One Blast Furnace is Still Down

According to a statement made by Mr. Robert Hobson, president of Steel of Canada, the company is operating under serious handicaps. Only one furnace is being operated, and whereas the repairs on the second furnace would probably be completed between the middle of June and the first of July, it would not be possible to put it in blast unless the coal situation has improved very materially in the meantime. Of the by-product coke ovens, only 30 cells are being pushed at present on account of the non-arrival of sufficient coal. The amount of fuel coming forward is approximately 400 tons a day, or one-fifth of normal shipments. The only method by which deliveries can be secured is to get entire trains routed through. Somewhat less than two-thirds of the normal working force is being employed at the Hamilton plants, according to the president of Steel of Canada. While the labor problem is still prominent it takes second place to the fuel shortage with the Steel Company of Canada. A conference was arranged between the striking engineers and the company by Senator Gideon Robertson, Federal Minister of Labor, and an understanding was reached by the company executives and the strikers' committee. The company proposes to take men back in order of seniority as soon as the coal supply becomes more plentiful and additional parts of the steel plant can be restarted. Meanwhile the production situation is serious—more so than for several years—and no immediate relief is in sight.

TRYING TO GET COAL TO EASTERN CANADA

Calgary Meeting Takes Up Question of Great Interest to Ontario

CALGARY.—In answer to an appeal from the Manufacturers' Association, of Toronto, for assistance in carrying them over the present situation, caused by the attitude of the American coal operators, the delegates to the Boards of Trade Congress, meeting at Calgary, adopted a resolution, which, if acted upon, will doubtless increase the coal output of the Province to a considerable extent, and incidentally demonstrate to Ontario consumers that the products of the West are at their disposal.

Following is the resolution which was adopted:—"That every effort possible be made to increase the use of Western Canada coal, and that this conference favors the investigation of freight rates on coal from Western Canada to the manufacturing centres of Ontario, with a view to making Canada independent of any other country in its fuel supply."

It was decided to ask the Canadian Pacific, Canadian National Railways, including the Grand Trunk Pacific, to give up the freight rates for the summer haulage of coal from Western Canada, and further, to ask coal operators, if they have not already done so, to make special summer prices for the sale of this fuel.

McCLARY CO. GETS THE BUCK BUSINESS

Brantford Concern, Forty-Eight Years Old, Taken Over by London Company

London.—Official announcement was made of the purchase of the William Buck Stove Company, Ltd., of Brantford, Ont., by the McClary Manufacturing Co., of London. Negotiations were closed this week, and the transaction involves the transfer of all the holdings of the Buck Company to the London concern. Lt.-Col. W. M. Gartshore and J. M. Gunn, of the McClary Company, go to Brantford shortly to complete arrangements for the taking over of the Buck plant.

The purchase will add a force of 360 men to the McClary organization as well as a large increase in equipment, facilitating the output of both factories. The purchase will not cause the transfer of any employees of the Brantford company to London, nor will one day's operation be lost. The William Buck Stove Co., Limited, was founded by the late Wm. Buck in 1852, and continued by him until his death in 1897, when it was incorporated, since which time it has been operated by his sons, George and Philip, president and vice-president, and joint managers of the business, with C. J. Parker, C.A., as secretary-treasurer. It built and equipped the present works, and largely extended the business. The company is liquidating voluntarily and has always been able to promptly meet in full every moral and legal obligation.

Long Contracts.—It is reported that the Dominion Coal Co. has just received a contract from the Government of Holland for 250,000 tons of coal, to be shipped as early as possible. This order, following upon the completion of a similar order for the same destination, would seem to indicate that the coal and the method of filling the order have given satisfaction to Holland and the hope is that a permanent export market is being established.

Morrow
The true philosopher does the thing now; he lives each day. He puts kindness into his actions, and when he grows old, he can look back through a life that was pleasant as he lived it, and pleasanter now in living it over again.

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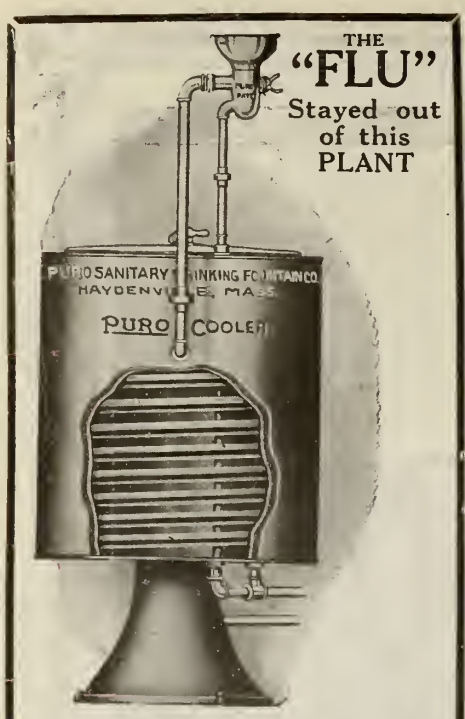

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MOVED TO NEW QUARTERS

The Page Steel & Wire Co. of New York have moved their previous quarters to the offices of the American Chain Co., with whom they have consolidated Their new address is Suite 1054 Grand Central Terminal, New York.

HOLDS OUT NO HOPE FOR DROP IN THE PRICE OF MACHINE TOOLS

MR. A. E. NEWTON, president of the National Machine and Tool Builders Association, at the semi-annual meeting on May 20, summed up conditions in his address as follows:—

At our last convention we were rather surprised that business conditions had held so favorably since the signing of the armistice. We had been promised, and most of us had looked forward to a real depression, at least, in our own line of industry.

We thought so many machine tools had been produced during the war period, and that so many of those were to be released by our Government, that it was reasonable to believe that we should have to meet an over-supplied market. Fortunately for us, things have turned out quite different. Instead of the depression, we have experienced a most unusual and an easy-selling market, and have had a very prosperous half year.

Government-owned machine tools have not unduly flooded the market, excepting those of educational institutions. An absorption of a large quantity of machine tools by these various schools is bound to benefit the whole country.

The need for mechanical training is greater to-day than ever before, and it will be still greater in coming years. I believe that we are just starting a new periol of trade and technical school development, and that the importance and necessity of these institutions is becoming more and more apparent, because of our actual dependence upon machinery and mechanical devices, for the maintenance of our present, and any future betterment of our living conditions.

To-day, most of us are experiencing a shortage of new orders, although having plenty of unfilled orders on our books.

I am looking forward to the resumption of good business conditions in a few months. In other words, if we are to have a business depression, it will be of short duration.

The price-cutting wave now attracting attention throughout this country, is caused by the calling of loans, or the refusal of loans, rather than the oversupply of materials; and in most cases these same materials which are being disposed of by the retailers, could not be replaced at a price as low as they are now being sold.

In the machine tool industry, I know that we could not in the near future, replace our inventories of finished and semi-finished materials at anywhere near the cost of our present inventory.

CANADIAN VICKERS LAUNCH A NEW VESSEL FOR NORWEGIAN FIRM

THE fourth vessel, built by Canadian Vickers, Limited, for Norwegian interests, was launched by Miss Ida Bodin, sister of the Resident Surveyor of the Nodwegian Veritas in Montreal.

The vessel, which is named "Loch Tay," was built for Mr. Alf. Monsen, Toensberg, under the supervision of Capt. Andersen and Engineer Haugerud for the owners, and Mr. F. H. Bodin, representing Mr. Hans Johnsen, Chief Surveyor of the Norwegian Veritas. She will be completed and ready for cargo in about three weeks.

The vessel is 413 ft. over all, has a beam of 52 ft. and is 31 ft. 7/8 in. deep. Her draft, when loaded with 8,300 tons of cargo, will be 25 1-3 feet. She is fitted with triple expansion engines and three Scotch boilers, adapted to burn either coal or oil fuel, boilers being fitted with Howden's forced draft system. About 1,500 tons of fuel oil are carried in the double bottom tanks and in a deep tank amidships.

The equipment for hanlding cargo is up to date in every respect; the cargo winches and windlasses being of Clarke-Chapman design, the steam steering gear being of Hastie horizontal type, all manufactured by Canadian Vickers, Limited. Steering from the navigating bridge is by means of a telemotor of MacTaggart-Scott type, made by Robert Mitchell Co., of Montreal, and also by hand steering gear on the poop deck. There is th usual complete equipment of mechanica engine-room and steering telegraphs.

The equipment and accommodation fo officers and crew are very complete, bein up to the latest requirements of the Nor wegian Sea Control Authorities. In ad dition to the ordinary equipment of boat one of the life-boats is equipped with gasoline motor, and there are also tw life-rafts.

Miss Bodin who was accompanied b her brother, Mr. H. Bodin, was receive on behalf of Canadian Vickers, Limite by Mr. A. R. Gillham, the managin director, and Mr. P. L. Miller, the ger eral manager.

Agency Wanted.—E. C. Beuthin, Con missioner Street, Johannesburg, writin to CANADIAN MACHINERY, says: shall be glad if you can put me in touc with any Canadian manufacturers of mi steel plates, bar iron and steel, tool stee spring steel, or belting, either leather Balata, who require representation South Africa, or who are desirous opening a branch in this country. Mr. H. Barton, the buyer of the Rand Mine Ltd., will give any references that ma be required as to my ability and know edge of the work. Any other inform tion desired I shall be pleased to gi direct."

TRADE GOSSIP

Secured Patents.—The Precision and Thread Grinder Mfg. Co., manufacturers of the multi-graduated precision grinder, announce that the United States patent on the grinder was issued May 1, 1920.

Sydney.—Watched by many hundreds of spectators, the Canadian Concrete Shipbuilding Company's new steamer Permanencia, the first ocean-going vessel of its kind built in Canada, took the water at North Sydney.

The Rich Tool Company, Chicago, announce that the Garlock-Walker Machinery Co., Ltd., with offices in Toronto, Montreal and Winnipeg, have been appointed their exclusive agents for Canada.

Plant Closed.—The fuel situation has become very serious in St. Catharines. McKinnon's, the largest plant here, was compelled to close down its moulding shops because it has no fuel, and other large plants are nearly out of coal.

Sydney, N.S. — The concrete vessel "Permanencia," was launched from the yard of the Canadian Concrete Shipbuilding Co. recently, the launch being entirely successful. The "Permanencia," which will be fitted with Bolinder crude oil engines, will be placed on the run between Sydney and Newfoundland, carrying freight and passengers.

The declared exports from Goteborg, Sweden, to the United States show a slight decrease during 1919 as compared with 1918, being valued at $4,451,276 and $4,354,327 in 1918 and 1919, respectively. Shipments of matches from this district to the United States declined from $2,559,257 in 1918 to $450,057 during the past year.

Get Steam Plants.—As a result of information received at the meeting of the Ontario Municipal Electric Association, Mayor Eden, of Kitchener, expressed the opinion to-day that local manufacturers who desire to have a steady supply of power for the next two years, or until the completion of the Queenston-Chippewa plant, should provide themselves with steam auxiliary plants. Mayor Eden considers that industries are face to face with a serious shortage of power, and no good purpose could be served by keeping the facts from the consumers.

Not a Dominion Charter.—Announcement that the British Empire Steel Corporation has secured a charter from the Province of Nova Scotia suggests the possibility that the merger may not press its application to the Federal Government for letters patent increasing its capital stock to $500,000,000. The company, in view of its large capitalization, would be required to pay the Dominion Government a fee of $100,000. It is said the fee charged by the Province of Nova Scotia amounts to a considerably smaller sum.

Rhodes, Curry, Ltd.—A business reorganization that is of importance in Nova Scotia, and not without interest in other parts of Canada, is that of the Rhodes, Curry Company, Limited, which now becomes simply Rhodes, Curry, Limited, divorced entirely from the Canada Car & Foundry Company, of which for some years it has been a subsidiary. It is understood that the latter company was not unwilling to cut away from everything except the making of cars and therefore it was convenient to allow the works at Amherst to be dissociated from the enterprise which has its headquarters at Montreal. The operations of Rhodes, Curry Company will be completely centralized in Amherst and branches which have been established at other points, it is understood, will be closed. This means the perpetuation of what has become one of the oldest of the industries of Nova Scotia.

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1250KVA	2300	1500	WESTINGHOUSE	1250		WESTINGHOUSE
2000	2200	750	GENERAL ELEC.	2000	150 lbs.	CURTIS
2500	2400		WESTINGHOUSE	2000	150 lbs.	WESTINGHOUSE
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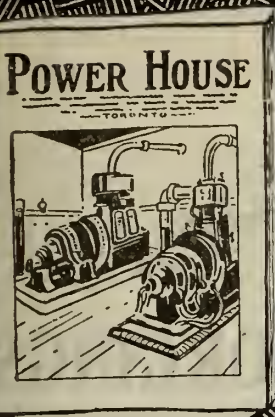

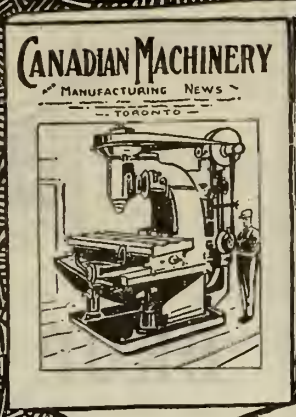

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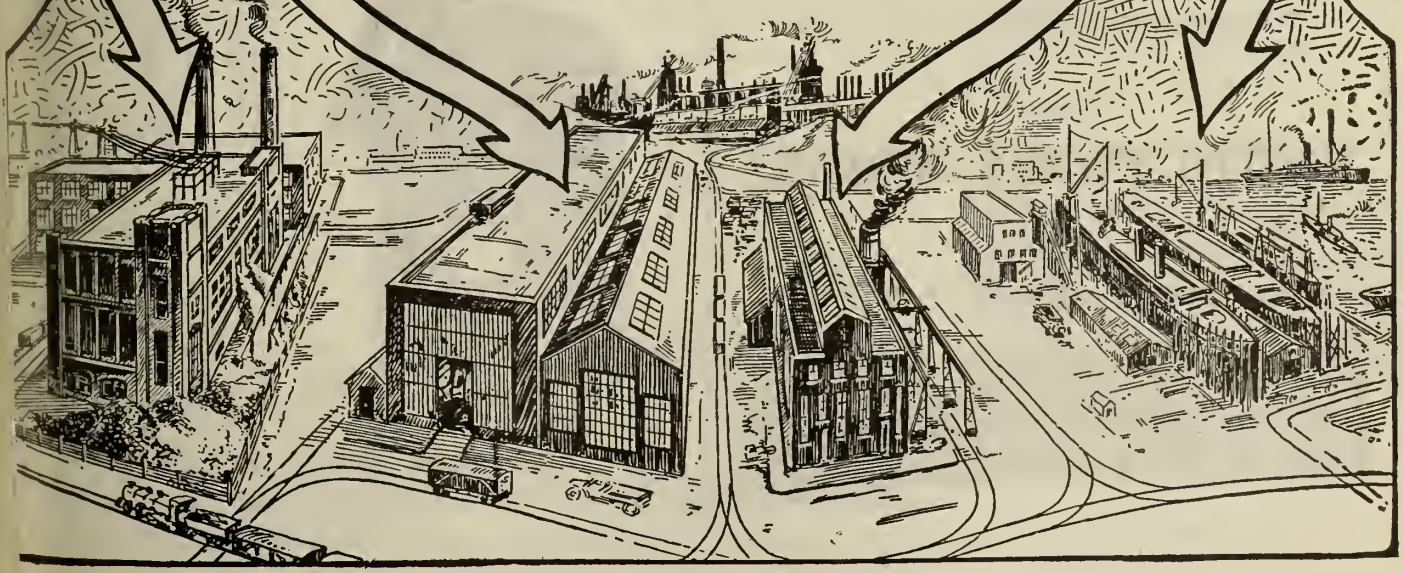

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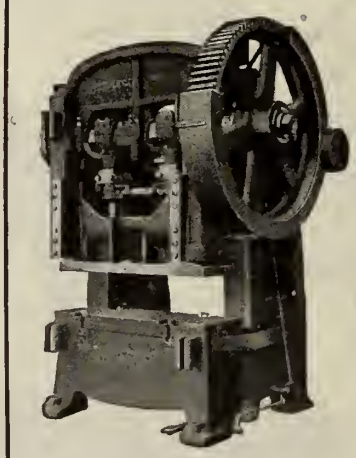

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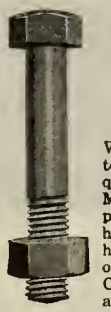
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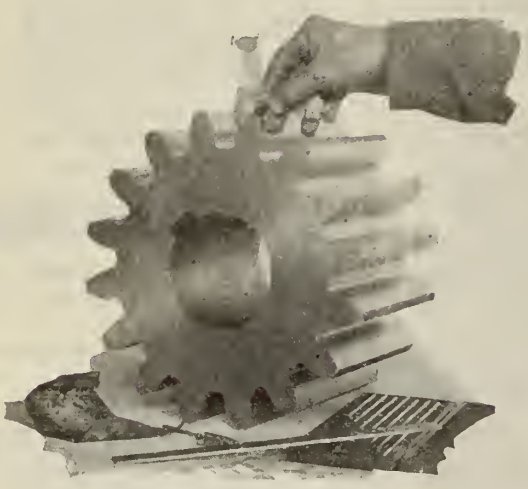

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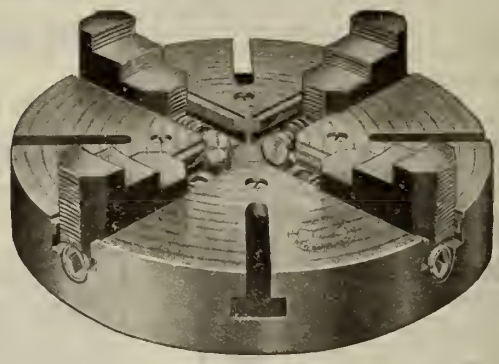

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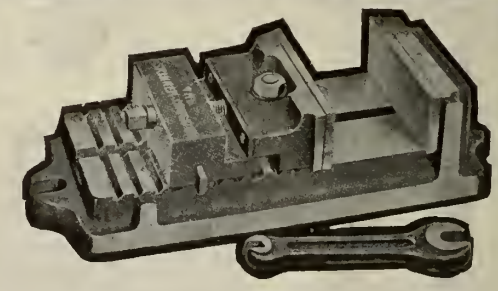

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15" x 6' New Sidney D.B.G. Quick-Change Lathe, swing 17"
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17" x 8' New National Quick-Change Lathe
3—17" x 8' New Sidney D.B.G. Quick-Change Lathe, swing 19"
17" x 10' New Sidney D.B.G. Quick-Change Lathe, swing 19"
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33" x 14' Putnam, arranged for Motor Drive
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The rapid and efficient tool wins a quick place for itself, but unless it survives hard service, it will never retain it. How Landis tools are built for long service is a long story, but here are some facts that are bound to impress:

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All the main details are of unusually heavy construction.
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All bearings are of high grade bronze.
Gears and shafts are of specially heat-treated chrome nickel steel.

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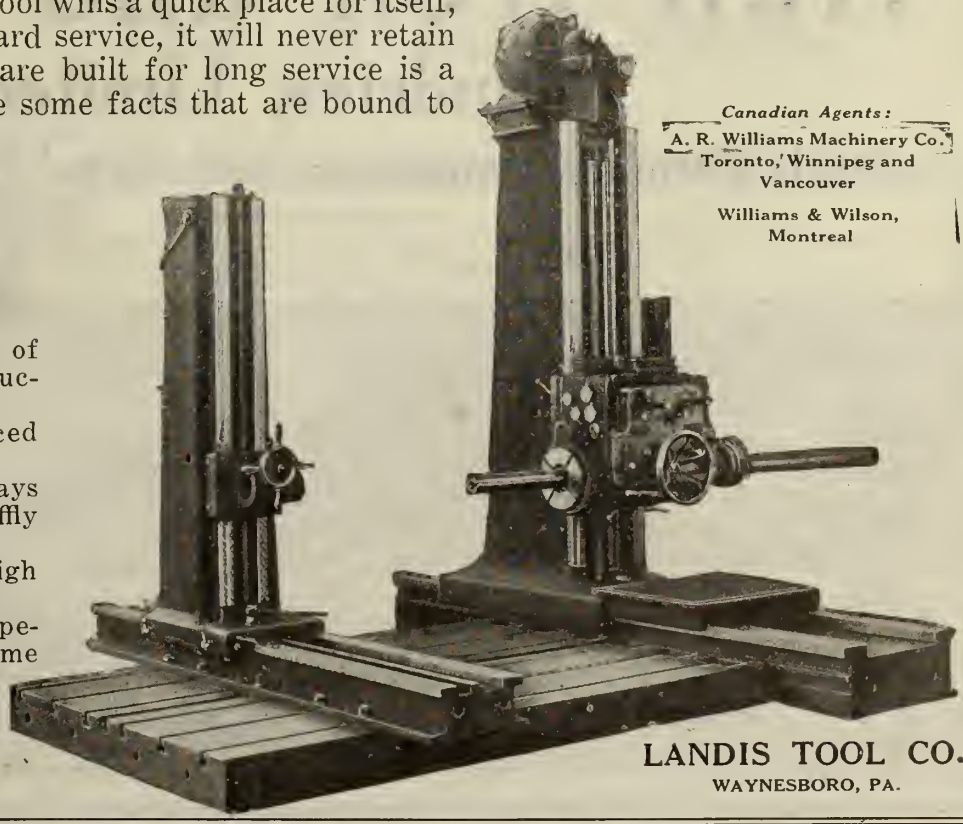

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LANDIS TOOL CO.
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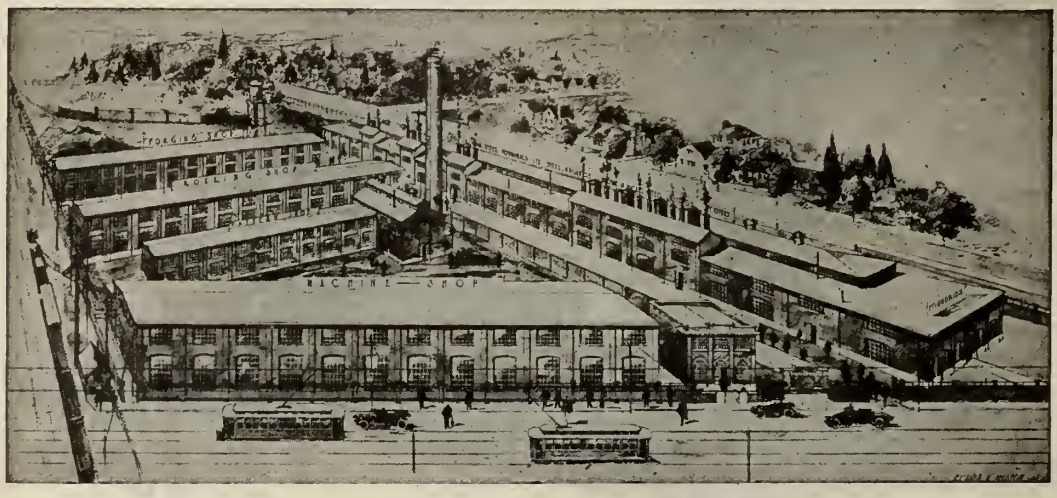

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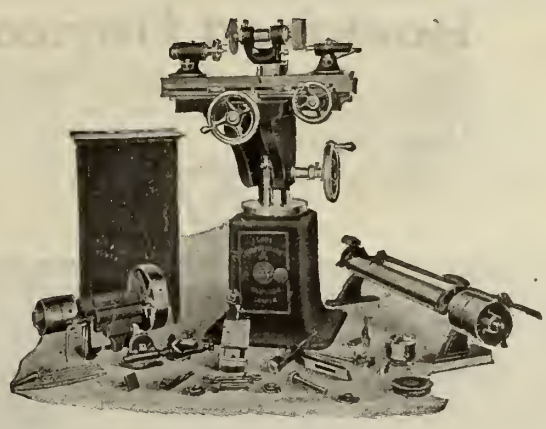

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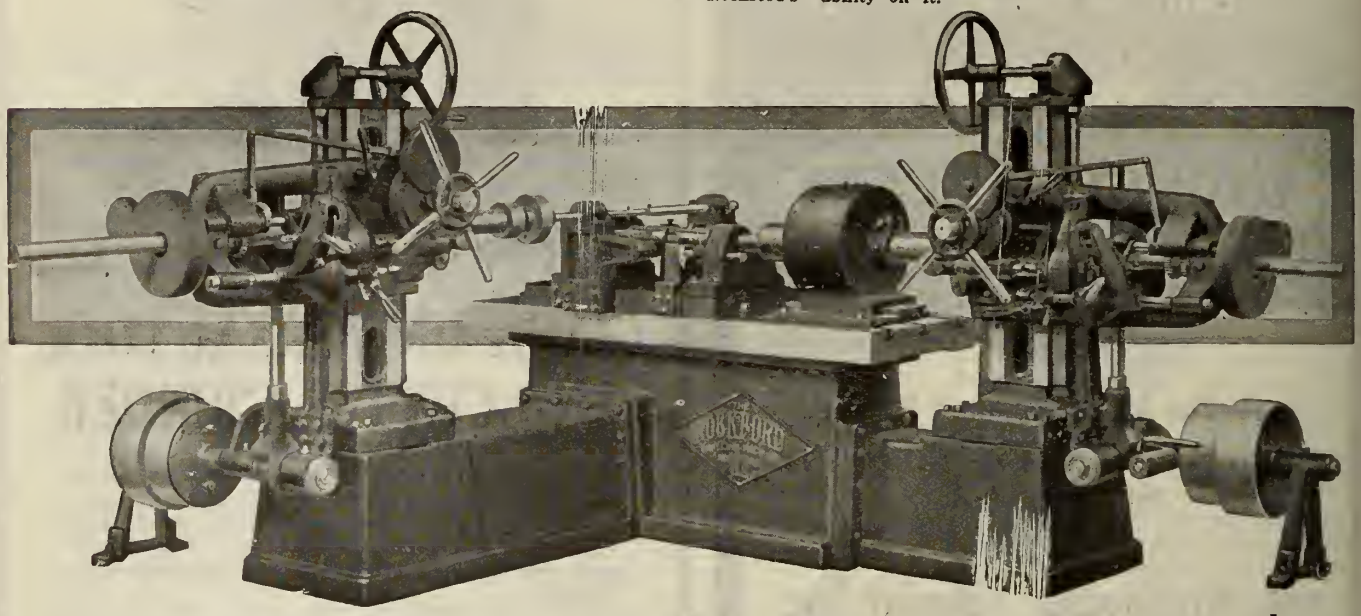
Send us blue prints of your boring work and we will give you figures on the "Rockford's" ability on it.



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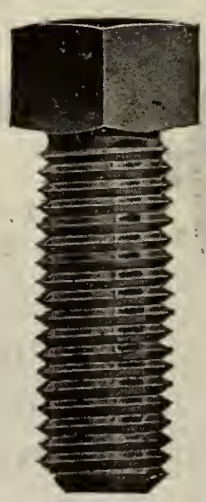

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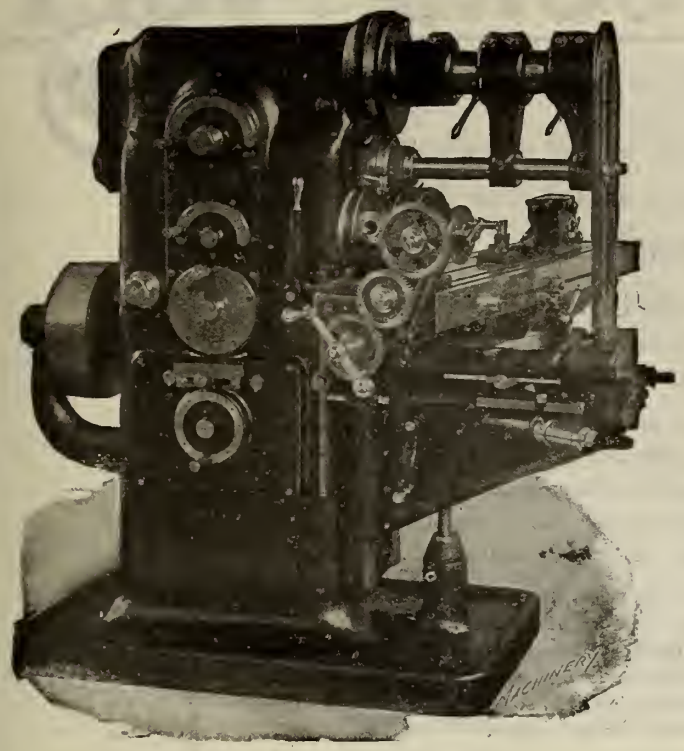

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have established an enviable reputation among prominent manufacturers for accuracy, simplicity in construction and ease of operation. That they have been able to do this is credited to the great care exercised in their design, and the high-grade workmanship used in their construction.

All feeds on the Rockford are controlled by one lever—the main spindle is instantly adjustable by a single nut, and the operator can complete a job without leaving the front of his machine. These are a few of the points that have made the Rockford a favorite with the men as well as their employers. We would like to tell you more about these machines. Write us for full information.

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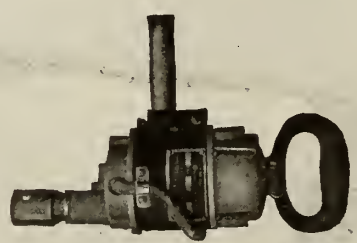

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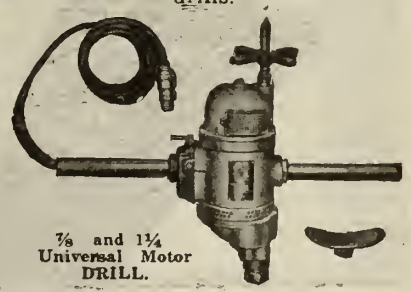
All motors wound for 110 or 220 volts.

Direct or alternating current.

Try a few of our Electric Drills and Grinders and you'll send us an order for more. Our guarantee protects you.



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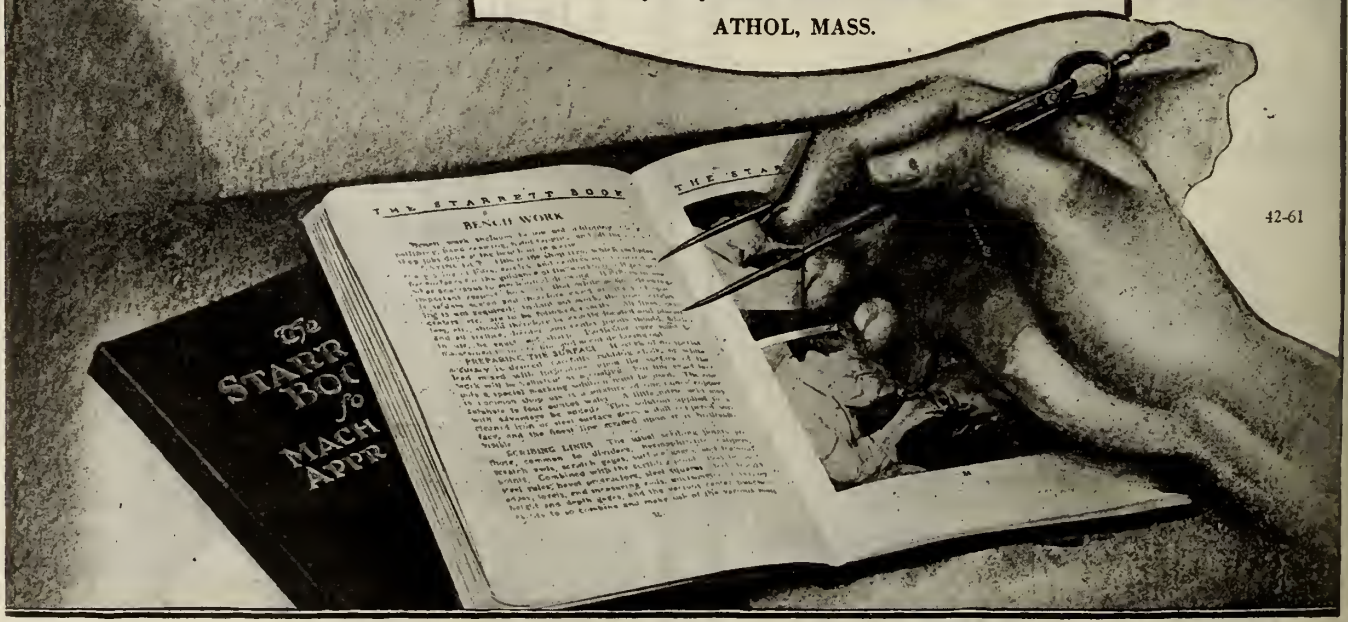

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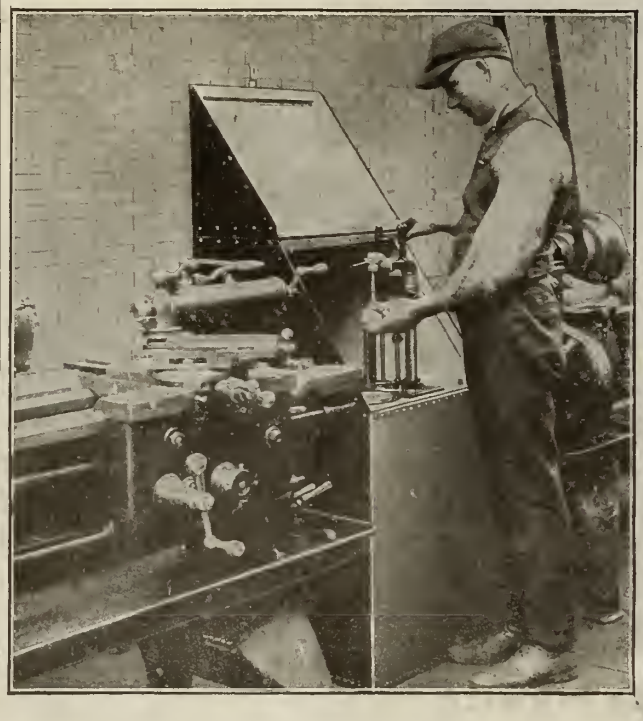

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There is no going back and forth to the oil room, no spilling, no wasted oil, no fire risk from the oil storage.

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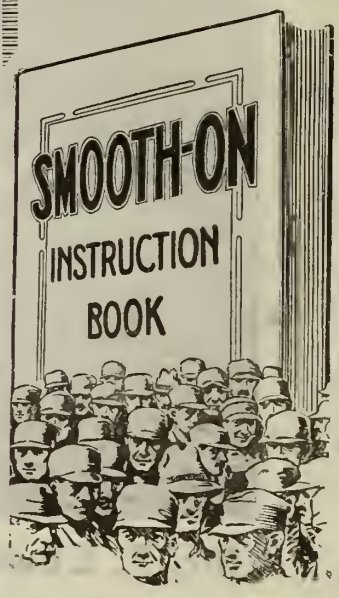

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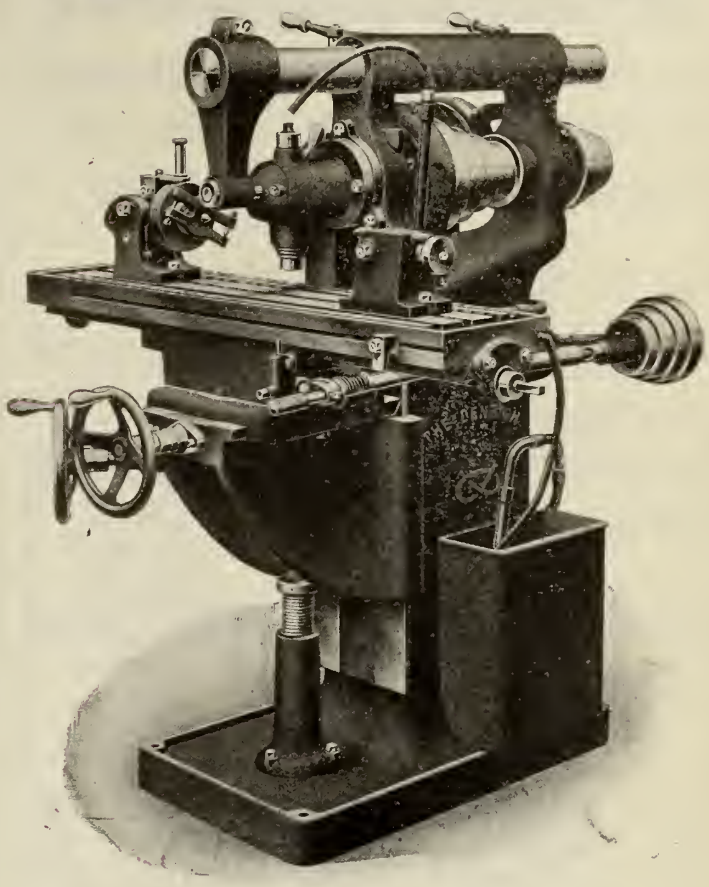

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We know "Electrite" cannot be bettered — and stand ready to prove it to you.

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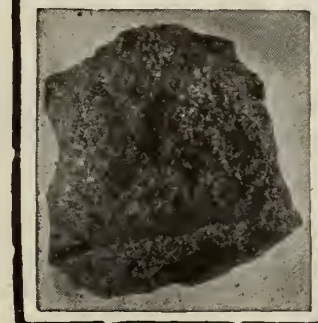

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We know the care with which Dominion Wheels are manufactured. Give them a trial and YOU will know how thoroughly reliable they are.

We are now making our own abrasives, therefore we can absolutely guarantee the quality to be uniform.

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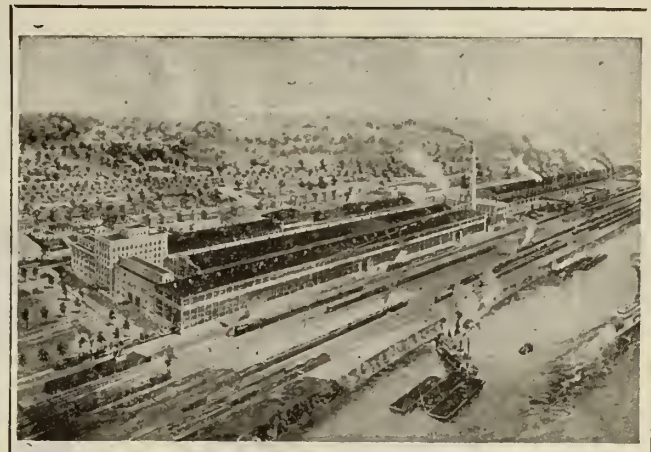

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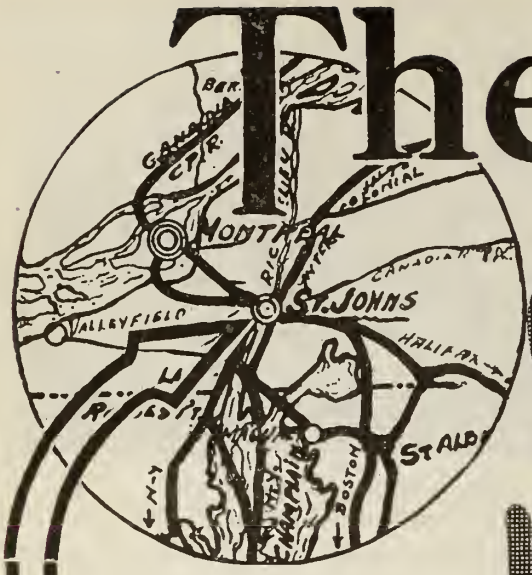

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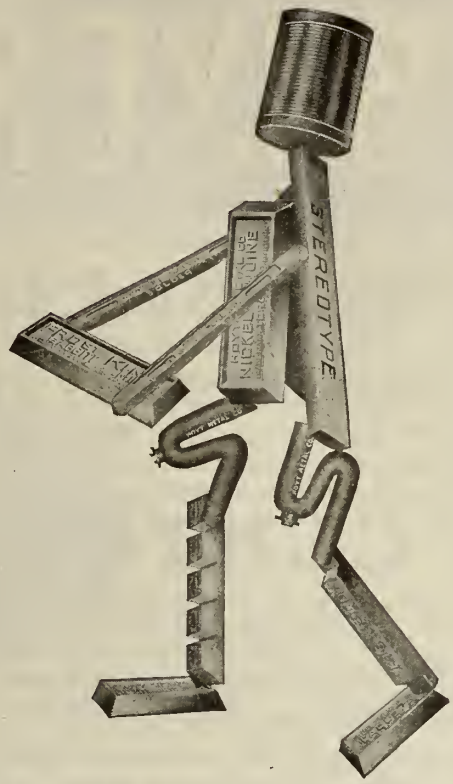
will withstand heavy pressure without increasing its temperature

For general machinery bearings it is without a peer.

If you are from Missouri try a sample lot and be convinced.



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Production of Rare Quality at Lowest Labor Costs

There is **unusual strength, accuracy, speed, convenience and range** in

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Drilling Machines

You can use them to great advantage on any work in your shop that's suitable for a machine tool of this kind. The operating is easy and the labor cost comparatively low.

Drop a line for full particulars and specifications.
Stationary Head Sizes 20"—21"
Sliding Head Sizes 22"—44"

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STELLITE

Not a Steel—but its master.

Red hot tools which give better service than cold!

When made of Stellite this is a fact. Stellite cuts better the hotter it gets, working continuously at temperatures up to 2,000° F., far past the point where the finest steel burns and crumbles.

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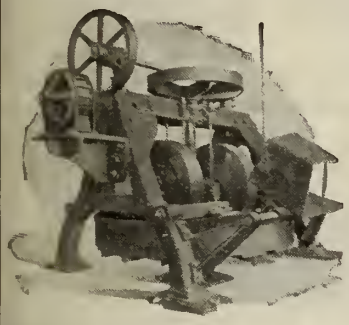

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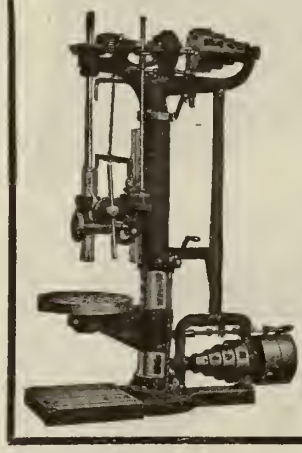

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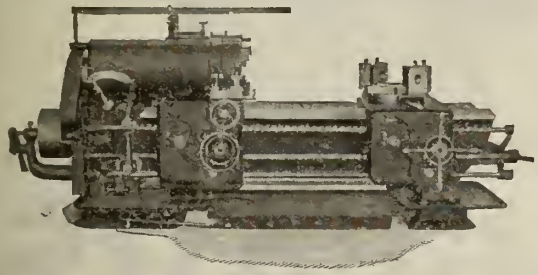

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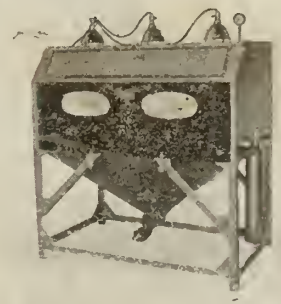

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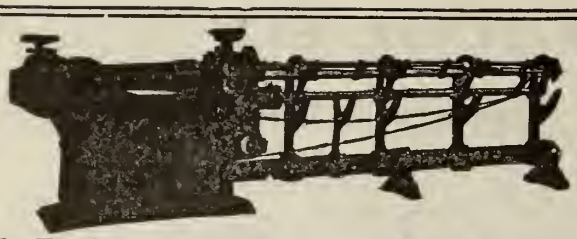

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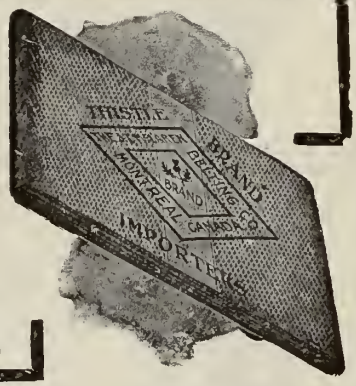

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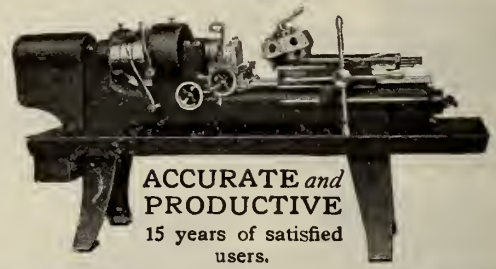

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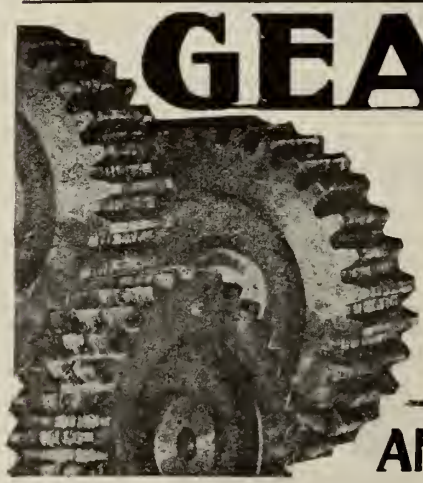

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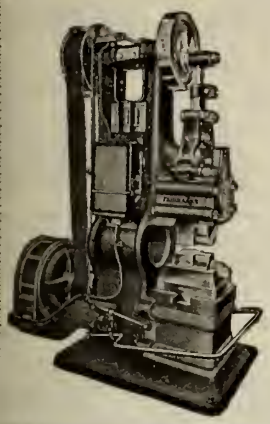

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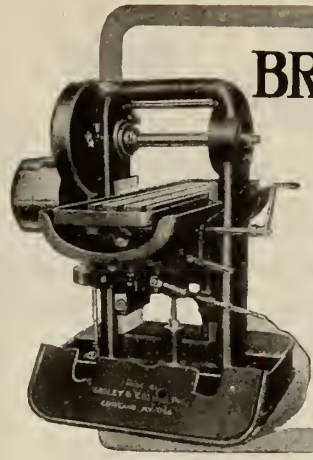

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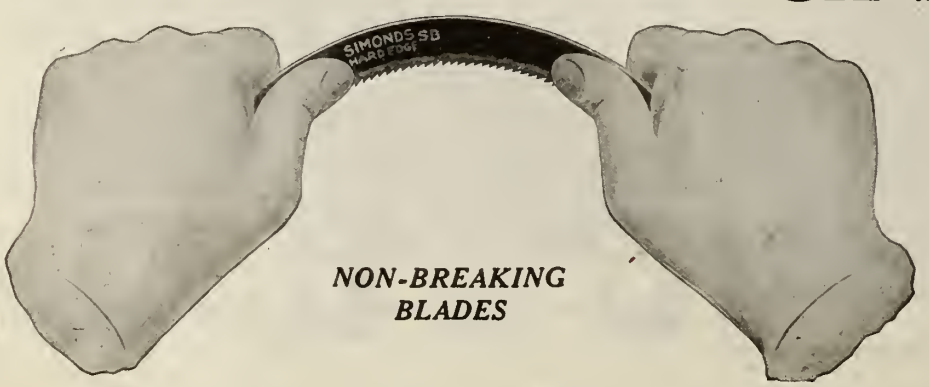

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Graton & Knight Mfg., Worcester, Mass.
International Mchy. Spls., Ltd., Montreal.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
McLaren Belting Co., J. C., Montreal,
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Quaker City Rubber Co, Philadelphia, Pa.
Rice, Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Sumner & Co., New York, N. Y.
Williams Mchy Co., A. R., Toronto, Ont.

BELTING, FRICTION AND SURFACE
Can. Con. Rubber Co., Ltd., Montreal.
Gutta Percha & Rubber, Ltd., Toronto.

BELTING, HAIR
Summer & Co., New York, N.Y.

BELTING, LEATHER
Can. Graton & Knight Mfg. Co., Montreal
Gutta Percha & Rubber, Ltd., Toronto, Canada.
Sumner & Co., New York, N. Y.
John Tullis & Son, Glasgow, Scotland.

BELTING, RUBBER
International Mchy. Spls., Ltd., Montreal.
Quaker City Rubber Co, Philadelphia, Pa.

BELTING, STITCHED COTTON DUCK
Dominion Belting Co., Hamilton, Ont.
Gutta Percha & Rubber, Ltd., Toronto.

BELTING, WOVEN
Federal Engineering Co., Ltd., Toronto
Summer & Co., New York, N.Y.

BENDING MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.
Bertram & Sons Co., John, Dundas
Brown-Boggs Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Kitchener.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Mach. Co., Toronto.
Petrie, Ltd., H. W., Toronto.

BLAST GATES
W. S. Rockwell Co., New York, N.Y.

BLASTING MACHINES, SAND
Garlock-Walker Machinery Co., Toronto.
Jardine, A. B., & Co., Hespeler, Ont.
National Mach. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

BILLET MARKERS
Matthews & Co., Jas. H., Pittsburgh, Pa.

BILLETS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Swedish Steel & Importing Co., Ltd., Montreal.
Algoma Steel Corp., Sault Ste. Marie
Kayser-Ellison & Co., Ltd., Montreal
Marshall, Son & Bunney, Toronto.
United States Steel Corp., Canton, Ohio.

BILLETS, FORGING
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal

BINS, STEEL
Dennis Wire & Iron Works, London, Ont
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Toronto Iron Works, Ltd., Toronto, Ont.
Wilkinson Hamilton Co., Peterboro, Ont.

BLACKSMITH WORK
The Thos. Pink Co., Ltd., Pembroke.

BLOCKS, CHAIN
Oliver Engineering Co., Montreal.

BLOOMS AND SLABS
Algoma Steel Corp., Sault Ste. Marie
United States Steel Corp., Canton, Ohio.

BLOWERS
Can. Blower & Forge Co., Kitchener, Ont.
Garlock-Walker Machinery Co., Toronto.
MacGovern & Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
U.S. Ordnance, Toronto, Ont.

BLOWING ENGINES
General Combustion Co., Ltd., Montreal, Que.

BLOW PIPES AND REGULATORS
Carter Welding Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

BLUE PRINTING MACHINERY
Commercial Camera Co., Providence, R.I.

BLUE PRINT PAPER
Hughes, Owens Co., Ltd., Montreal, Que.

BOARDS, GLASS CUTTING
Lufkin Rule Co., of Can., Windsor, Ont.

BOARTZ
Joyce, Koebel & Co., Inc., New York

BOLT CUTTERS
Greenfield Tap & Die Corp., Greenfield, Mass

BOILER TUBES
Lyman Tube & Supply Co., Montreal, Que.

BOILER BREECHINGS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
St Lawrence Welding Co, Ltd., Montreal
William Hamilton Co., Peterboro, Ont.

BOLT CUTTERS
Fellows Gear Shaper Co., Springfield, Vt.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros., of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.

BOILERS, RANGE
Can. John Wood Mfg. Co., Ltd., Toronto, Ont.

BOILERS
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.

BOLT CUTTERS AND NUT TAPERS
Aikenhead Hardware Co., Toronto, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Landis Machine Co., Waynesboro, Pa.
A.B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Wells Bros. Co. of Canada, Galt, Ont.
Petrie, Ltd., H. W., Toronto

BOLTS
Aikenhead Hardware Co, Toronto, Ont.
London Bolt & Hinge Wks., London, Ont.
Morrow Screw & Nut Co., John, Ingersoll.
Rice, Lewis & Son, Toronto, Ont.
Steel Co., of Canada, Ltd, Hamilton.
Wilkinson & Kompass, Hamilton, Ont.
Williams & Co., J. H. Brooklyn, N.Y.

BOLTS, COUPLING
Gast Machine Screw Co., Ltd., Galt, Ont.

BOLTS, STAY
Morrow Screw & Nut Co., John, Ingersoll.

BOLTS, SPRING SHAKLE
Can. Winkley Co., Ltd., Windsor, Ont.
Morrow Screw & Nut Co., John, Ingersoll

BOLTS, PATCH
Morrow Screw & Nut Co., John, Ingersoll.

BOLT AND NUT MACHINERY
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Gardner & Son, Robt., Montreal.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Universal Mach, Co., Bowling Green, O.
Williams Machinery Co., A. R., Toronto

BOLT THREADING MACHINERY
Jardine & Co., Ltd., B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
Victor Tool Co., Waynesboro, Pa.

BONDING MACHINES (Electric Railway)
The Lincoln Electric Co., Toronto, Ont.

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Cleveland Pneumatic Tool Co., Toronto.
Canadian Fairbanks-Morse Co., Montreal
Can. Ingersoll-Rand Co., Sherbrooke Que
Garlock-Walker Mach. Co., Toronto.

BORING MACHINES, UPRIGHT AND HORIZONTAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto
Oliver Mach'y Co., Grand Rapids, Mich.
Gisholt Machine Co., Madison, Wis.
Hoefer Mfg., Co., Freeport, Ill.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Rockford Drilling Mchs. Co, Rockford, Ill

BORING AND TURNING MILLS
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Pratt Mch. & S'ply Co., Geo. F., Montreal
Knight Metal Products, Toronto.
Oliver Mach. Co., Grand Rapids, Mich.
Niles-Bement-Pond Co., New York.

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Brown & Sharpe Mfg. Co., Providence, R.I.

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Cleveland Wire Spring Co., Cleveland.

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Electric Steel & Metals, Ltd., Welland.

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British Smelting & Refining Co., Ltd., Montreal, Que.

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Lyman Tube & Supply Co., Montreal, Que.

BRASS FOUNDERS
Canada Metal Co., Toronto.
St. Lawrence Welding Co., Montreal.
Tallman Brass & Metal Co., Hamilton.

BRASS GOODS
Crane, Ltd., Montreal, Que.

BRASS PIPE AND TUBE
Crane, Ltd., Montreal, Que.

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Barber Mchy. Co., Ltd., Toronto, Ont.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machinery Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Pratt-O-Lite Co., Inc., Toronto, Ont.
Wood Turret Machine Co., Brazil, Ind.
Williams Machy. Co., A. R., Toronto.
Brown's Copper and Brass Rolling Mills, New Toronto.

BRAZING EQUIPMENT
Chicago Flexible Shaft Co., Chicago, Ill.

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Elk Fire Brick Co., Can., Ltd., Hamilton, Ont.

BRIDGES, RLY. AND HIGHWAY
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.

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BRONZE, NAVAL
Canada Metal Co., Toronto.
Tallman Brass and Metal Co., Hamilton.

BRONZE COPPER
Canada Metal Co., Toronto.

BRUSHES, CARBON
Lyman Tube & Supply Co., Montreal, Que.

BUFFING AND POLISHING MACHINERY
Ford-Smith Mach. Co., Hamilton.
Foss Mchy. & S'ply Co., Geo. F. Montreal
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.

BUCKETS, DUMP
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
St Lawrence Welding Co, Ltd , Montreal

BUCKETS, ELEVATOR
Can. Link-Belt Co., Toronto, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
nce Welding Co, Ltd., Montreal

BUCKETS, CLAM SHELL, CRAB, DUMP
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Ltd, Walkerville.

BULLDOZERS
Bertram & Sons Co., John, Dundas.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

BURNERS, OIL AND NATURAL GAS
Northern Crane Works, Ltd., Walkerville.
W. S. Rockwell Co., New York, N.Y.

BURRS, IRON AND COPPER
Parmenter & Bulloch Co., Gananoque,.

BUSHINGS, BRONZE
Morrow Screw & Nut Co., John, Ingersoll.
St Lawrence Welding Co, Ltd., Montreal

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R.I.
Pangborn Corporation, Hagerstown, Md.

CABINETS, SAND BLAST
Pangborn Corporation, Hagerstown, Md.

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International Machinery & Supply Co., Ltd., Montreal, Que.

CABLES, TRANSMISSION AND TELEPHONES
Northern Electric Co., Ltd., Montreal.

CALKS, BOOT
Lufkin Rule Co., of Can., Windsor, Ont.

CANNERS' MACHINERY
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Can.

CANNERS' CONVEYORS
Can. Link-Belt Co., Toronto, Ont.

CARBIDE
Carter Welding Co., Ltd., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.
Union Carbide Co., of Canada, Limited, Weland, nt.

CARBONIZING BOXES
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Katie Foundry, Galt, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
Swedish Crucible Steel Co., Windsor.

CARRIERS, PNEUMATIC TUBE
Jones & Glassco, Montreal.

CARS, INDUSTRIAL
Can. Blower & Forge Co., Kitchener, Ont
Can. Fairbanks-Morse Co., Ltd, Montreal
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

CASES, FILING
Economy Drawing Table Co., Adrian, Mich.

CASTINGS, ALUMINUM, BRASS BRONZE, COPPER, AND GUN METAL
Algoma Steel Corp., Sault Ste. Marie.
Franklin Mfg. Co., Syracuse, N.Y.
Canada Metal Co., Ltd., Toronto, Ont.

CASTINGS, DIE CAST
Canada Metal Co., Ltd., Toronto, Ont.
Franklin Mfg. Co., Syracuse, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Tallman Brass & Metals Ltd., Hamilton, Ont.

CASTINGS, STEEL—ALL KINDS
Canada Electric Castings, Ltd., Orillia, Ont.
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Electric Steel & Metals Co., Welland.
Mesta Machine Co., Pittsburgh, Pa.

CASTINGS, ELECTRIC AND ALLOY STEEL
Can. Elec. Castings Co. Ltd., Orillia, Ont
Dominion Foundries & Steel Ltd., Hamilton, Ont.

CARRIERS COUPLING BOLTS
John Morrow Screw & Nut Co., Ingersoll
Alexander Fleck Ltd., Ottawa.
Tallman Brass & Metal Co., Hamilton.

CASTINGS, BENCH LEG.
Brown & Sharpe Mfg. Co., Providence, R.I.

CASTINGS, BRASS AND IRON
Algoma Steel Corp., Sault Ste. Marie.
International Machinery and Supply Co., Ltd., Montreal, Que.

CASTINGS, BUILDING
Katie Foundry, Galt, Ont.

CASTINGS, GRAY IRON
Bernard Industrial Co., A., Fortierville, Q
Brown & Sharpe Mfg. Co., Providence, R.I.
Brown, Boggs Co., Ltd., Hamilton.
Can. Elec. Castings Co, Ltd., Orillia, Ont
Alexander Fleck, Ltd., Ottawa.
Gardner & Son, Robt., Montreal.
Hull Iron & Steel Foundries, Ltd., Hull
International Malleable Iron Co., Guelph
Kennedy & Sons, Ltd., Wm., Owen Sound.
Katie Foundry, Ltd., Galt, Ont.
Hamilton Co., Wm., Peterboro.
McFarlane Engineering Ltd., G. W., Paris, Ont.

CASTINGS, PLUMBERS'
Katie Foundry, Galt, Ont.

CASTINGS, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville

CASTINGS, HARDWARE
Katie Foundry, Galt, Ont.

CASTINGS, STEEL CHROME AND MANGANESE STEEL
Thos. Davidson Mfg. Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hull Iron & Steel Foundries, Ltd., Hull.
Kennedy & Sons, Ltd, Owen Sound.

CASTINGS, MALLEABLE
International Malleable Iron Co., Guelph

CASTINGS, NICKEL STEEL
Hull Iron & Steel Foundries, Ltd., Hull.

CEMENT MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gardner, Robt., & Son. Montreal.

CEMENT HANDLING MACHINERY
Can. Link-Belt Co., Toronto, Ont.

CEMENT TOOLS
Atkins & Co., E. C., Hamilton, Ont.

CENTERING MACHINES
Victoria Foundry Co., Ottawa, Ont.

CENTRE REAMERS
Bertram & Sons Co., John, Dundas.
Butterfield & Co., Inc., Rock Island, Que.
Gardner, Robt. & Son, Montreal.
Hurlburt, Rogers Mch. Co., South Sudbury, Mass.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co., of Canada, Galt, Ont.

CHAIN, WELDED COIL
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

CHAIN BLOCKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford Chain Block & Mfg. Co., Phila., Pa.
Garlock-Walker Machy. Co., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & HoistCo., Herbert, Niagara Falls, Ont.
Oliver Engineering Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Jones & Glassco, Montreal, Que.

CHAINS, AGRICULTURAL
Canadian Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.

CHAINS, AUTOMOBILE ENGINE
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.

CHAINS, BICYCLE, DRIVE AND BLOCK
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAINS, FOR ELEVATORS AND CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAIN, MALLEABLE, DETACHABLE AND RIVETED
Can. Link-Belt Co., Toronto, Ont.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAINS, POWER TRANSMISSION
Canadian Link-Belt Co., Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, New York.
Glasgow, N.S.

CHAINS, SPROCKET WHEEL
Can. Link-Belt Co., Ltd., Toronto, Ont.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAIN DRIVES
Can. Link-Belt Co., Toronto, Ont.
Coventry Chain Co., Coventry, England.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHASERS
National Acme Co., Cleveland, Ohio.
Taylor, J. A. M., 315 Stair Bldg., Toronto, Ont.

CHEMISTS
Toronto Testing Lab'tory, Ltd., Toronto

CHUCKS, AERO, AUTOMATIC
Garvin Machine Co., New York.

CHUCKS, CENTERING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKS, COLLET, AIR
Elliott & Whitehall Mach. & Tool Co. Galt, Ont.
Smalley-General Co., Inc., Bay City, Mich.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, LATHE AND UNIVERSAL
Aikenhead Hardware Co., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt., & Son, Montreal.
Garlock-Walker Mach'y Co., Toronto.
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Chicago, Ill.
Jacobs Mfg. Co., Hartford, Conn.
Ker & Goodwin Machine Co., Ltd.,
Knight Metal Products, Toronto.
Modern Tool Co., Erie, Pa.
Rice Lewis & Son, Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, AUTOMATIC AND KEYLESS
Aikenhead Hardware Co., Toronto, Ont
Can. Blower & Forge Co., Kitchener,
McCrosky Tool Corp., Meadville, Pa., U. S. A.

CHUCKS, FRICTION AND TAP
Victor Tool Co., Waynesboro, Pa.

CHUCKS, MAGNETIC
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

CHUCKS, RING WHEEL
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.

CHUCKS, WHEEL, CAR
Hoggson & Pettis Mfg. Co., New Haven Conn.

CHUCKING MACHINES
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Windsor, Vt.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Wood Turret Mach. Co., Brazil, Ind.
Williams Mchy Co., A. R., Toronto, Ont.

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Bowser Co., Ltd., S. F., Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

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Oakley Chemical Co., New York, N.Y.

CLEANING COMPOUND
Oakley Chemical Co., New York.

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CLOCKS, WATCHMAN, PORTABLE
Gisholt Machine Co., Madison, Wis.

CLOSETS
Crane, Ltd., Montreal, Que.

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Wright Mfg. Co., Lisbon, Ohio.

CLUTCHES, FRICTION AND PULLEY
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Can. Link-Belt Co., Toronto, Ont.
Carlyle Johnson Mach. Co., Manchester, Conn.
Positive Clutch & Pulley Wks., Aurora, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.

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Canadian Mead-Morrison Co., Limited, Montreal, Que.

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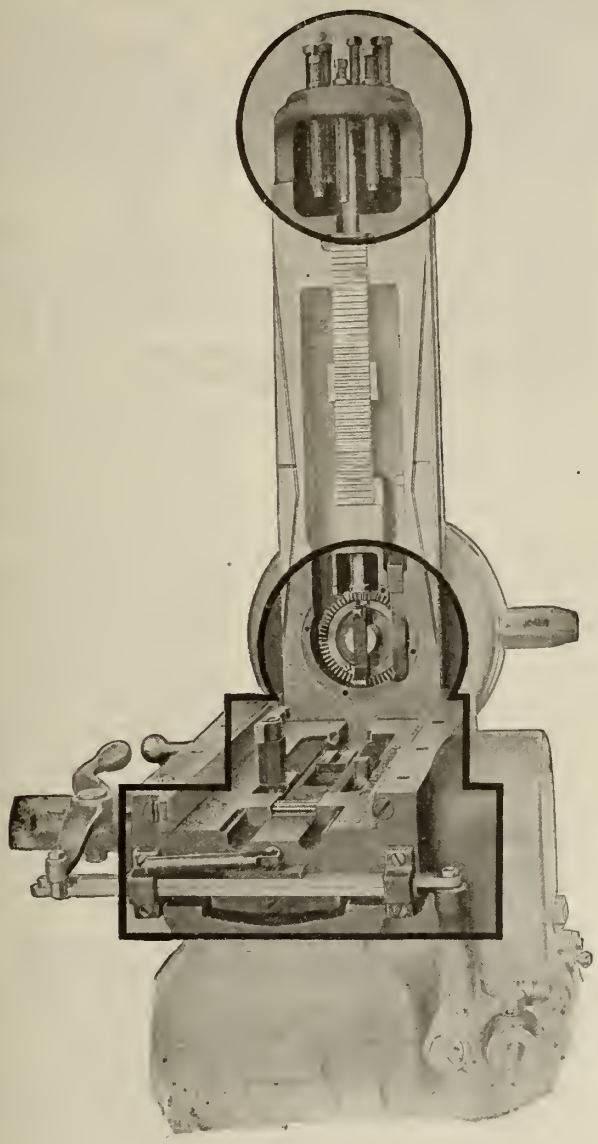
Can. Link-Belt Co., Toronto, Ont.
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Nova Scotia Steel & Coal Co., New



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Browne & Sharpe

Wire Feed Screw Machines

TURRET SLIDE FEATURES

Individual stop screws shown in circle, one for each turret position, obviate exact setting of each tool.

In addition to a positive lock by means of a taper pin which aligns the turret holes with the spindle, the larger machines are automatically clamped as the turret is moved forward, by a tapered bushing controlled by the rocker arm shown in the centre of the large bevel gear.

These features of rugged construction and practical design, combined with automatic feeding and chucking of stock and centralization of all levers—points vital to production, make these machines the choice of the discriminating manufacturer who must have high production and accuracy.

BROWN & SHARPE MFG. CO.

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Takes stock from ½-in. to 2-in. diameter — round, square or hexagonal.

This machine is the largest in our line of five, each of which is constructed with that same care and attention to detail for which Brown & Sharpe is known throughout the world.

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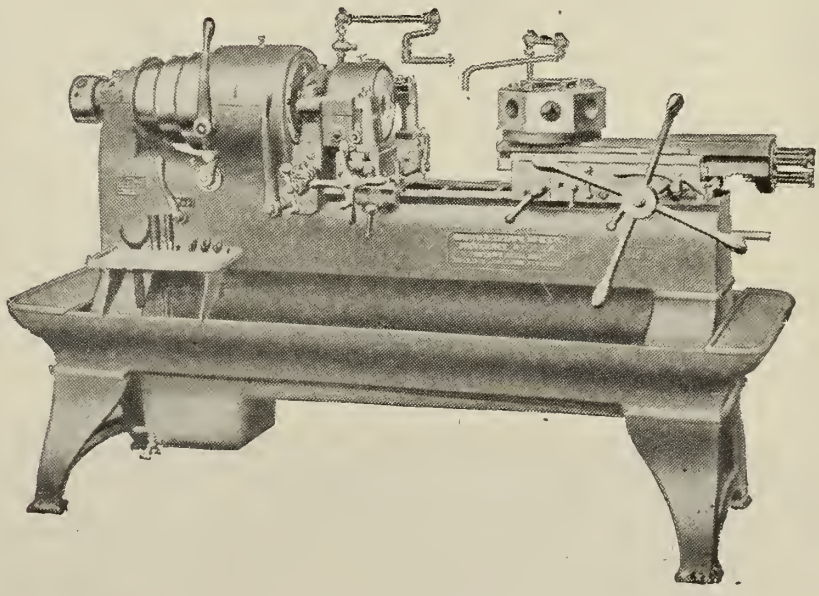

If interested, tear out this page and keep with letters to be answered.

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Garlock-Walker Machy. Co., Toronto.
MacGovern & Co., Montreal, Que.
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Williams Mchy Co., A. R., Toronto, Ont.
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Globe Engineering Co., Hamilton, Ont.
Homer & Wilson, Hamilton, Ont.
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Jones & Glasco, Montreal.
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Canadian Mead-Morrison Co., Limited, Montreal, Que.
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Puro Sanitary Drinking Fountain Co., Haydenville, Mass.
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Bertram & Sons Co., John, Dundas, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co. Toronto.
Niles-Bement-Pond Co., New York.
Can. Blower & Forge Co., Kitchener.
COPPER, BUS BAR, SHEET, PATES, RODS
British Smelting & Refining Co., Ltd., Montreal, Que.
Brown's Copper and Brass Rolling Mills, New Toronto.
Brown's Copper and Brass Rolling Mills, New Toronto.
CORE OIL
Swan & Finch, Inc., 155 Broadway.
COUNTERBORES AND COUNTERSINKS
Aikenhead Hardware Co., Toronto, Ont.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mach. Co., New Bedford, Mass
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
COUNTERSINKS, INTERCHANGEABLE
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
COUNTERBORES, INVERTED, INTERCHANGEABLE
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
COUNTERSHAFTS
Almond Mfg. Co., Ashburnham, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Gray Ball Bearing Co., Ltd., Toronto.
Baird Machine Co., Bridgeport, Conn.
Ford-Smith Machine Co., Hamilton, Ont.
Foster Machine Co., Elkhart, Ind.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co. Ltd., A. R., Montreal
Williams Mchy Co., A. R., Toronto, Ont.
COUPLINGS, FRICTION
Bernard Industrial Co., The A., Fortierville, Que.
Can. Link-Belt Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.
COUPLINGS, RAPID HOSE
Int. Machinery & Supply Co., Ltd., Montreal, Que.

COILING MACHINERY, WIRE AND SPRING
Garlock-Walker Machinery Co., Toronto.
COKE AND COAL
Hanna & Co., M. A., Cleveland, O.
COUPLINGS, PLAIN, FLEXIBLE AND CUT OFF
Cleveland Pneumatic Tool Co., of Canada, Toronto.
CRANES, OVERHEAD, HAND AND
Gardiner, Robt. & Son, Montreal.
Independent Pneumatic Tool Co., Chicago
CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.
Northern Crane Works, Walkerville.
ELECTRIC
Volta Manufacturing Co., Welland, Ont.
CUPS, OIL
Can. Winkley Co., Ltd., Windsor, Ont.
COVERS, OIL HOLE
Can. Winkley Co., Ltd., Windsor, Ont.
CRANES, GANTRY
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
CRANE RUNWAYS
MacKinnon Steel Co., Sherbrooke, Que.
CRANES, JIB
Brown Hoisting Machinery Co., Cleveland, Ohio.
CRANES, LOCOMOTIVE
Brown Hoisting Machinery Co., Cleveland, Ohio.
CRANES, GOLIATH, PNEUMATIC AND PORTABLE
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Morris Crane and Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Petrie, Ltd., H. W., Toronto.
CRANES, PILLAR
Brown Hoisting Machinery Co., Cleveland, Ohio.
CRANES, TRAVELLING, ELECTRIC AND HAND POWER
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Machy. Co., St. Louis
Dominion Bridge Co., Montreal.
Hepburn, John T., Ltd., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Niles-Bement-Pond Co., New York.
Northern Crane Works, Walkerville.
Oliver Engineering Co., Montreal.
CRANK SHAFTS
Canada Found's & Forgings Ltd., Welland
Williams & Co., J. H., Brooklyn, N.Y.
CRANES, PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.
CRIMPS, LEATHER
Graton & Knight Mfg. Co., Worcester, Mass.
CRUSHERS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Elec. Steel & Metals, Welland, Ont.
CUPOLAS
Can. Blower & Forge Co., Kitchener.
Northern Crane Works, Walkerville.
CURB PUMPS FOR OIL, GASOLINE
Bowser Co., Ltd., S. F., Toronto, Ont.
CURRENT TRANSFORMERS
Volta Manufacturing Co., Welland, Ont.
CUT-OFF COUPLINGS, FRICTION
Petrie, Ltd., H. W., Toronto.
CUTTERS, BOLT
See Bolt Cutters.
CUTTERS, GEARS
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Fellows Gear Shaper Co., Springfield, Vt.
CUTTERS, FLUE
Cleveland Pneumatic Tool Co., Toronto.
CUTTER HEADS
Oliver Machinery Co. Grand Rapids, Mich
CUTTERS, PIPE (See Pipe Cutters)
CUTTERS, MILLING
Becker Milling Mach. Co., Boston, Mass.
Butterfield & Co., Rock Island, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cleveland Twist Drill Co., Cleveland.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Illinois Tool Works, Chicago, Ill.
Ingersoll Machine Co., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Whitney Mfg. Co., Hartford, Conn.
Wilt Twist Drill Co., Walkerville, Ont.
CUTTER RELIEVING MACHINES
Cleveland Milling Machine Co., Cleveland.
CUTTING-OFF MACHINES
Armstrong Bros., Tool Co., Chicago.
Atkins & Co., E. C., Hamilton, Ont.
Bertram & Sons Co., John, Dundas.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Foss Mchy & S'ply Co., Geo. F., Montreal
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield, Mass
Hurlburt, Rogers Machy. Co., South Sudbury, Mass.
Hall & Sons, John H., Brantford, Ont.
Kennedy & Sons, Wm., Owen Sound.
Lyman Tube & Supply Co., Montreal, Que.
Niles-Bement-Pond Co., New York, N.Y.
Prest-O-Lite Co., Inc., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Tabor Mfg. Co., Philadelphia, Pa.
Wells Bros. of Can., Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.
CUTTING COMPOUND AND CUTTING OIL
Cataract Refining Co., Ltd., Toronto.
Swan & Finch, Inc., New York.
CUTTING OIL, RECLAIMING SYSTEM
Bowser Co., Ltd., S. F., Toronto, Ont.
CUTTING AND WELDING PLANTS
Davis-Bournonville Co., Jersey City, N.J.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.
CYANIDE AND LEAD BATH POTS
Swedish Crucible Steel Co., Windsor.
CYLINDERS, AIR
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Smalley General Co., Inc., Bay City, Mich
CYLINDERS, AUTOMATIC REBORING JIGS AND REAMERS
Kelley Reamer Co., Cleveland, O.
DEHUMIDIFYING
B. F. Sturtevant Co, Galt, Ont.
DERRICKS
Aikenhead Hardware Co., Toronto, Ont.
Dominion Bridge Co., Montreal.
Hepburn Co., Ltd., J. T., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
DERRICK HOISTS
Canadian Mead-Morrison Co., Limited, Montreal, Que.
DIAMOND (BORTZ)
Furniss, Clarke & Co., Montreal, Que.
DIAMOND TOOLS
Ford-Smith Machine Co., Hamilton, Ont.
Furniss, Clarke & Co., Montreal, Que.
Joyce-Koebel Co., Inc., New York City.
Wheel Trueing Tool Co., Detroit.
Petrie, Ltd., H. W., Toronto.
DIAMONDS, CARBON AND BORTZ
Wheel Trueing Tool Co., Detroit.
DIAMONDS, BLACK AND ROUGH
Joyce, Koebel & Co., Inc., New York.
Wheel Trueing Tool Co., Windsor, Ont.
DIE CASTINGS
Fisher Motor Co., Ltd., Orillia, Ont.
Tallman Brass & Metals Ltd., Hamilton, Ont.
DIE HEADS, AUTOMATIC
Greenfield Tap & Die Corp., Greenfield Mass.
Wells Bros. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
DIES, BRASS PRINTING, EMBOSSING AND LETTERING
Matthews, Jas. H., & Co., Pittsburgh, Pa
DIES FOR BIT BRACE USE
Butterfield & Co., Rock Island, Que.
Crescent Mche. Co., Ltd., Montreal, P.Q.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Wells Brothers Co., of Canada, Galt.
DIES AND DIE STOCKS
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Rock Island, Que.
Brown, Boggs Co., Hamilton, Ont.
Crescent Mche. Co., Ltd., Montreal, P.Q.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt. & Son, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Jones & Lamson, Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.
Marshall, Son & Bunney, Toronto.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Rickert-Shafer Co., Erie, Pa.
Stoll Co., Inc., D. H., Buffalo, N.Y.
Wells Brothers of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.
DIES, HAMMERED
Kimber & Hillier Mfg., Co., St. Catharines, Ont.
DIES, DROP FORGE.
Kimber & Hillier Mfg., Co., St. Catharines, Ont.
DIES, METAL STAMPING
Crescent Mche. Co., Ltd., Montreal, P.Q.
Elliott & Whitehall, Galt, Ont.
DIES, PIPE THREADING
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Crescent Mche. Co., Ltd., Montreal, P.Q.
Landis Machine Co., Waynesboro, Pa.
DIES, THREADING
Butterfield & Co., Inc., Rock Island, Que.
Crescent Machine Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.
DIE SINKERS
Becker Milling Machine Co., Boston
Garvin Machine Co., New York.
Kimber & Hillier Mfg., Co., St. Catharines, Ont.
Pratt & Whitney Co., Dundas, Ont.
Walcott Lathe Co., Jackson, Mich
DIES FOR MACHINES
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Rock Island, Que.
Firth & Sons, Thos., Montreal, Que.
Landis Machine Co., Waynesboro, Pa.
Wells Brothers Co. of Canada, Galt.
DIE HEADS
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Canada, Galt, Ont.
DIES, SELF-OPENING
Geometric Tool Co., New Haven.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Wells Brothers Co. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
DIE FILING MACHINES
Oliver Mach. Co., Grand Rapids, Mich.
DIE STEEL, HOT AND COLD WORK
Armstrong-Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.
Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
DIES FOR SCREW PLATES
Butterfield & Co., Inc., Rock Island, Que.
Wells Bros. Co. of Can., Galt, Ont.
DIES, SHEET METAL WORKING
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada
Globe Engineering Co., Hamilton, Ont.
Stoll Co., D. H., Buffalo, N.Y.
DIES, SCREW AND THREAD
Butterfield & Co., Rock Island, Que.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
National-Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros., Co., of Can., Galt, Ont
DISCS, LEATHER, STEEL
Graton & Knight Mfg. Co., Worcester, Mass.
Swedish Steel & Importing Co., Montreal
DIRECT CONNECTED UNITS
MacGovern & Co., Montreal, Que.
DRAFT, MECHANICAL
Butterfield & Co., Rock Island, Que.
Can. Blower & Forge Co., Kitchener.
A. B. Jardine & Co., Hespeler, Ont.
Pratt & Whitney Co., Dundas, Ont.
Sturtevant Co., B. F., Galt, Ont.
DRAINAGE FITTINGS
Crane, Ltd., Montreal, Que.
DRAWING INSTRUMENTS
Hughes, Owens Co., Ltd., Montreal, Que.
DRAWING OFFICE SUPPLIES
Hughes, Owens Co., Ltd., Montreal, Que.
DRESSERS, GRINDING AND EMERY WHEEL
Atkins & Co., E. C., Hamilton, Ont
Can. Desmond-Stephan Mfg. Co., Hamilton
Dominion Abrasive Co., Ltd., Mimico, Ont.
Petrie, Ltd., H. W., Toronto.
Wheel Trueing Tool Co., Windsor, Ont.
DRILL PRESSES
Aurora Tool Works, Aurora, Ind.
Barber Mchy. Co., Ltd., Toronto, Ont.
W. F. & John Barnes Co., Rockford.
Can. Blower & Forge Co., Kitchener.
Canada Machinery Corp., Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal
Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
U. S. Mach. Tool Co., Cincinnati, Ohio.
A. R. Williams Machinery Co., Toronto.
DRILL RODS
Atkins & Co., Ltd., Wm., Sheffield, Eng
Kayser-Ellison & Co., Ltd., Montreal.
Lincoln Electric Co. of Canada, Ltd. Toronto, Ont.
Marshall, Son & Bunney, Toronto.
Swedish Steel & Importing Co., Ltd., Montreal.
DRILLING MACHINES, GANG
Barnes, W. F. & John Co., Rockford, Ill.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bilton Mach. Tool Co., Bridgeport, Conn
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Silver Mfg. Co., Salem, Ohio.
DRILLING MACHINES, LOCOMOTIVE AND MULTIPLE SPINDLE
Barber Mchy. Co., Ltd., Toronto, Ont.
John Bertram & Sons Co., Dundas.
Bilton Mach. Tool Co., Bridgeport, Conn
Can. Blower & Forge Co., Kitchener, Ont
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal
Garlock-Walker Mach. Co., Toronto.
Garvin Machine Co., New York.
Hoefer Mfg., Co., Freeport, Ill.
Henry & Wright Mfg. Co., Hartford, Conn
A. B. Jardine & Co., Hespeler, Ont.
Landis Tool Co., Waynesboro, Pa.
Nat. Automatic Tool Co., Richmond, Ind.
Niles-Bement-Pond Co., New York.
Rockford Drilling Mach Co., Rockford, Ill.

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If you could buy a genuine Balata Belt at a little more than the price for a Rubber Belt, would you not jump at the chance?

Do you remember when you used to buy Balata belting for your motor in preference to any other, or have you forgotten it?

Some people think that Balata has been withdrawn from the market. It is not now, nor was it at any time during the war withdrawn from the Canadian market.

We are in a fortunate position in that we purchased a large supply of LANCO Balata belting more than a year ago, which was before the large advances in price took place.

If you buy now you can be in the same fortunate position, as we have averaged our selling prices, the average being based on the cost of our entire stock.

We have a large stock on hand and can make immediate delivery.

LANCO Balata belting is honestly made, and we do not believe it possible to improve on this type of belting.

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Scandinavia Belting
Leather Belts
Rubber Belts
Grinder Belts
Conveyor Belts

There is little stretch to this belt.

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172 John St., Toronto

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Barber Mchy. Co., Ltd., Toronto, Ont.
John Bertram & Sons Co., Dundas.
Canadian Fairbanks-Morse Co., Montreal
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Henry & Wright Mfg. Co., Hartford,
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLING MACHINES, SENSITIVE
Barber Mchy. Co., Ltd., Toronto, Ont.
Bilton Mach. Tool Co., Bridgeport, Conn
W. F. & John Barnes Co., Rockford, Ill.
Canadian Fairbanks-Morse Co., Montreal
Canadian Machinery Corp., Galt, Ont.
Geo. F. Foss Mch. & S'ply Co., Montreal
Garlock-Walker Mach. Co., Toronto, Ont
Henry & Wright Mfg. Co., Hartford, Conn
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
United States Mach. Tool Co., Cincinnati
Williams Mchy Co., A. R., Toronto, Ont.

DRILLING MACHINES, UPRIGHT AND HORIZONTAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Aurora Tool Works, Aurora, Ind.
John Bertram & Sons Co., Dundas.
Garlock-Walker Mach. Co., Toronto, Ont
Can. Blower & Forge Co., Kitchener.
Canada Mach. Corp., Galt, Ont.
Garvin Machine Co., New York.
Ford-Smith Machine Co., Hamilton, Ont
Garlock-Walker Mach. Co., Toronto, Ont
Hoefer Mfg. Co., Freeport, Ill.
A. B. Jardine & Co., Hespeler, Ont.
Knight Metal Products, Toronto.
Landis Tool Co., Waynesboro, Pa.
R. McDougall Co., Galt.
Nat. Automatic Tool Co., Richmond, Ind
Rockford Drilling Mach. Co., Rockford, Ill
Niles-Bement-Pond Co., New York.
Silver Mfg. Co., Salem, Ohio.
A. R. Williams Machinery Co., Toronto.

DRILLING MACHINES, SPECIAL
Hoefer Mfg. Co., Freeport, Ill.

DRILLING POSTS
Aikenhead Hardware Co., Toronto, Ont
Keystone Mfg. Co., Buffalo, N.Y.
Rice Lewis & Son, Toronto, Ont.
Silver Mfg. Co., Salem, Ohio.

DRILLS, BENCH
Aikenhead Hardware Co., Toronto.
W. F. & John Barnes Co., Rockford, Ill
Can. Blower & Forge Co., Kitchener.
Can. Fairbanks-Morse Co., Montreal.
Geo. F. Foss Mch. & S'ply Co., Montreal
Garlock-Walker Machinery Co., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

DRILLS, BLACKSMITH AND BIT STOCK
Aikenhead Hardware Co., Toronto, Ont
Butterfield & Co., Inc., Rock Island, Que
Can. Blower & Forge Co., Kitchener.
Cleveland Twist Drill Co., Cleveland.
Geo. F. Foss Mch. & S'ply Co., Montreal
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.
Whitman & Barnes Mfg. Co., Akron, O.
Wilkinson & Kompass, Hamilton, Ont.
Wilt Twist Drill Co. of Can., Walkerville

DRILLS, CENTRE
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto.
Rice Lewis & Son, Toronto, Ont.
Wilt Twist Drill Co., of Can., Walkerville

DRILLS CORE, INTERCHANGEABLE
Eclipse Counteroore Co., Ltd., Walkerville, Ont.

DRILLS, CARBON
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Marshall, Son & Bunney, Toronto.
John Morrow Screw & Nut Co., Ingersoll

DRILLS, ELECTRIC, PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener.
Cincinnati Electrical Tool Co., Cincinnati
Geo. F. Foss Mch. & S'ply Co., Montreal
Haskins Co., R. C., Chicago, Ill.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Pilot Steel & Tool Co., Montreal, Que.
Prest-O-Lite Co., Inc., Toronto, Ont.
U. S. Electrical Tool Co., Cincinnati, O.
A. R. Williams Mach. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLS, HAMMER
Samuel Osborne, Ltd., Montreal, P.Q.

DRILLS, EMERY
Garlock-Walker Mach. Co., Toronto, Ont.

DRILLS, HIGH SPEED TWIST
Aikenhead Hardware Co., Toronto, Ont
Armstrong-Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Canadian Fairbanks-Morse Co., Montreal
H. A. Drury Co., Montreal
Geo. F. Foss Mch. & S'ply Co. Montreal
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
W. F. & John Barnes Co., Rockford, Ill
Osborne, Samuel, Montreal, P.Q.
Pratt & Whitney Co., Dundas, Ont.
Petrie, H. W, Toronto.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Taylor J. A. M., Stair Bldg., Toronto.
Wilt Twist Drill Co. of Can., Walkerville
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLS, OIL TUBE
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

DRILLS, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Williams Mchy Co, Ltd., A. R., Montreal
Greenfield Tap & Die Corp., Greenfield, Mass.

DRILLS, PNEUMATIC CORNER
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.

DRILLS, RATCHET AND HAND
Aikenhead Hardware Co., Toronto, Ont.
Armstrong Bros. Tool Co., Chicago, Ill.
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cincinnati Electrical Tool Co., Cincinnati.
Cleveland Twist Drill Co., Cleveland.
Garlock-Walker Mchy. Co., Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilt Twist Drill Co. of Can., Walkerville.

DRILLS, ROCK
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
The Foss Mchy. & Supply Co., Montreal.
Samuel Osborne Ltd., Montreal, P.Q.
A. R. Williams Machy. Co., Toronto.

DRILLS, SQUARE & HEXAGON
Globe Engineering Co.

DRILLS, TRACK
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
The Foss Mchy. & Supply Co., Montreal.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Wilt Twist Drill Co. of Can., Walkerville.

DRINKING FOUNTAINS, SANITARY
Crane, Ltd., Montreal, Que.
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

DRIVES, CHAIN
See Belting, Chain.

DRIVING TOOLS
The Thos. Pink Co., Ltd., Pembroke, Ont.

DRY CLEANING SYSTEM
Bowser Co., Ltd., S. F., Toronto, Ont.

DRYERS, SAND
Lyman Tube & Supply Co., Montreal, Que.
Pangborn Corporation, Hagerstown, Md.

DRYING APPLIANCES
Baird Machine Co., Bridgeport, Conn.
Sturtevant Co., B. F., Galt, Ont.
W. S. Rockwell Co., New York, N.Y.

DRUM CONTROLS
Volta Manufacturing Co., Welland, Ont.

DUMP CARS
Canadian Fairbanks-Morse Co., Montreal.
MacKinnon Steel Co., Sherbrooke, Que.

DUST EXHAUSTER. ARRESTER SYSTEM
Pangborn Corporation, Hagerstown, Md.

DUST HANDLING EQUIPMENT
Pangborn Corporation, Hagerstown, Md.
Sturtevant Co., B. F., Galt, Ont.

DUST SEPARATORS
Can. Blower & Forge Co., Kitchener, Ont.
Sturtevant Co., B. F., Galt, Ont.

DYNAMOS AND ELECTRICAL SUPPLIES
Canadian Fairbanks-Morse Co., Montreal.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
MacGovern & Co., Montreal, Que.
A. R. Williams Machy. Co., Toronto.

ELECTRICAL SUPPLIES
Can. General Electric Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Northern Electric Co., Ltd., Montreal Que

ELECTRIC FURNACES
Electric Furnace Construction Co., Philadelpria, Pa.
Hamilton & Hansell, Inc., New York City
Volta Manufacturing Co., Welland, Ont.

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Canadian Mead-Morrison Co., Limited, Montreal, Que.
Volta Manufacturing Co., Welland, Ont.

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Sturtevant Co., B. F., Galt, Ont.
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Curtis Pneumatic Machy. Co., St. Louis.

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Oliver Machinery Co., Grand Rapids, Mich

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Ford-Smith Machine Co., Hamilton, Ont.

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Atkins & Co., E. C., Hamilton, Ont.

EMERY PAPER
Atkins & Co., E. C., Hamilton, Ont.

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Garvin Machine Co., New York.
Canadian Fairbanks-Morse Co., Montreal.
Canada Emery Wheels Co., Hamilton.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Wilkinson & Kompass, Hamilton, Ont.
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Canadian Fairbanks-Morse Co., Montreal.
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Sturtevant Co., B. F., Galt, Ont.

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Johnson Mach. Co., Carlyle, Manchester, Conn.
Petrie, Ltd., H. W., Toronto.
A. R. Williams Machy. Co., Toronto.

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ENGINES, HEAVY OIL, DIESEL TYPE
Dom. Steel Products Co., Ltd., Brantford

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Sturtevant Co., B. F., Galt, Ont.

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Sturtevant Co., B. F., Galt, Ont.

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Page Steel & Wire Co., New York, N.Y.

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Vanadium-Alloys Steel Co., Pittsburgh, Pa

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Morrow Screw & Nut Co., J., Ingersoll, Ont
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Nicholson File Co., Port Hope, Ont.
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Simonds Mfg. Co., Fitchburg, Mass.
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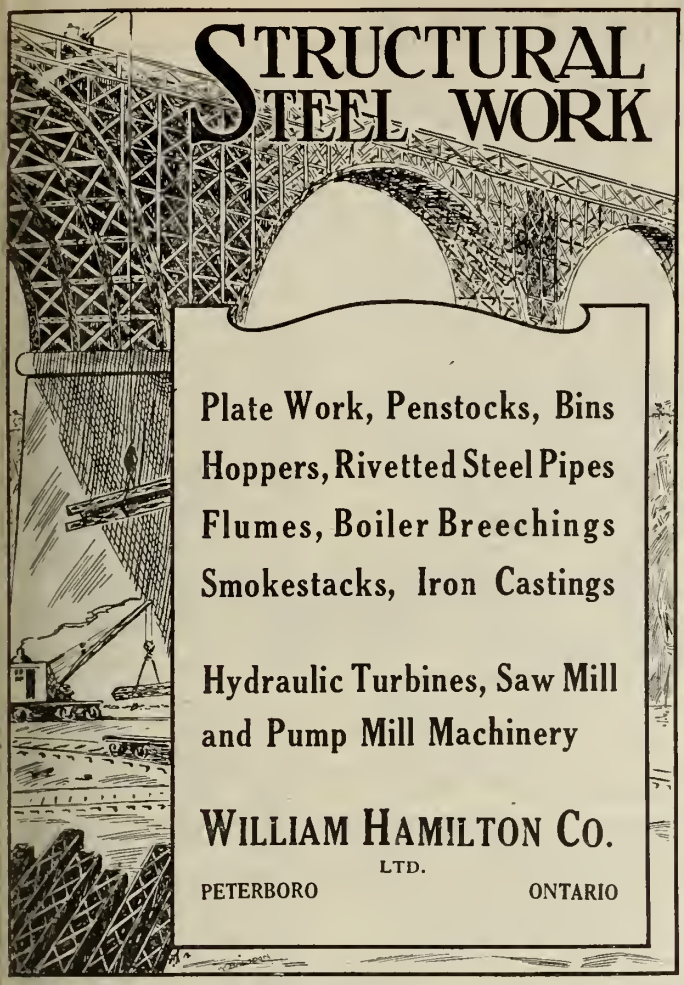

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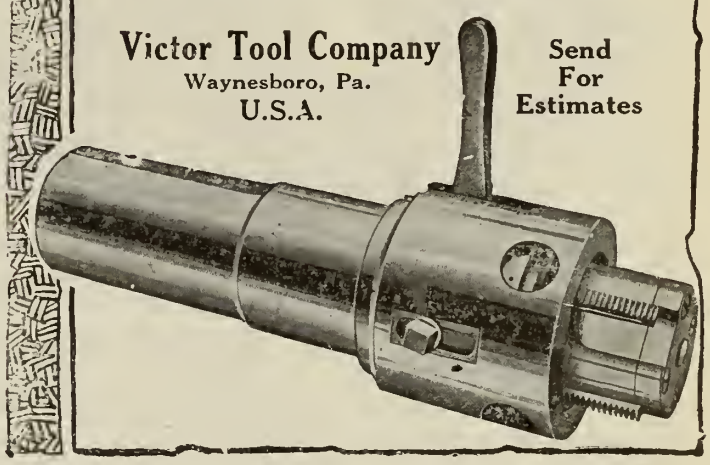

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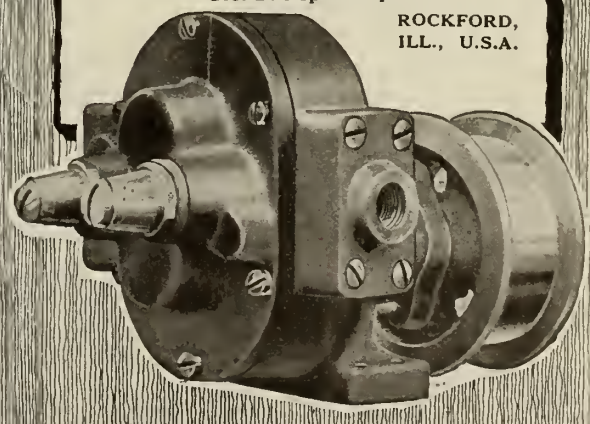
STRAINER ATTACHMENT

We do not recommend a TRAHERN Coolant Pump for pumping iron or steel chips, waste, etc. We recommend that a strainer be used on the bottom of suction pipe, thus permitting only clean coolant (free from foreign matter) to pass through pump and be delivered to the cutting tool.

Manufacturers of so called "clog proof pumps" tell purchasers that, although their pumps are "clog proof" they advise them to use strainers, as chips passing through pumps wear out working parts and also damage cutting tools.

Our Bulletin 44 explains in detail.

TRAHERN PUMP DIVISION
Geo. D. Roper Corp.
ROCKFORD, ILL., U.S.A.



If interested, tear out this page and keep with letters to be answered.

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Williams & Co., J. H., Brooklyn, N.Y.

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Katie Foundry, Galt, Ont.

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Landis Tool Co., Waynesboro, Pa.
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Heald Machine Co., Worcester, Mass.
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Heald Machine Co., Worcester, Mass.
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MacGovern & Co., Montreal, Que.

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Brown & Sharpe Mfg. Co., Providence, R.I
Ford-Smith Machine Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield.
National-Acme Co., Cleveland, Ohio.
Tabor Mfg. Co., Philadelphia, Pa.
Wells Bros. of Canada, Galt, Ont.

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Manhattan Machine & Tool Co., Grand Rapids, Mich.
Modern Tool Co., Erie, Pa.
Norton Co., Worcester, Mass.
Williams Mchy Co, Ltd., A. R., Montre

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Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Norton Co., Worcester, Mass.
Williams Mchy Co., A. R., Toronto, On

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Gardner & Son, Robt., Montreal.
Garvin Machine Co., New York.
Garlock-Walker Machy. Co., Toronto.
Greenfield Machine Co., Greenfield, Mas
Haskins & Co., R. C., Chicago, Ill.
Hall & Sons, John H., Brantford, On
Niles-Bement-Pond Co., New York, N.Y
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Wisconsin Electric Co., Racine, Wis.
Williams Mchy Co., A. R., Toronto, Ont

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Brown & Sharpe Mfg. Co., Providence, R.
Norton Co., Worcester, Mass.

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Atkins & Co., E. C., Hamilton, Ont.
Brantford Emery Wheel Co., Brantford
Can. Fairbanks-Morse Co., Montreal.
Carborundum Co., Niagara Falls, N.Y.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Foss Mchy. & S'ply Co. G. F., Montreal
Norton Co., Worcester, Mass.

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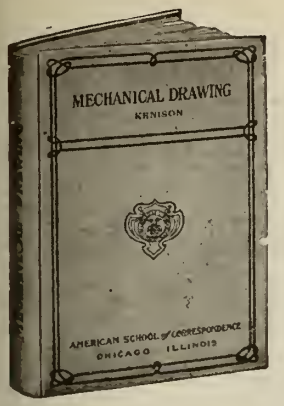

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Chesterman & Co., Jas., Sheffield, Eng.

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Samuel Osborne (Can.), Ltd., Montreal.

METALLURGISTS
See Chemists.

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Atkins & Co., E. C., Hamilton, Ont.
Lyman Tube & Supply Co., Montreal, Que.

METAL SAWS
See Saws.

METAL, ANTI-FRICTION
Thos. Moore & Son, Montreal.

METAL SAWS, POWER
E. C. Atkins & Co., Inc., Indianapolis
Hoefer Mfg. Co., Freeport, Ill.
Lyman Tube & Supply Co., Montreal, Que.

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Canada Metal Co., Toronto, Ont.
Deloro Smelting & Refining Co., Ltd. Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.

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General Combustion Co., Ltd., Montreal, Que.

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Taylor, J. A. M., 318 Stair Bldg., Toronto.
Petrie, Ltd., H. W., Toronto.

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Atkins & Co., E. C., Hamilton, Ont.

MILLS, SAND
Frost Mfg. Co., Chicago, Ill.

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Alexander Fleck, Ltd., Ottawa.
Greenfield Tap & Die Corp., Greenfield
Wells Bros. of Canada, Galt, Ont.

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Bertram & Sons Co., John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence
Canada Machinery Corp., Galt, Ont.
Cincinnati Milling Machine Co., Cincinnati
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal
Garlock-Walker Machy. Co., Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Taft-Peirce Mfg. Co., Woonsocket, R.I.

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Brown & Sharpe Mfg. Co., Providence, R.I.
Betts Machine Co., Rochester, N.Y.
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Standard Equipment & Tool Wks., Montreal, P.Q.

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Butterfield & Co., Inc., Rock Island, Que.
Cleveland Milling Machine Co., Cleveland.
Delore Smelting & Refining Co., Ltd, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Marshall, Son & Bunney, Toronto.
Petrie, Ltd., H. W., Toronto.
Wilt Twist Drill Co., Walkerville, Ont.

MILLING MACHINES, HAND
Bristol Machine Tool Co., Bristol, Conn.

MILLING MACHINES, THREAD
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Inc., Chicago, Ill.
Gray Ball Bearing Co., Ltd., Toronto.
United States Mach. Tool Co., Cincinnati
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Smalley Gen. Co., Inc., Bay City, U.S.A.
Standard Equipment & Tool Wks., Montreal, P.Q.

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Bristol Machine Tool Co., Bristol, Conn.
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Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Knight Metal Products, Toronto.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
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United States Mach. Tool Co., Cincinnati.
Whitney Mfg. Co., Hartford, Conn.
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Canada Machinery Corp., Galt, Ont.
Cleveland Milling Machine Co., Cleveland.
Cincinnati Milling Machine Co., Cincinnati
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
National Machy. Co., Tiffin, Ohio.
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Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Knight Metal Products, Toronto.
Niles-Bement-Pond Co., New York.
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Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Ford-Smith Mach. Co., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn
Kempsmith Mfg. Co., Milwaukee, Wis.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Can Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dominion Bridge Co., Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.

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Can Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
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Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., A. R., Toronto, Ont

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Garlock-Walker Machy. Co., Toronto, Ont.
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Garlock-Walker Machy. Co., Toronto, Ont.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
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Northern Elec. Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
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Volta Mfg. Co., Welland, Ont.
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MOTORCYCLE FRAME AND FORK
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Graton & Knight Mfg. Co., Worcester, M.

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Turner Brass Works, Sycamore, Ill.

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Can. Driver-Harris Co., Ltd., Walkerville.

NICKEL
Pilot Steel & Tool Co., Montreal, Que.

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Brown's Copper and Brass Rolling Mills, New Toronto.

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Hall & Sons, Ltd., John H., Brantford
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NITROGEN
Carter Welding Co., Toronto, Ont.

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NUT FACING AND BOLT SHAVING MACHINES
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National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
Victor Tool Co., Waynesboro, Pa.

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Garvin Machine Co., New York.
Hall & Son, J. H., Brantford, Ont.
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Landis Machine Co., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
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Wells Bros. of Canada, Galt, Ont.

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Cleveland Pneumatic Tool Co. of Canada, Toronto

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Brantford Oven & Rack Co., Brantford.

OVEN TRUCKS, STEEL
Brantford Oven & Rack Co., Brantford.
MacKinnon Steel Co., Sherbrooke, Que.

OVENS FOR DRYING, TEMPERING AND OXYGEN, ELECTROLYTIC CELLS UNDER TRUCKS
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L'Air Liquide Society, Toronto, Ont.
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Davis-Bournonville Co., Toronto, Ont.

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Dominion Oxygen Co., Ltd., Toronto, Ont.
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MacKinnon Steel Co., Sherbrooke, Que.

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Oliver Machy. Co., Grand Rapids, Mich.
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See Lathes.

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Clipper Belt Lacer Co., Grand Rapids.

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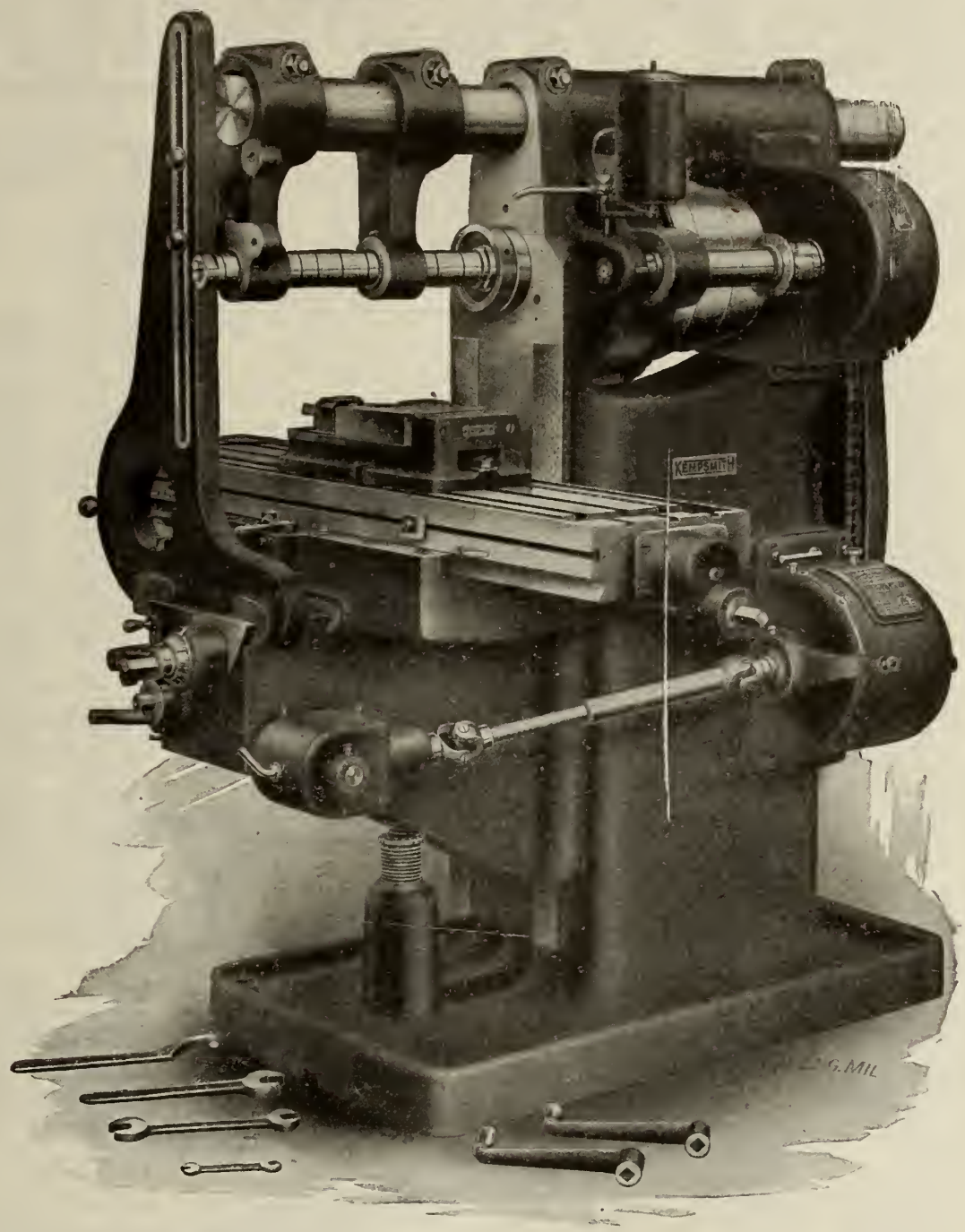

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Garlock-Walker Machinery Co., Toronto.
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Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal

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Bliss Co., E. W., Brooklyn, N.Y.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.

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Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
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Positive Clutch & Pulley Works Ltd., Toronto.
Petrie, Ltd., H. W., Toronto.

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American Pulley Co., Philadelphia, Pa.

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Baird Machine Co., Bridgeport, Conn.
Bernard Industrial Co., A., Fortierville, Q
Can. Link-Belt Co., Toronto, Ont.
Carlyle Johnson Mch. Co., Manchester, Ct.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
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Morse Twist Drill & Mach. Co., New Bedford, Mass.
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Wilt Twist Drill Co., Walkerville, Ont.

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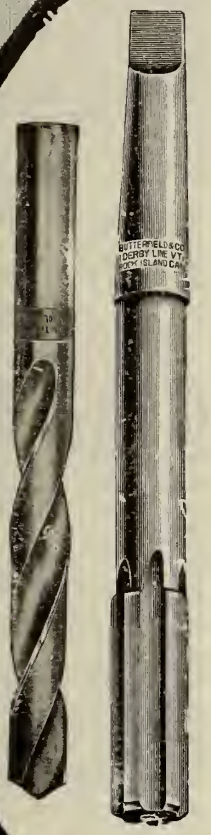

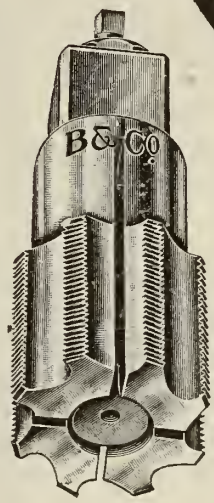

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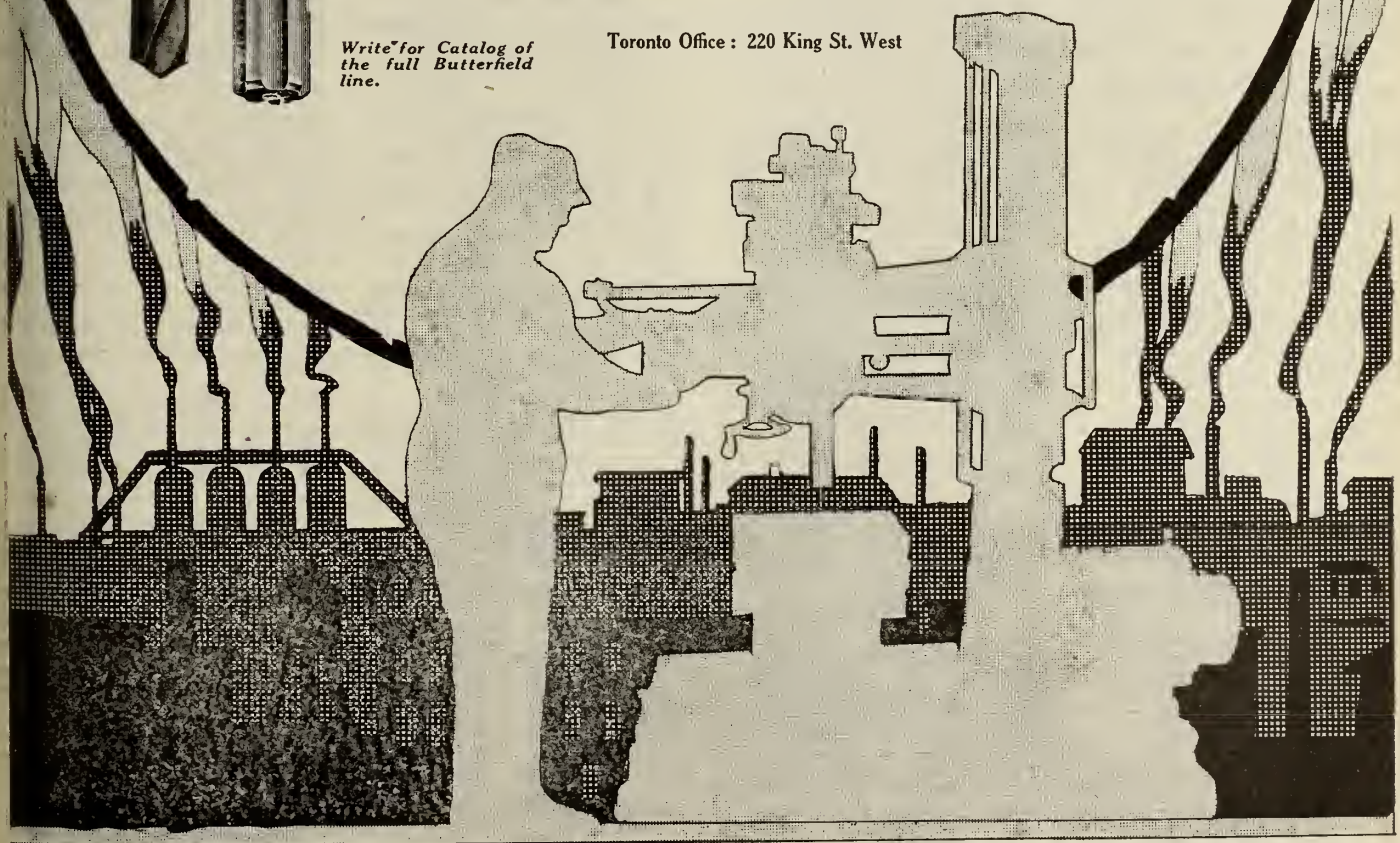

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Aikenhead Hardware Co., Toronto, Ont.
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Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram, John, & Sons Co., Dundas.
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada
Brown Engineering Corp., Toronto, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
Globe Engineering Co., Ltd., Hamilton.
John H. Hall & Sons, Brantford.
Hamilton Co., Ltd., Wm., Peterborough,
A. B. Jardine & Co., Hespeler, Ont.
Katie Foundry, Galt, Ont.
Ker & Goodwin Machine Co., Ltd., Brantford, Ont.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
National-Acme Co., Cleveland, Ohio.
Mesta Machine Co., Pittsburgh, Pa.
Rae Mach. Tool Co., Hamilton.
Stoll Co., D. H., Buffalo, N.Y.
Victoria Foundry Co., Ottawa, Ont.
William R. Perrin, Ltd., Toronto.

SPECIAL TOOLS, MACHINERY
Crescent Machine Co., Ltd., Montreal, Que.
McClean Machine & Tool Co., Ltd., Hamilton, Ont.
Hoggson & Pettis Mfg. Co., New Haven Conn.

SPOT FACERS, INTERCHANGEABLE
Eclipse Counterbore Co., Ltd., Walkerville, Ont.

SPRING COILING AND WINDING MACHINERY
Baird Machine Co., Bridgeport, Conn.
Garvin Machine Co., New York.

SPRING MAKING MACHINERY (AUTOMATIC)
Baird Machine Co., Bridgeport, Conn.

SPRINGS, SPIRAL, TOOL
The Dunbar Bros. Co., Bristol, Conn.

SPRINGS STEEL
Barnes Co., Wallace, Bristol, Conn.

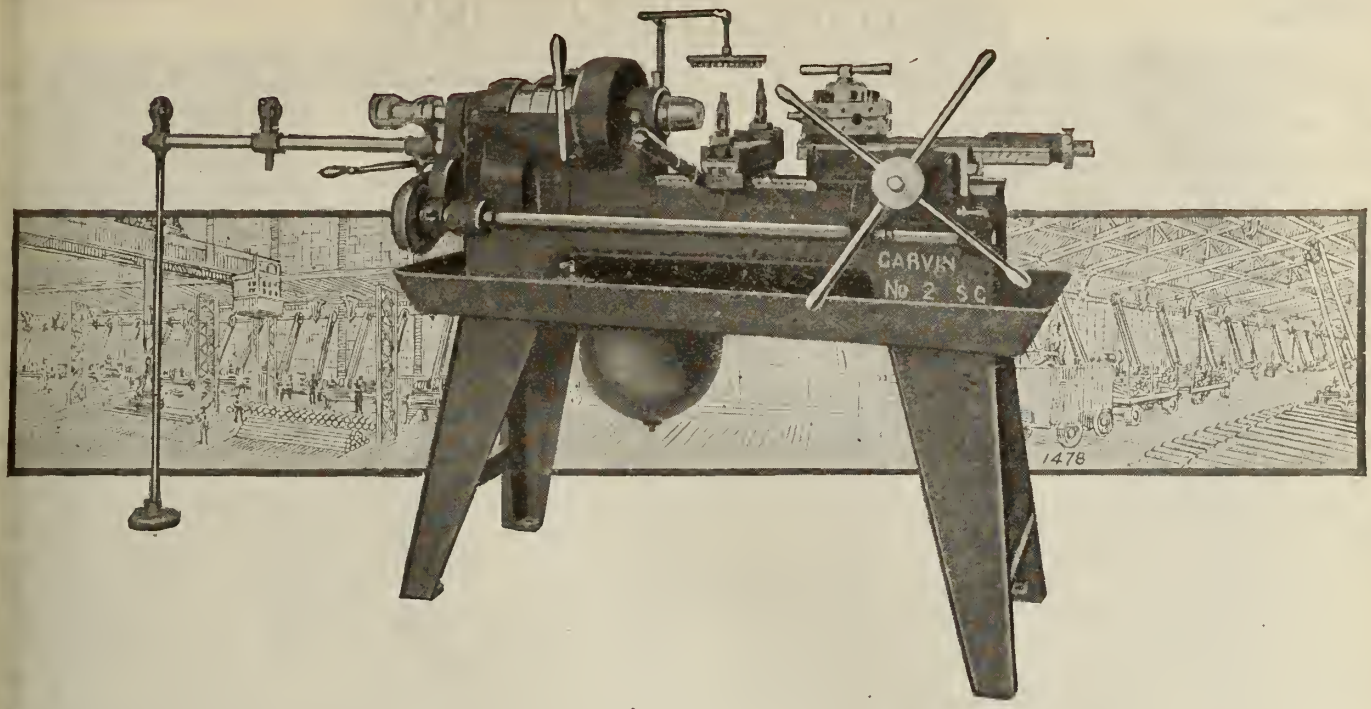
SPROCKETS, COMPENSATING
Morse Chain Co., Ithaca, New York.

SPROCKETS, SPRING
Morse Chain Co., Ithaca, New York.

SPROCKETS, CHAIN
Can Link-Belt Co., Toronto, Ont.
Grant Gear Works, Boston, Mass.
Jones & Glasseo, Montreal.
Lyman Tube & Supply Co., Montreal, Que
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia

SPRINGS FOR TOYS AND ELECTRIC DEVICES
The Dunbar Bros. Co., Bristol, Conn.

SPROCKET WHEELS, CAST
Can. Link Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Ltd., Montreal



Garvin Screw Machines

belong in the machine Shop where workmanship counts

There are superiorities built into Garvin Screw Machines that give them sustained accuracy throughout a long life. The turret rotating mechanism, for instance, has a reputation for rigidity without cumbersomeness. The turret rotator is of one solid piece—nothing to jar loose. Turret momentum is topped by a solid plug, the lock being used for indexing only.

The whole machine is designed to the same standard of better building. Cross slides made so that they can be lifted direct from the bed. Fitted with plug stops to give fine adjustment. Spindle of extra large diameter so made as to permit realignment under all conditions of wear.

These are but few of the many features which, coupled with the assurance of high-grade manufacture, justify your preference for Garvin Machines.

Let the Garvin Catalog tell the story in full detail. Its 340 pages are full of valuable information.

Ask your dealer or address

The Garvin Machine Company, Spring and Varick Sts., New York, N.Y. U.S.A.

GARVIN

BUILDER OF BETTER MACHINE TOOLS C—38

If interested, tear out this page and keep with letters to be answered.

SAFETY CYLINDERS
Oliver Mach. Co., Grand Rapids, Mich.

SANDERS
Oliver Mach. Co., Grand Rapids, Mich.

SAW BENCHES
Oliver Mach. Co., Grand Rapids, Mich.

SAW GUARDS
Oliver Mach. Co., Grand Rapids, Mich.

SAWS SWING
Oliver Mach. Co., Grand Rapids, Mich.

STAYBOLT TOPS
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

STAIRS, IRON
Canada Wire & Iron Goods Co., Hamilton, Ont.

STAMPINGS, SHEET BRASS, COPPER, ALUMINUM AND STEEL
Dom. Forge & Stamping Co., Walkerville
Globe Engineering Co., Hamilton, Ont.
Homer & Wilson, Hamilton, Ont.

STAMPING MACHINERY
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs, & Co., Hamilton, Can.
Canada Machinery Corp., Galt, Ont.
Matthews, Jas. H & Co., Hartford, Conn.

SAFETY CYLINDERS
Oliver Mach. Co., Grand Rapids, Mich.

STEAM APPLIANCES
Darling Bros., Ltd., Montreal, Quebec.

STEAM SEPARATORS AND TRAPS
Can. Fairbanks-Morse Co., Montreal.

STEAM HOISTING ENGINES
Canadian Mead-Morrison Co., Limited, Montreal, Que.

STEAM TURBINES
General Combustion Co., Ltd., Montreal, Que.
Sturtevant Co., B. F., Galt, Ont.

STEEL BALLS
See Balls Steel.

STEEL, CRUCIBLE TOOL
Atkins & Co., Ltd., Wm. Sheffield, Eng.
Baines & David, Toronto.
Illingworth Steel Co., John, New York.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.

STEEL, CARBON, FERRO-TUNGSTEN
Armstrong, Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Baines & David, Toronto.
Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Latrobe Electric Steel Co., Latrobe, Pa.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
Marshall, Son & Bunney, Toronto.
Peckovers, Ltd., Toronto, Ont.
Samuel Osborne (Can.), Ltd., Montreal.
Canadian-Alloys Steel Co., Pittsburgh.

STEEL, CHROME MOLYBDENUM
United States Steel Corp., Canton, Ohio.

STEEL CHROME VANADIUM
Kayser-Ellison & Co., Ltd., Montreal.
Norton, Ralph B., Agent, Montreal.
Atkins & Co., Ltd., Wm. Sheffield, Eng.
Marshall, Son & Bunney, Toronto.
United States Steel Corp., Canton, Ohio.

STEEL CHROME NICKEL
Firth & Sons, Ltd., Thos., Montreal,
Kayser-Ellison & Co., Ltd., Montreal
Lyman Tube & Supply Co., Ltd., Montrea
Norton, Ralph B., Agent, Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.
United States Steel Corp., Canton, Ohio.

STEEL CASTINGS
Can. Elec. Steel Casting Co., Aurora, Ont.
Davidson Mfg. Co., Ltd., Montreal, Que.
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Dom. Iron & Steel, Sydney, N.S.
Jollette Steel Co., Montreal, Que.
Kennedy & Sons, Wm., Owen Sound
Electric Steel & Metals Co., Welland.
Nova Scotia Steel & Coal Co., Windsor
Swedish Crucible Steel Co., Windsor.

STEEL, COLD DRAWN
United States Steel Corp., Canton, Ohio.

STEEL, COLD ROLLED
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Drawn Steel Co., Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co. Ltd., Montreal.
Union Drawn Steel Co., Hamilton, Ont.

STEEL, ELECTRIC FURNACE
United States Steel Corp., Canton, Ohio.

STEEL FJAB
Lincoln Electric Co., of Canada, Ltd., Toronto, Ont.

STEEL, NICKEL
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
United States Steel Corp., Canton, Ohio.

STEEL, HIGH SPEED
Armstrong-Whitworth of Can., Montreal
Baines & David, Toronto.
Wm. Atkins & Co., Sheffield, Eng.
Can. Fairbanks-Morse Co., Montreal
Deloro Smelting & Refining Co., Ltd. Toronto, Ont.
H. A. Drury Co., Ltd., Montreal.
Firth & Sons, Thos., Montreal, Que.
Illingworth Steel Co., J., New York.
Kayser Ellison & Co., Sheffield, Eng.
Latrobe Electric Steel Co., Latrobe, Pa.
Marshall, Son & Bunney, Toronto, Ont.
Osborne, Samuel, Montreal, P.Q.
Plewes, Ltd, Winnipeg, Man.
Pilot Steel & Tool Co., Montreal, Que.
Ralph R. Norton, Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co., Ltd., Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL, CHROME, MANGANESE
Jollette Steel Co., Montreal, Que.

STEEL, OPEN HEARTH
Illingworth Steel Co., John, New York
United States Steel Corp., Canton, Ohio.

STEEL PLATES
Dominion Foundries & Steel Ltd., Hamilton, Ont.

STEEL PRODUCTS AND MACHINERY
Dom. Steel Products Co., Ltd., Brantford

STEEL, ROCK DRILL
Armstrong, Whitworth of Canada, Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Lincoln Electric Co. of Canada, Ltd Toronto, Ont.

STEEL, SPECIAL ANALYSIS
United States Steel Corp., Canton, Ohio.

STEEL, SPRING AND REINFORCING
Peckovers, Ltd., Toronto, Ont.
United States Steel Corp., Canton, Ohio.

STEEL, STRUCTURAL
Algoma Steel Corp., Sault Ste. Marie
Dom. Iron & Steel Co., Sydney, N.S.
MacKinnon Steel Co., Sherbrooke, Que.
Peckovers, Ltd., Toronto, Ont.

STEEL, TOOL
Armstrong, Whitworth of Can., Montreal
Atkins & Co., Wm., Sheffield, Eng.
Baines & David, Toronto.
Can. Fairbanks-Morse Co., Montreal.
Drury Co., H. A., Montreal, Que.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.
Firth & Sons, Thos., Montreal, Que.
Hawkridge Bros. Co., Boston, Mass.
Kayser-Ellison & Co., Ltd., Montreal.
Lincoln Electric Co., of Canada, Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Ltd., Montreal
Marshall, Son & Bunney, Toronto, Ont.
Latrobe Electric Steel Co., Latrobe, Pa.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son Toronto, Ont.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL TUBING
Tube Co. of Canada, Ltd,, Toronto, Ont.

STEEL, VANADIUM
Wm. Atkins & Co., Ltd., Sheffield, Eng.
Armstrong, Whitworth of Can., Montreal.
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Drury, H. A., Co., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.
Wells Bros. of Can., Galt, Ont.

"STELLITE"
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.

STOCK RACKS FOR BARS, PIPING, ETC.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

STOCKS AND DIES
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros., of Can., Galt, Ont.

STOCKS, PIPE
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Wells Bros., Co., of Canada, Galt, Ont.

STONES, COMMUTATORS
Lyman Tube & Supply Co., Ltd., Montreal

STRAIGHTENING MACHINERY
Baird Machinery Co., Bridgeport, Conn.
Bertrams, Ltd., Edinburgh, Scotland.

STRAND
Dom. Steel Products Co., Ltd., Brantford.
Page Steel & Wire Co., Adrian, Mich.

SURFACE PLATES
Brown & Sharpe Mfg. Co., Providence, R.I.

STRUCTURAL STEEL WORKS
William Hamilton Co., Peterboro, Ont.

SWITCHBOARDS
Northern Electric Co., Ltd., Montreal Que

SWITCHES, RAILWAY
Can. Steel Foundries, Ltd., Montreal.

TABLES, DRAWING
Economy Drawing Table Co., Adrian, Mich.

TABLES, SAND-BLAST
Pangborn Corporation, Hagerstown, Md.

TAPPING MACHINES (PNEUMATIC)
Cleveland Pneumatic Tool Co., Toronto.

TANKS, AIR, EXPANSION
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, GASOLINE, KEROSENE AND OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. John Wood Mfg. Co., Ltd., Toronto
Dominion Bridge Co., Montreal, Que.
Dom. Forge & Stamping Co., Walkerville.
MacKinnon Steel Co., Sherbrooke, Que.
Marshall, Son & Bunney, Toronto.

TANKS, LEAD LINED
Can. Hanson Van Winkle Co., Ltd.,

TANKS, LUBRICATING, OIL STORAGE
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, PNEUMATIC AND CLOSET
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, RUBBER CEMENT
Bowser Co., Ltd., S. F., Toronto, Ont.

TANKS, STEEL, WATER PRESSURE
Bowser Co., Ltd., S. F., Toronto, Ont.
Dominion Bridge Co., Montreal, Quebec.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Toronto Iron Works, Ltd, Toronto.

TANK WAGONS
MacKinnon Steel Co., Sherbrooke, Que.
Toronto Iron Works, Ltd., Toronto.

TANKS, WELDED
Can. John Wood Mfg. Co., Ltd., Toronto
Can. Hanson Van Winkle Co., Ltd.,
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.

TANKS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
William Hamilton Co., Peterboro, Ont.

TAPER PINS
Galt Machine Screw Co., Ltd., Galt, Ont.

TAPES, MEASURING
James Chesterman & Co., Ltd., Sheffield, Eng.
Rice Lewis & Son, Toronto, Ont.

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Bertram, John & Sons Co., Dundas.
Canada Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garvin Machine Co., New York.
The Geometric Tool Co., New Haven.
J. H. Hall & Sons, Brantford, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Niles-Bement-Pond Co., New York.
Rickert-Shafer Co., Erie, Pa.
National-Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto.
L. S. Starrett Co., Athol, Mass.
Whitney Mfg. Co., Hartford, Conn.

TAPS, ADJUSTABLE
Butterfield & Co., Rock Island, Que.
Geometric Tool Co., New Haven.
Ingersoll Mach. Co., Ingersoll, Ont.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Pilot Steel & Tool Co., Montreal, Que.
Victor Tool Co., Waynesboro, Pa.

TAPS, GUN, HAND, BOILER
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, MACHINE RELIEVED
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can. Galt, Ont.

TAPS, MACHINE SCREW
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, PIPE
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Mach. Co., Ingersoll, Ont.
Marshall, Son & Bunney, Toronto.
Wells Bros. of Can., Galt, Ont.

TAPS, SPECIAL
Elliott & Whitehall, Galt, Ont.

TAPS, STAYBOLT, TAPPER
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

TAPS, DIES AND WRENCHES
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Foss Mchy. & Sply. Co., G. F., Montreal.
Geometric Tool Co., New Haven.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Mach. Co., Ingersoll, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Morse Twist Drill & Mchy. Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Rice Lewis & Son, Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Taylor, J. A. M., 318 Stair Bldg., Toronto.
Wells Bros. of Canada, Galt, Ont.

TAP EXTRACTORS
Walton Co., The, Hartford, Conn.

THERMOMETERS, INDUSTRIAL ENGRAVED TEMPERATURE AND PRESSURE
Taylor Instrument Co., Rochester, N.Y.

THERMOMETERS, RECORDING AND INDEX
Bristol Co., Waterbury, Conn., U.S.A.
Taylor Instrument Co., Rochester, N.Y.

TESTING INSTRUMENTS, METALLURGICAL
Shore Instrument & Mfg. Co., New York.

TENOVERS
Oliver Machy. Co., Grand Rapids, Mich.

TESTING LABORATORIES
Toronto Testing Laboratory, Toronto.

THREAD-CUTTING MACHINES
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Mach. Co., Ltd., Toronto
Geometric Tool Co., New Haven.
Jardine & Co., Ltd., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National-Acme Co., Cleveland, Ohio.
National Machy. Co., Tiffin, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt, Ont.

THREADING TOOLS
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Landis Machine Co., Waynesboro, Pa.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. of Canada, Galt, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

THREADING MACHINES FOR BOLTS, NUTS AND PIPES
Greenfield Tap & Die Corp., Greenfield
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt, Ont.

THREAD MILLING MACHINES
Taft-Pierce Mfg. Co., New York, N.Y.
Smalley-General Co., Bay City, Mich.

THUMB SCREWS AND NUTS
See Screws.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.

TIN—PIG AND BAR
British Smelting & Refining Co., Ltd. Montreal, Que.

TINSMITHS' TOOLS
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Petrie, Ltd., H. W., Toronto.

TIRE BENDERS
Jardine & Co., Ltd., A. B., Hespeler.

TIRE SETTING MACHINES, HYDRAULIC
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Perrin, Ltd., William R., Toronto.
West Tire Setter Co., Rochester, N.Y.

TOOL CASES
Rice Lewis & Son, Toronto, Ont.

TOOL HOLDERS
Aikenhead Hardware Co., Toronto, Ont.
Armstrong Bros. Tool Co., Chicago.
Cleveland Twist Drill Co., Cleveland.
Deloro Smelting & Refining Co. Ltd Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

TOOL MAKERS
Samuel Osborne (Can.), Ltd., Montreal

TOOL POSTS, LATHE
Armstrong Bros. Tool Co., Chicago.
Williams & Co., J. H., Brooklyn, N.Y.

TOOL ROOM PARTITIONS
Canada Wire & Iron Goods Co., Hamilton

TOOLS, BLACKSMITHS'
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son Toronto, Ont.

TOOLS, ADJUSTABLE BORING
Kelly Reamer Co., Cleveland, O.
Petrie, Ltd., H. W., Toronto.

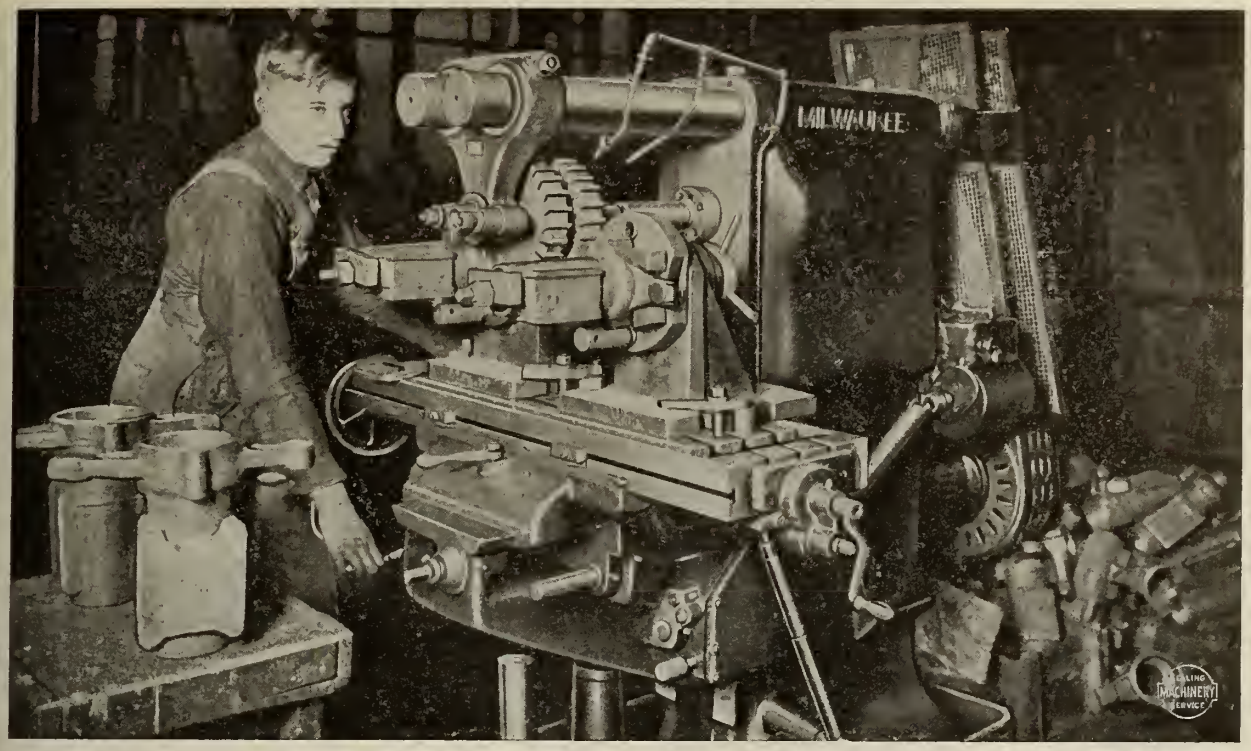
TOOLS, ELECTRIC
Independent Pneumatic Tool Co., Chicago
Williams Machy. Co., A. R., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.
U. S. Electrical Tool Co., Cincinnati.

TOOLS, FORMING
Davidson Tool Mfg. Co., New York, N.
Deloro Smelting & Refining Co., L Toronto, Ont.

TOOLS, LUMBERING
Thos. Pink & Co., Pembroke, Ont.

TOOLS, LATHE, PLANER, SLOTTER
Armstrong Bros. Tool Co., Chicago.
Gisholt Machine Co., Madison, Wis.
Williams & Co., J. H., Brooklyn, N.Y.

TOOLS, SCREW MACHINE
Foster Machine Tool Co., Elkhart, Ind.



Milwaukee Milling Machines

The straddle milling of "spider" arms is illustrated above. The work is held in indexing fixtures and the table is fed upward towards the cutters. No table travel is used. The castings are made of malleable iron and about 1/16 in. of stock is removed from the face of each arm.

The pieces are held at a considerable distance from the top of the table and the work is done efficiently, due to the double overarm and solid top knee with extended bearing.

Milwaukee Milling Machines possess many features of merit that not only contribute towards exceptional accuracy, rigidity and durability, but also minimize supervision and upkeep, and provide for ease of operation. Simplicity—stands out preeminently. Following are some noteworthy features: Constant speed drive; box section column; solid top; box section knee; double overarm; flanged spindle; automatic flooded lubrication of all gears and bearings in the column, feed box and pulley bracket; automatic cutter lubrication.

Write for catalog.

KEARNEY & TRECKER CO. MILWAUKEE, WIS. U.S.A.

If interested, tear out this page and keep with letters to be answered.

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Crescent Machine Co., Ltd., Montreal, Que.
McClean Machine & Tool Co., Ltd., Hamilton, Ont.
McCrosky Tool Corp., Meadville, Pa., U. S. A.

TORCHES, BLOW
Int. Mach. & Supply Co., Ltd., Montreal.

TORCHES, GASOLINE, KEROSENE AND ALCOHOL
Turner Brass Works, Sycamore, Ill.

TORCHES, STEEL
Armstrong, Whitworth of Can., Montreal.
Prest-O-Lite Co., Inc., Toronto, Ont.

TRACK SYSTEMS
Brown Hoisting Machinery Co., Cleveland, Ohio.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.

TRAM RAIL SYSTEMS (Overhead)
Brown Hoisting Machinery Co., Cleveland, Ohio.

TRAMWAYS, BRIDGE
Brown Hoisting Machinery Co., Cleveland, Ohio.

TRANSFORMERS
Can. General Electric Co., Toronto, Ont
MacGovern & Co., Montreal, Que.
Northern Electric Co., Ltd., Montreal.

TRANSITS
Hughes, Owens Co., Ltd., Montreal, Que.

TRANSMISSION CHAIN
Lyman Tube & Supply Co., Ltd., Montreal
Morris Chain Co., Ithaca, New York.

TRANSMISSION MACHINERY
American Pulley Co., Philadelphia, Pa.
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Coventry Chain Co., Coventry, England.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Hamilton Gear & Machine Co., Toronto.
Jones & Glassco, Montreal.
Kennedy & Sons, Wm., Owen Sound, Ont.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Machinery Co., A. R., Toronto.

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Jones & Glassco, Montreal, Que.
MacKinnon Steel Co., Ltd., Sherbrooke.

TRANSMISSION TOWERS
Curtis Pneumatic Machy. Co., St. Louis.
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Northern Crane Works, Walkerville.
Tallman Brass & Metal Co., Hamilton.

TROLLEYS
Brown Hoisting Machinery Co., Cleveland, Ohio.
Lyman Tube & Supply Co., Ltd., Montreal
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

TRUCKS, FACTORY, FREIGHT, ETC
Canada Machinery Corp., Galt, Ont.
Chapman Double Ball Bearing, Toronto.
Cowan Truck Co., Holyoke, Mass.
Holyoke Truck Co., Holyoke, Mass.
MacKinnon Steel Co., Sherbrooke, Que.
Rice Lewis & Son, Toronto, Ont.

TRUCKS, ELECTRIC
Cowan Truck Co., Holyoke, Mass.
Good Engineering Co., Toronto, Ont.

TRUCKS, FLOOR
Cowan Truck Co., Holyoke, Mass.
Holyoke Truck Co., Holyoke, Mass.

TRUCKS, HAND
Can. Kron Scale Co., Montreal, P.Q.
Cowan Truck Co., Holyoke, Mass.

TRUCKS, LUMBER AND KILN
Holyoke Truck Co., Holyoke, Mass.
Swedish Steel & Importing Co., Montreal
Northern Crane Works, Walkerville.

TRUCKS, LIFT, ELEVATING & TRANSFER
Cowan Truck Co., Holyoke, Mass.
Holyoke Truck Co., Holyoke, Mass.

TUBES, BOILER
Lyman Tube & Supply Co., Montreal, Que.

TUBING ELECTRIC WELDED OR OXYACETYLENE WELDED
Tube Co. of Can., Ltd., Toronto, Ont.

TUBE PROUCTS
Tube Co. of Can., Ltd., Toronto, Ont.

TUBING, SEAMLESS, BRASS AND COPPER
Lyman Tube & Supply Co., Montreal, Que.
Standard Tube & Fence Co., Woodstock.
Tallman Brass & Metal Co., Hamilton.

TUBING, FLEXIBLE METALLIC
Lyman Tube & Supply Co., Montreal, Que.

TUBING, SEAMLESS STEEL
Tube Co. of Can., Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.

TUBING, WELDED STEEL
Lyman Tube & Supply Co., Montreal, Que.
Tube Co. of Can., Ltd., Toronto, Ont.

TURRET MACHINES, LATHES
Acme Mach. Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence.
Garlock-Walker Machinery Co., Toronto.
Greenfield Tap & Die Corp., Greenfield.
Hardinge Bros., Chicago, Ill.
Oliver Mchy. Co., Grand Rapids, Mich.
Pratt & Whitney, Hartford, Conn.
Petrie, Ltd., H. W., Toronto.
Steinle Turret Mach. Co., Madison, Wis
Warner & Swasey Co., The, Cleveland, O

TURBO GENERATOR UNITS
MacGovern & Co., Montreal, Que.
Warner & Swasey, Cleveland, O.
Garvin Machine Co., New York.

TURNBUCKLES
Canada Fdrs. & Forg. Ltd., Welland.
. Morrow Screw & Nut Co., Ingersoll, Ont.
Rice Lewis & Son, Toronto, Ont.

TURNTABLES
Can. Link-Belt Co., Toronto, Ont.
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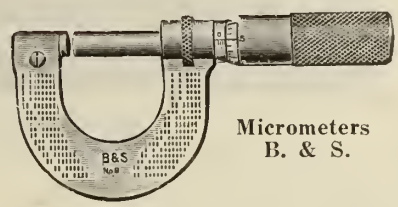

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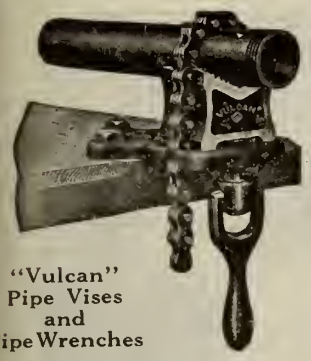
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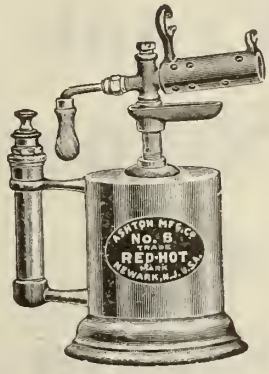

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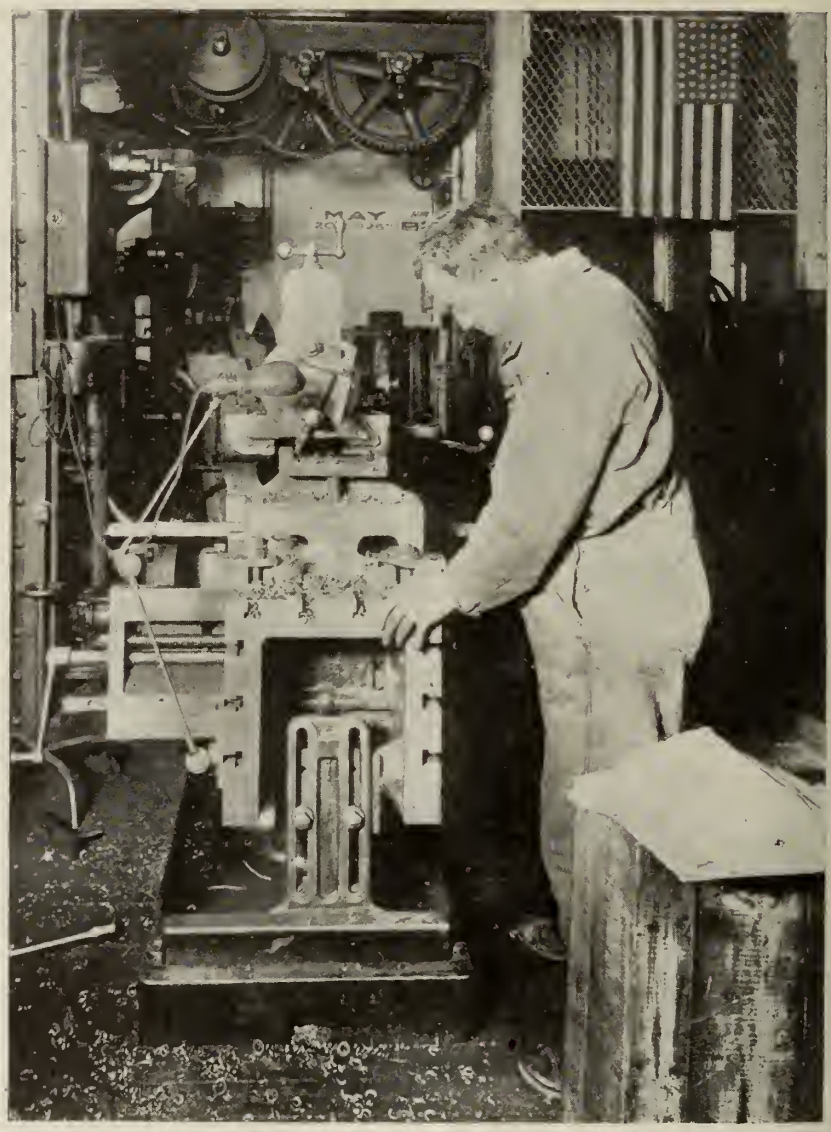

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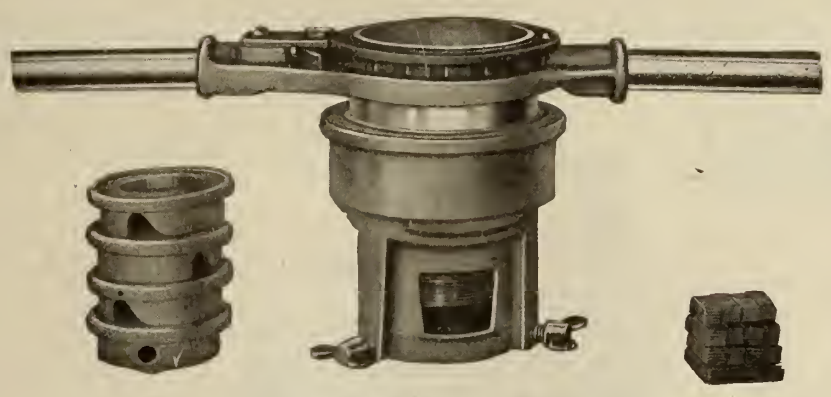

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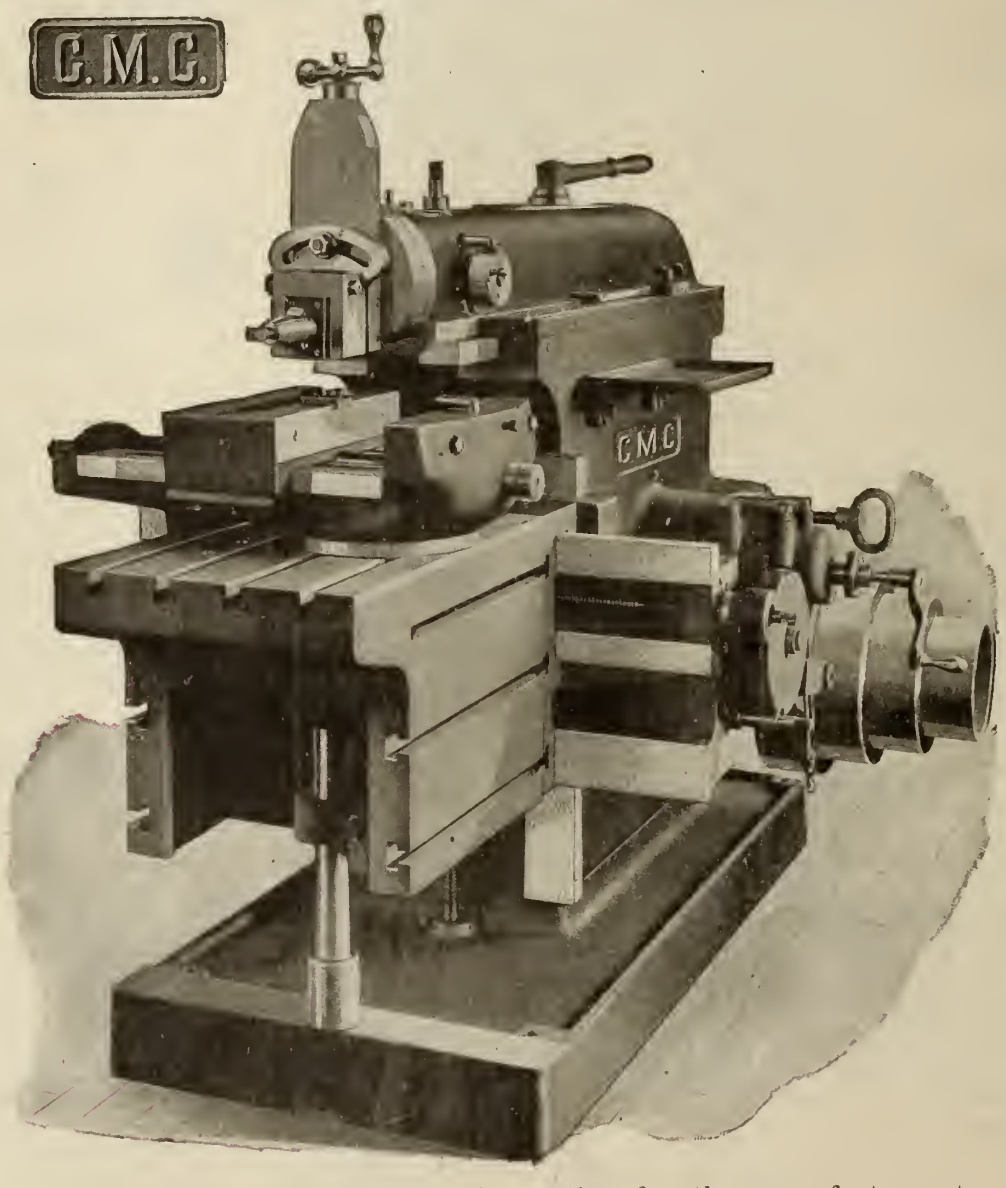

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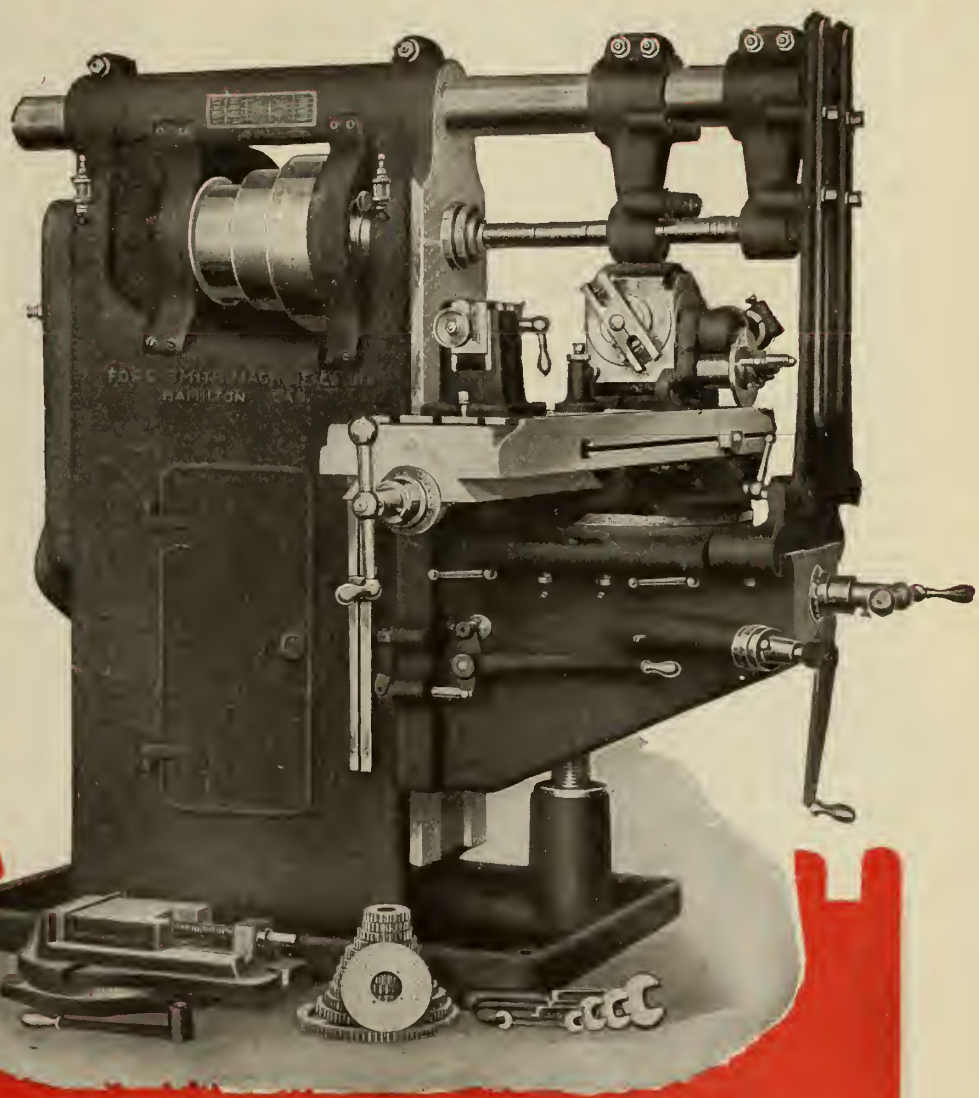
Machine Tools of Quality— Canadian Made



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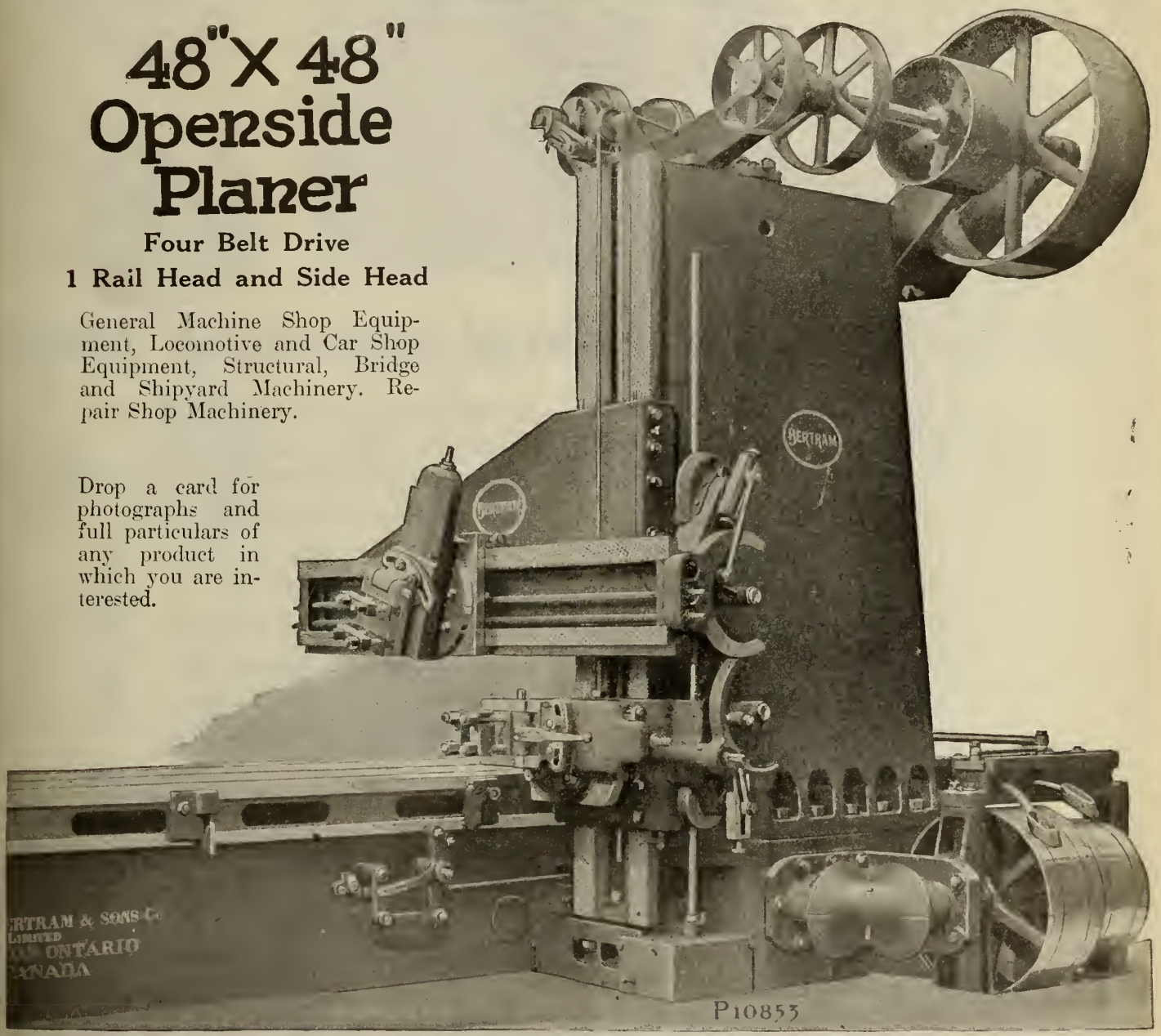

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Standard in a prominent automobile plant

"MY requisitions for drills read 'Little Giants' exclusively. Our piece workers like them better than other pneumatic tools, because they find they can push them harder, and thus increase their earnings."

This from the foreman of assembly in a prominent automobile plant. Little Giant Air Drills won here entirely on their merits. They proved their superiority by comparison over two years ago, and have been *standard* ever since.

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P-39-H

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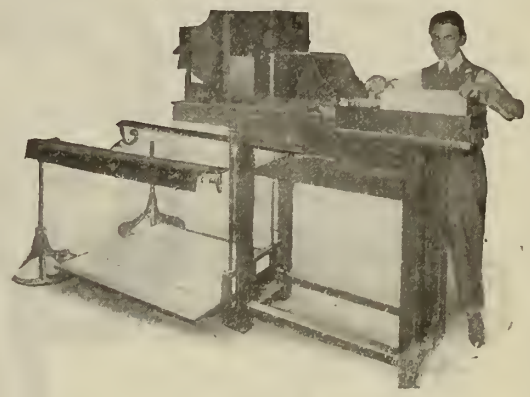

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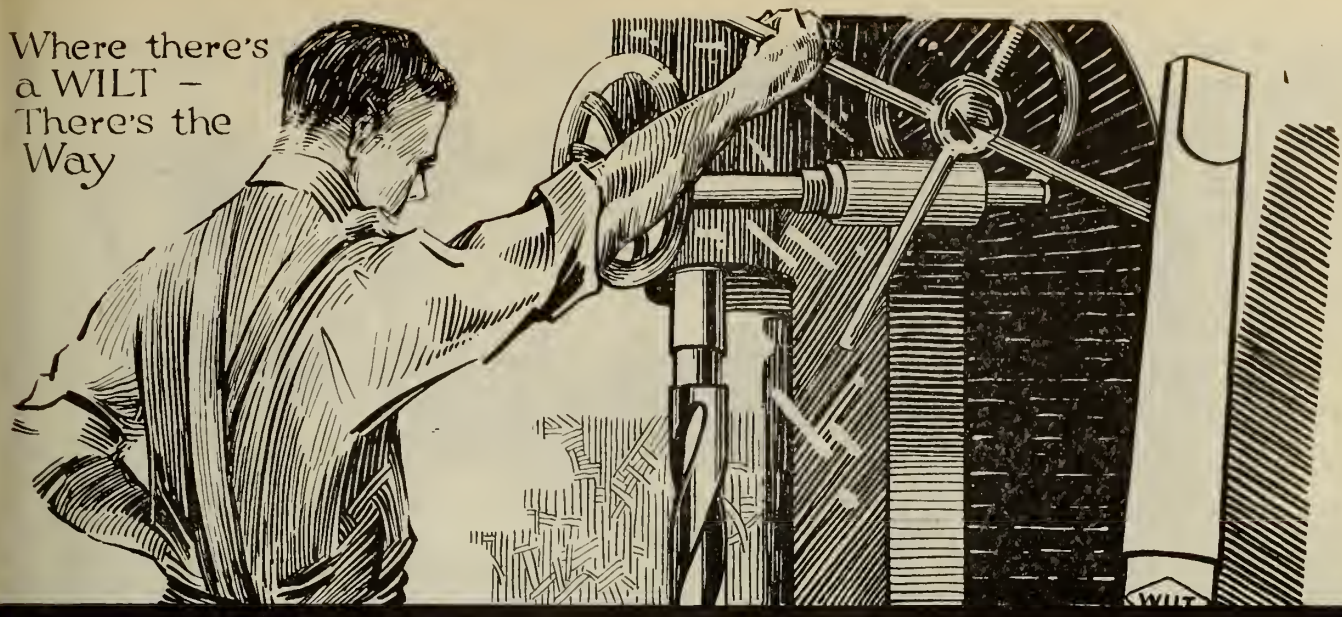
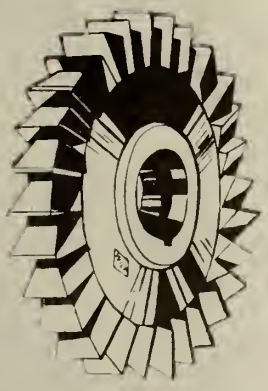


WILT HIGH SPEED & CARBON TWIST DRILLS, REAMERS & MILLING CUTTERS

Canadian manufacturers must be up and doing! Big production is Canada's big need. Every manufacturing firm must do its level best. Tools of ordinary quality won't do, and this applies to Drills, Reamers and Milling Cutters as well as all other tools.

Many of Canada's largest manufacturing plants learned during the strenuous days of the war that their Drilling, Reaming and Milling operations reached the highest point of efficiency and production when they were using WILT Drills, Reamers and Milling Cutters



The excellent reputation for quality and productive ability conceded to WILT products by manufacturers during the war is not only being adhered to but every effort is being made to further improve them by the use of the most modern and scientific methods available.

For big production put your faith in tools of the highest quality—use WILT High Speed and Carbon Drills, Reamers and Milling Cutters.

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Railway shops being the first to use pneumatic tools are probably more familiar with them than any other class of users and consequently demand, and use, the best to be had.

The simplicity, sturdiness and power of Little David Air Tools has won a place for them in over 250 railroad shops alone. The operations illustrated here, as any railroad man will tell you, require a tool with power and stamina and Little David is the tool chosen.

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In addition, they are **fully** automatic.

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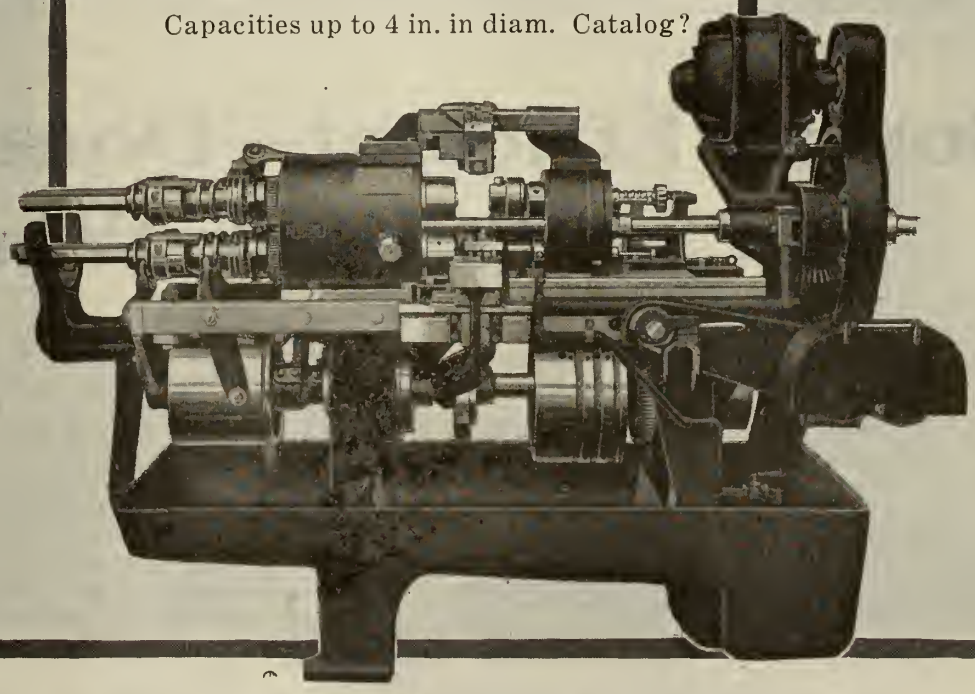

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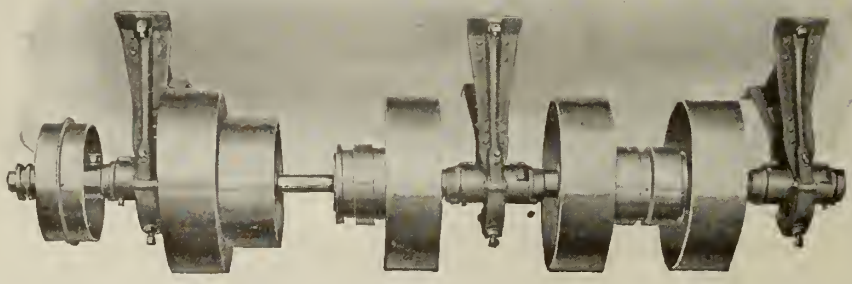

Put Johnson Clutches on Your Countershafts

Here's a countershaft equipped with three Johnson Clutches — two of the single type and one of the double — providing two speeds, a reverse, and a light auxiliary drice. An exceptionally neat and compact construction is obtained, light in weight and smooth-running.

Wherever really high-grade equipment is desired Johnson Clutches are the selection. For general transmission purposes there is no clutch more reliable, and none so adaptable to all conditions. Johnson Clutches in special types have also been incorporated successfully in machinery of all kinds. Their exceptional fitness for this line of work is described in our booklet, "Clutches as Applied to Machine Building."

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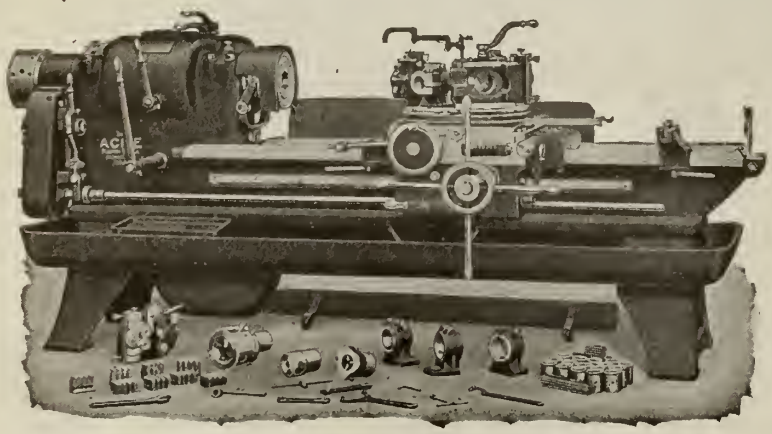
This Cincinnati Acme Flat Turret Lathe is a double-production, geared head machine of the sliding gear type. It operates on minimum power because the only gears running are those doing the actual work.

This machine saves remarkable time and labor machining either bar work or chuck work up to 16 in. diameter.



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Head is cast solid with the bed. You know what that means: accuracy, rigidity, constant and perfect alignment of spindle with vees, upon which the turret carriage travels.

We also make a full line of Screw Machines and Turret Lathes.

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EASTERN UNIVERSAL HYDRAULIC PRESS. Supplied in 20-35 and 50 ton capacities, full hydraulic depending on no springs or weight for return of ram, delivering pressure instantly at a speed of 1½ in. per second return of ram 3 in. per second.

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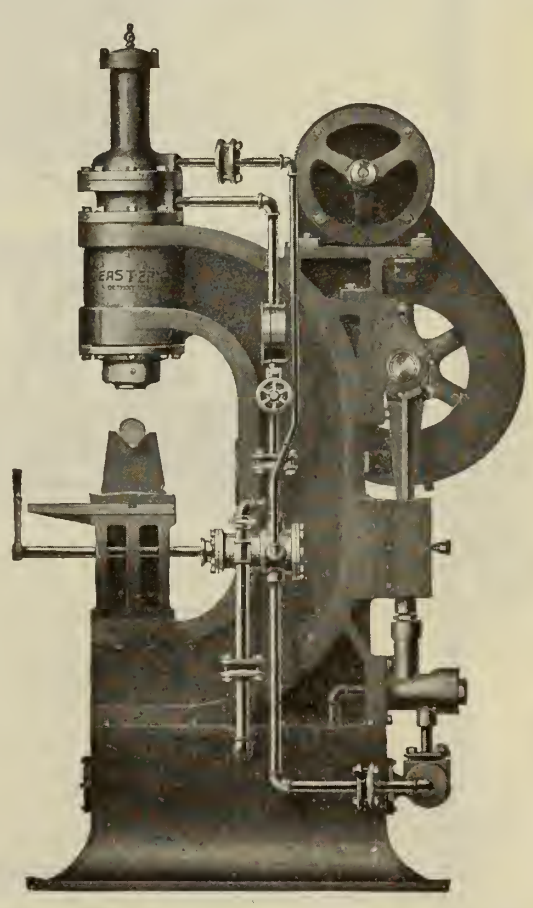
EASTERN UNIVERSAL PRESSES are tested before leaving our plant at 33 1/3% overload. They are furnished with rolling centres and are unexcelled for straightening of motor crank-shafts, heavy wheel shafts, broaching splines in drive plate, differential gears, and others. Straightening front axles and spindles.



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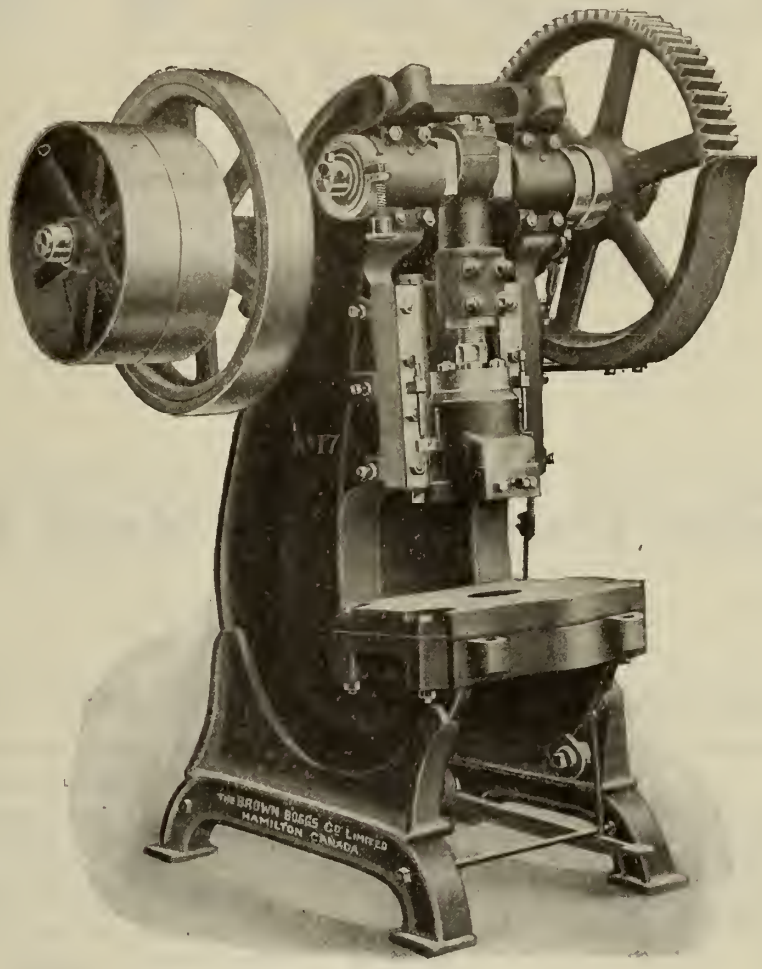

No. 17 Geared Inclinable Press

We have recently redesigned our line of Inclinable Power Presses, adding several new features that increase their efficiency and add life to the dies used in them.

The pitman connection is of the ball type made from **High Carbon Steel** carefully heat treated so as to give the maximum **Service.**

Crankshafts are also made from Carbon Steel properly heat treated, which greatly increases their tensile strength and prevents crystallization.

We manufacture a full line of Power Presses for blanking, forming, punching, trimming, etc., in many different types. Also Shears, Bending Rolls, Brakes, etc.

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Manufacturers of Sheet Metal Working Machinery, Presses, Shears, Rolls, etc.

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Squares 2" to 6"

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MADE TO ANY ANALYSIS

PROMPT SHIPMENT

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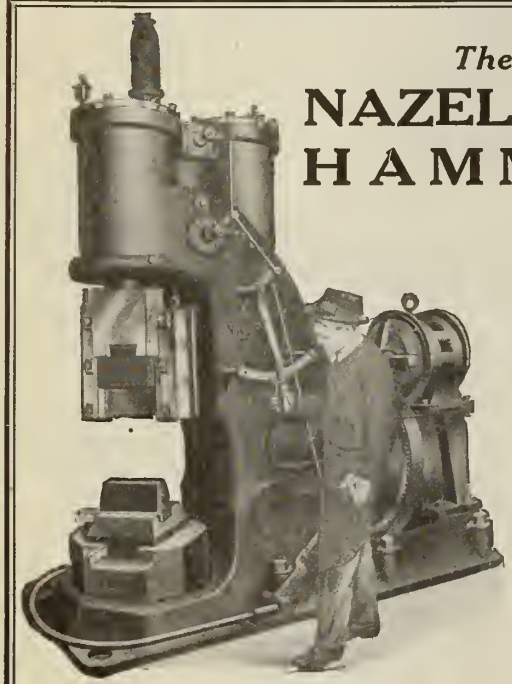

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NOTED FOR ITS BLOW AND CONTROL

A self-contained unit, built in three types, six sizes, arranged for belt or direct motor drive, with capacities up to 7-inch square, for all manner of jobbing, manufacturing and certain classes of die forging.

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We are manufacturing SPECIALISTS—Carry large STOCKS — Give PROMPT deliveries, and rely upon our products for REPEATS.

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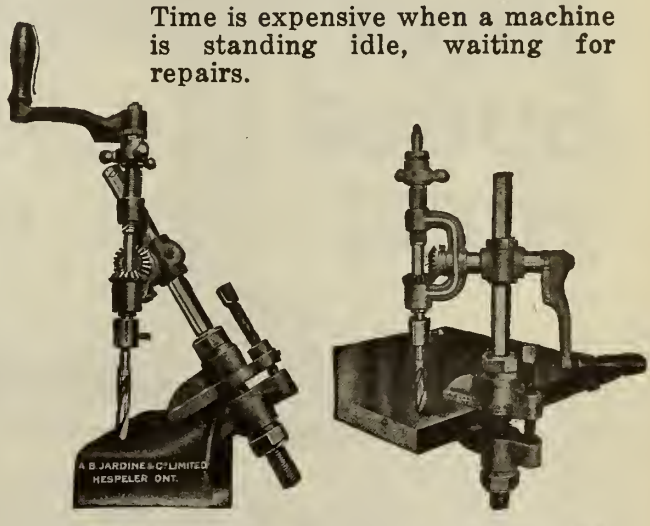
Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.



On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

Weight, 40 lbs. Price, $26.50 net.
Sold by all Machinery and Supply Houses

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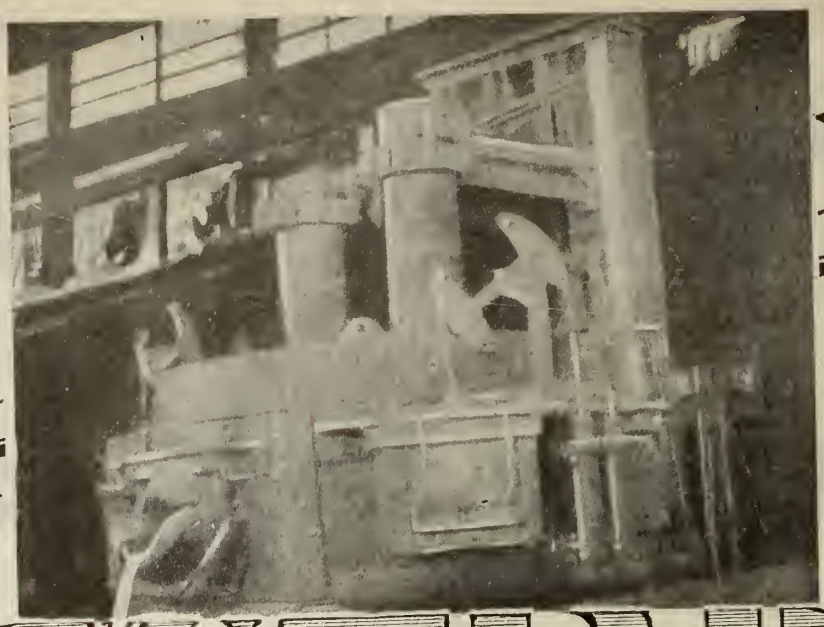

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High Speed Steel

SEVERAL factors combine to make this high-speed steel a triumph of the steel-maker's art; Electric Furnaces — entirely infallible, automatically regulated, delivering the same result time after time.

Uranium — This rare element, cousin to Radium, effects a profound change in the texture and quality of the steel.

Added to these, the constant care and skill of years of steel-making experience make the result of each melt a foregone conclusion.

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YOU can rub the dirt from a soiled collar, with an eraser—but the laundry does a better job.

You *can* clean your Metal Parts with caustic or benzine; but scientific methods and materials—do a better job for less money.

These two booklets open the way to better cleaning methods—more thorough, quicker, less expensive methods of handling the cleaning problem.

No abstract theorizing—no vague generalizations—but concrete *facts,* compiled by practical men from practical experience.

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Saving 30 hours and 16 men on this one job

The job consisted of unloading sixteen steel underframes from the cars and mounting them on trucks. The frames weighed over 8 tons apiece and took a gang of 30 men 2 hours to handle each frame. But with the Brownhoist on the job, 14 men handled 16 frames in 1¾ hours.

This is not an unusual saving of time and money for a Brownhoist locomotive crane. In hundreds of plants and on many kinds of work Brownhoists are doing just as well. Wherever there are bars, rails, castings, forms, coal or ore to handle they will effect a saving in time and money. And this saving will probably be as great as the one described above.

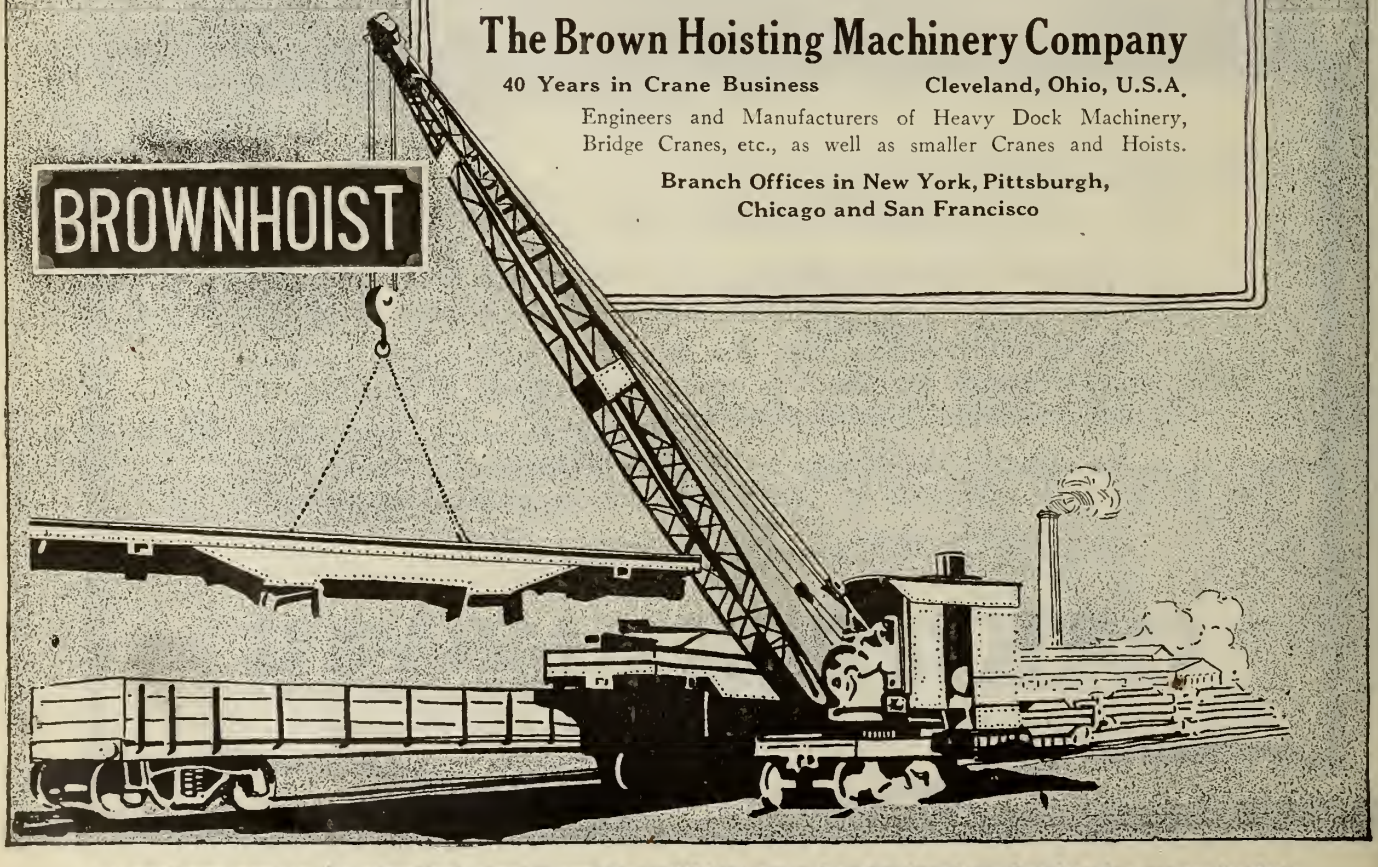
If you are interested in handling materials of this kind, let us tell you how and at what cost a Brownhoist will do the work. It will make an interesting comparison with your present costs. Catalog K shows different types of Brownhoists doing many kinds of work. This book will be of value to you if you handle material. We will send you a copy promptly for the asking.

The Brown Hoisting Machinery Company

40 Years in Crane Business **Cleveland, Ohio, U.S.A.**

Engineers and Manufacturers of Heavy Dock Machinery, Bridge Cranes, etc., as well as smaller Cranes and Hoists.

Branch Offices in New York, Pittsburgh, Chicago and San Francisco



No Delay

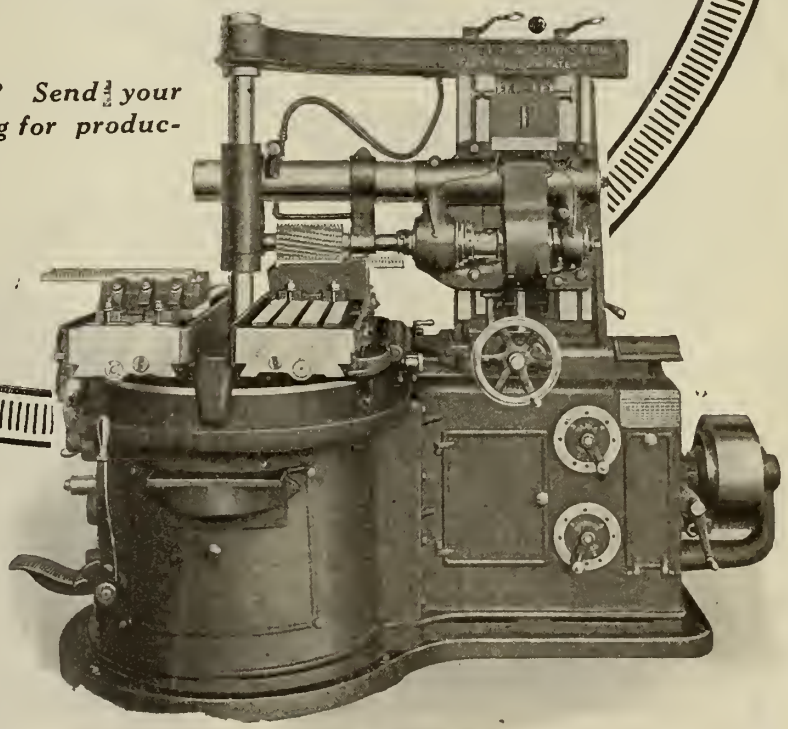
Of course there is no delay on a P & J Automatic Milling Machine—It was built expressly to eliminate delay. No lost time returning table by hand and removing finished work from vise or fixture.

Keep two tables going at a time. Load up on one while the cutter is milling work mounted on the other. With the exception of 10 seconds for indexing table turret, bringing work into alignment with cutter, and advancing table—automatically—to cutting point, there is no lost time—no waste of power.

Real Production

16 Table Feeds, 1/8 to 12, 5/16 inches.
Length of Table Feed, 29 inches.
16 Spindle Speeds, 20 to 180 R.P.M

Why not get familiar now? Send your blueprints or samples along for production estimate.



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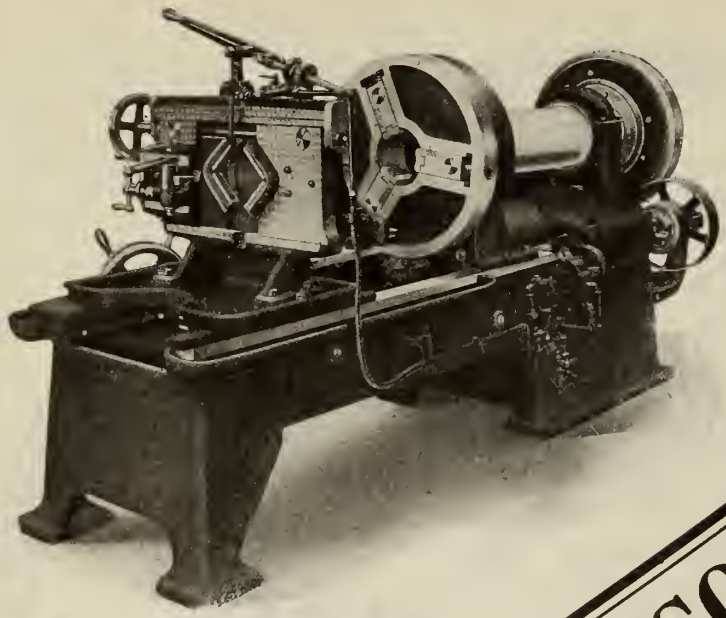

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MANUFACTURERS OF

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Built to
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All
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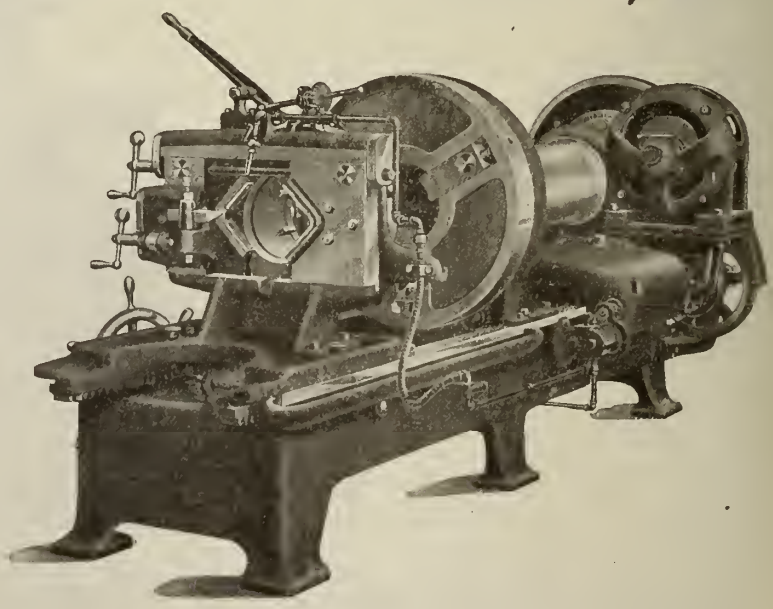

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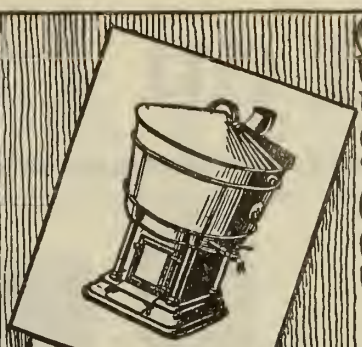
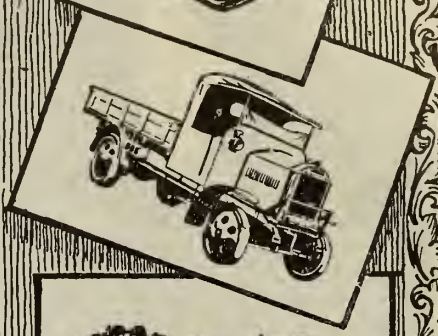
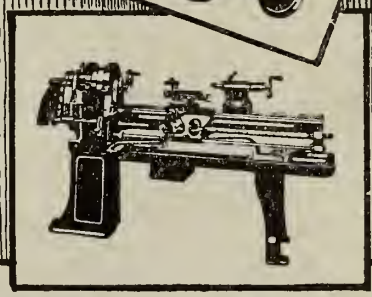
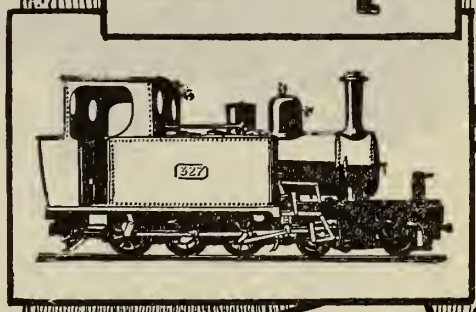

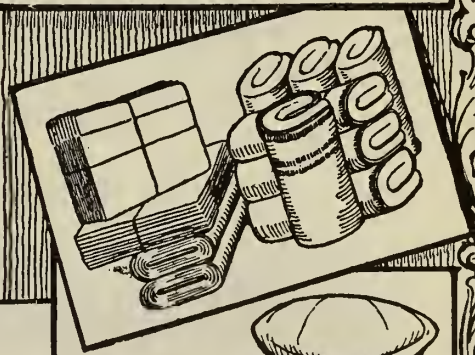
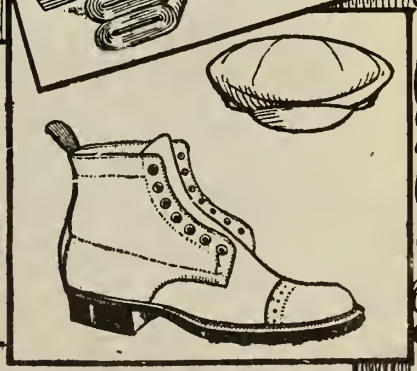
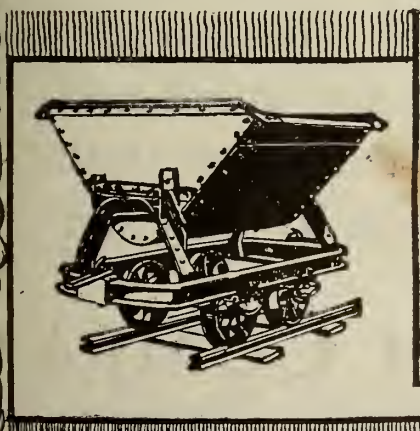
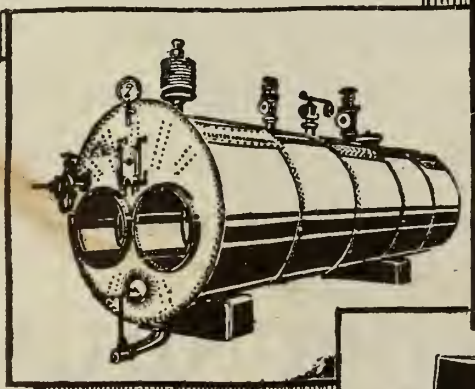
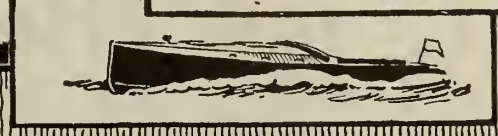

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You Have Never Had a

As the New ALOXITE AA

THE success of the new Aloxite AA Wheel is nothing short of astonishing.

It is in a sense making grinding history.

For years you have been looking for just such a wheel to grind reamers, cutters, hob mills and general tool room work—for surfacing high speed steel for die work and for internal grinding on steel. You have wanted a wheel that was so open and

THE CARBORUNDUM COMPANY

NEW YORK CHICAGO BOSTON PHILADELPHIA CLEVELAND DETROIT CINCINNA

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

Wheel that Cut So Fast

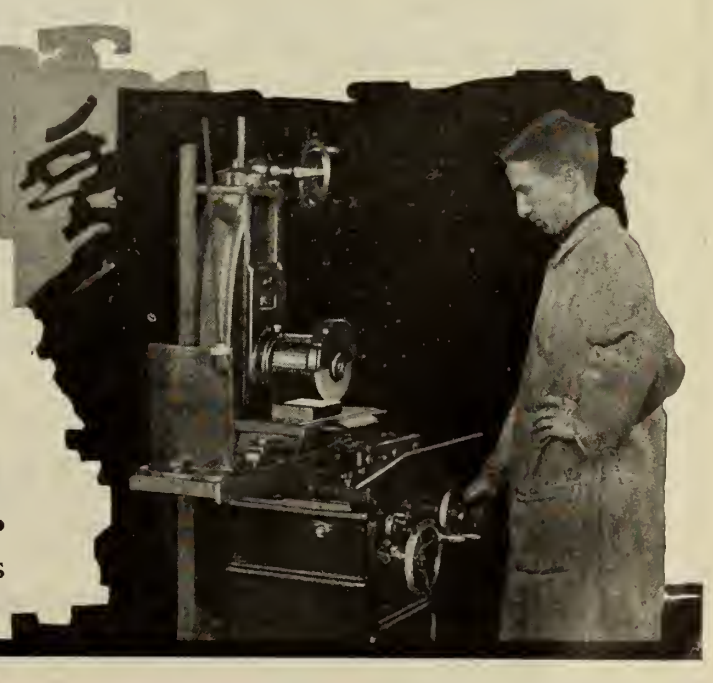
porous in its structure that it would cut cool, clean, free and fast—that would keep on cutting that way, freeing itself and keeping sharp with practically no dressing, because of its sharp, tough, remarkably large crystals.

Tests have proved that the Aloxite AA Wheel has every one of these qualities.

And many a time you have wanted a wheel that would take off heavy cuts without burning.

This Aloxite AA Wheel Took a Cut of .035

A 36 grit T grade Aloxite AA Wheel, in a test on hardened steel dies, started in with a cut of .005, then gradually increased to .020, finally taking a cut of .035. Give Aloxite AA a test in your tool room. You will find that you have never had a wheel that cuts so fast, so free, so cool.



NIAGARA FALLS, N. Y.

PITTSBURGH MILWAUKEE GRAND RAPIDS

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IT IS TO YOUR ADVANTAGE

PUTTING YOUR LIFTING AND MATERIAL HANDLING PROBLEMS UP TO US WILL BE TO YOUR ADVANTAGE

Our broad experience combined with modern facilities enables us to serve you with efficiency and dispatch

THE HERBERT MORRIS
CRANE AND HOIST COMPANY
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NIAGARA FALLS, CANADA

Electric Cranes and Hoists

Storage Battery Trucks, Chain Blocks

Overhead Runways Grab Buckets

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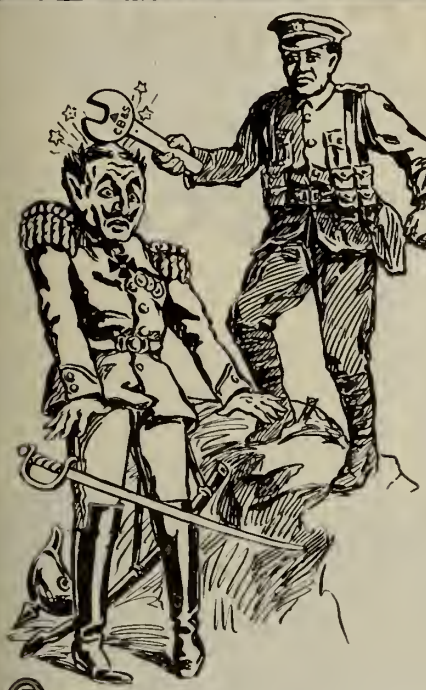
LIMITED



If a Bad "Nut" Gets Loose
—Use a Wrench

Endurance Brand

Never Wear Out
Ask You Jobber

Canadian Billings & Spencer Plant
WELLAND, ONTARIO

Harris Heavy Pressure

The Babbitt Metal that's at the Front in Efficiency and Economy

Order a Box from our nearest Factory

Our Guarantee is Back of Every Pound of Babbitt Metal We Make

Manufactured by
The Canada Metal Company, Limited

TORONTO	-	CANADA
HAMILTON		WINNIPEG
MONTREAL		VANCOUVER

STAR LATHES

Combine Speed With Precision

For that light tool room and machine shop work which demands an exacting degree of accuracy in addition to high speed, no better lathe than the "Star" 11" x 5" Style QC-E Quick Change Engine Lathe can be found.

11" x 5" Style QC-E
"Star" Quick Change Engine Lathe

A small "Star" is much more economical than a larger machine not only in power, but also in floor space. Besides, it will leave the big tools for the big jobs. In design and construction "Star" Lathes conform to the highest standard. They offer simplicity of operation and unsurpassed mechanical advantages.

We have a booklet containing full details of the "Star." **Obey that impulse; send for a copy to-day!**

The Seneca Falls Mfg. Co., Inc.
366 W. Falls St., Seneca Falls, N.Y.

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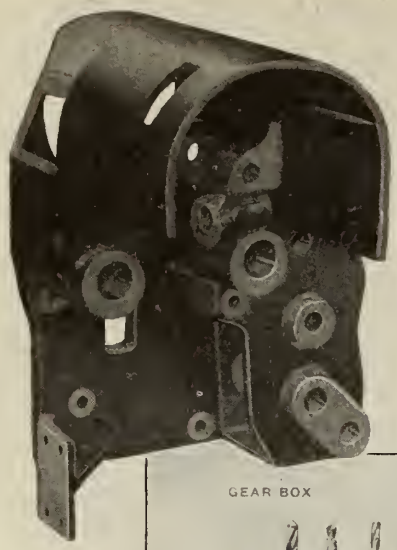
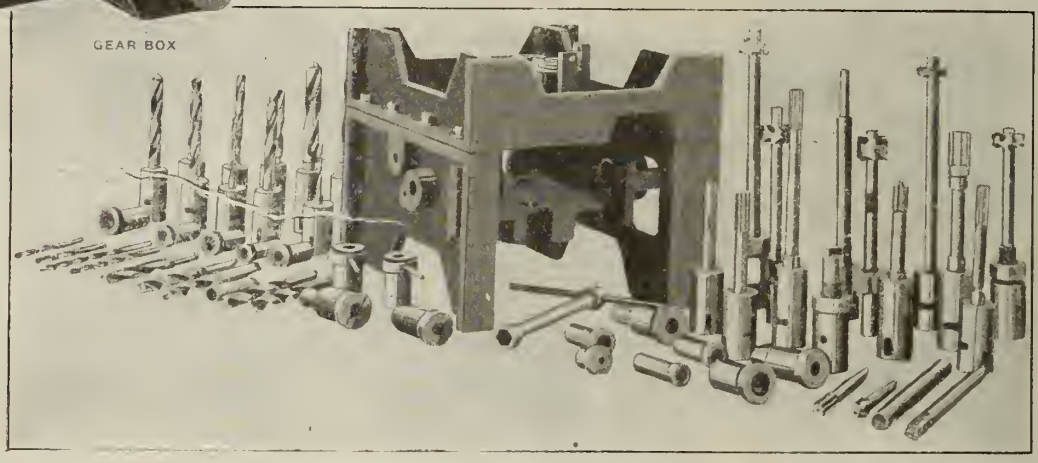


MODERN "Magic" Chucks

As used by

Foster Machine Co.

Of Elkhart, Ind.



The illustration above does not show the "Magic" chuck, but only the collet equipment and tools used therein. This cut was used by the Foster Machine Company in its bulletin "Foster Quality," and also in its trade magazine advertising.

As the text in both the bulletin and the advertising is designed to impress readers with the quality work done in building the Foster turret lathes, the array of tools presents a very fine tribute to the quality, efficiency, and usefulness of Modern "Magic" Chucks.

In our own advertising we have confined most of our argument to the "Quick Change" feature. In view, however, of the Foster experience we should, perhaps, make "Quality of Work Performed" our chief appeal. But remember, tools changed instantly without stopping or slowing machine.

Send for complete technical bulletin of this wonderfully adaptable tool.

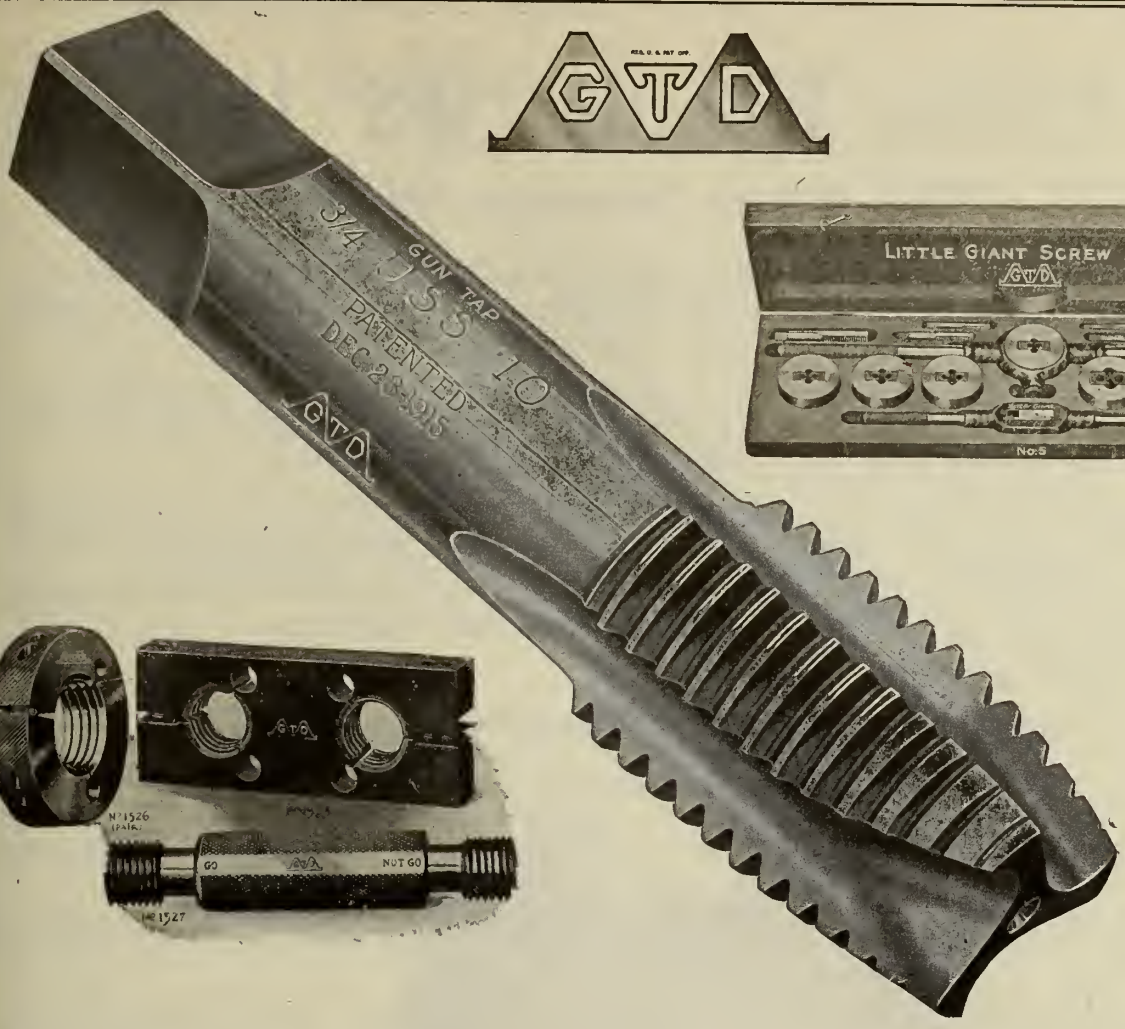
MODERN TOOL CO., ERIE, PA.

Main Office and Works: State and Peach Sts.

Branch Offices:

New York, N.Y., 2 Rector St.
Detroit, Mich., 40 Larned St. E.
Cleveland, Ohio, 335 Guardian Bldg.
Chicago, Ill., 32 N. Clinton St.
Philadelphia, Pa., The Bourse.
Buffalo, N.Y., Associated Service Bldg.
Export Dept., Bishop Bldg., New York, N.Y.

CANADIAN AGENTS: Rudel-Belnap Machinery Co., Ltd., Toronto and Montreal.
CALIFORNIA REPRESENTATIVES: Herberts Machinery & Supply Co., San Francisco and Los Angeles.



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REAMERS
ACCURATE AND HARD-WEARING

TAPS
FOR HAND and MACHINE USE: "GUN" TAP "IT SHEARS"

SCREW PLATES
The Famous "LITTLE GIANT" and "O.K."

Little Giant

WELLS BROS.

Company of Ltd. Galt, Ontario

Canadian Plant of the Greenfield Tap & Die Corp.

CANADA

World's Largest Manufacturers of Screw Cutting Tools.

USE THE COUPON →

Or have your stenographer write us.

WELLS BROS. OF CANADA, GALT, ONTARIO
Please send me the following catalogs

SMALL TOOLS ☐
PIPE TOOLS - ☐
GAGES - - - ☐

Name..... Position.....
Firm .....
Address.....C.M. 1002

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Gear Cutting With the "IFS" Left Out

The Gear Shaper Way

A production manufacturer knows that he will secure good gears IF he has an accurate cutter, an accurate machine and a machine working on the correct principle. The whole question of good gears is resolved in this one little word "IF."

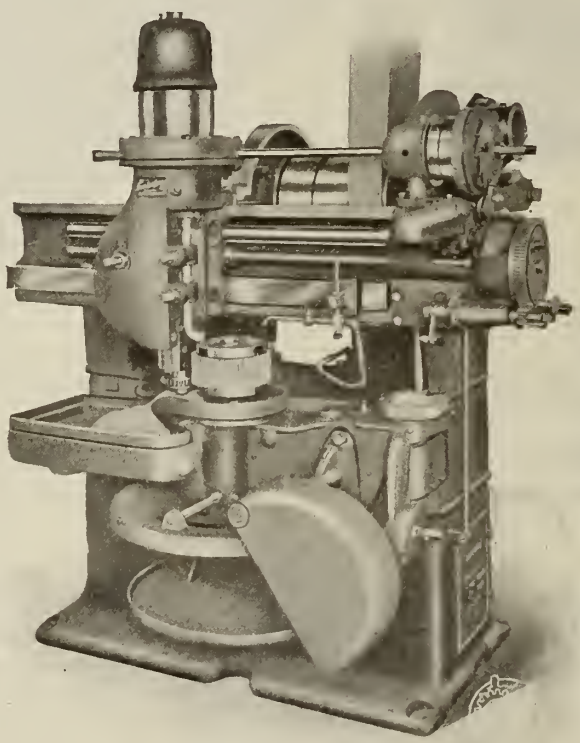
When the Gear Shaper was originally designed, the question of "IF" was taken into consideration and every possible means known to mechanical engineering was employed to eliminate the "IFS" from gear cutting.

That we have been successful in solving the problem is evidenced by the fact that each ensuing year sees a larger number of manufacturers adopting the Gear Shaper method.

How the Gear Shaper has accomplished this is clearly explained in our general catalog "Commercial Gear Cutting," which is a treatise on the subject of:—

Gear Cutting with the "IFS" Left Out.

Send for your copy to-day.



The Fellows Gear Shaper—the machine which has taken the "IFS" out of gear cutting.

The Fellows Gear Shaper Company

Springfield, Vermont, U.S.A.

FOREIGN AGENTS:—Alfred Herbert, Limited, Coventry, England; Société Anonyme Alfred Herbert, Paris, France; Societa Anonima Italiana Alfred Herbert, Milan, Italy; Alfred Herbert, Limited, Yokohama, Japan; Societe Anonyme Alfred Herbert, Barcelona, Spain; Societe Anonyme Belge Alfred Herbert, Brussels, Belgium; Alfred Herbert, Limited, Calcutta, India.

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STRUCTURAL STEEL
FOR
Bridges Buildings Tank Work
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ALSO
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Main Office and Works: LACHINE, QUE.
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Pulp and Paper Making Machinery

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Barking Drums, Sulphite, Sulphate, Paper, Screens,

Granite Rolls, Millspaugh Patent Suction Couch and Press Rolls

WORKS: LACHINE, QUE. PHONE WESTMOUNT 6800

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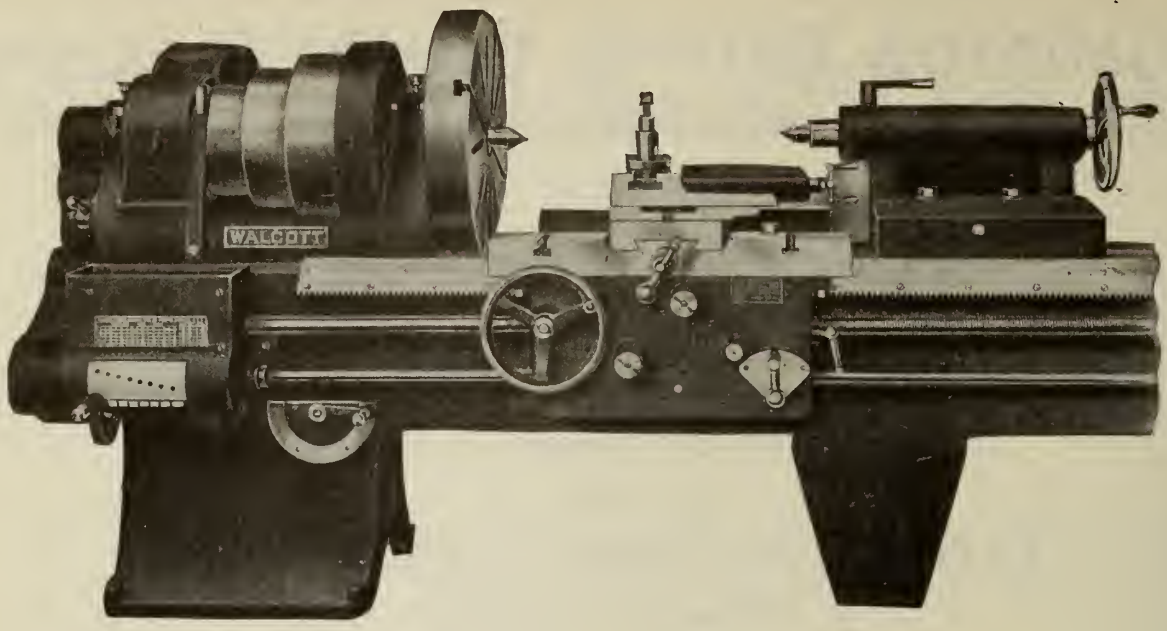
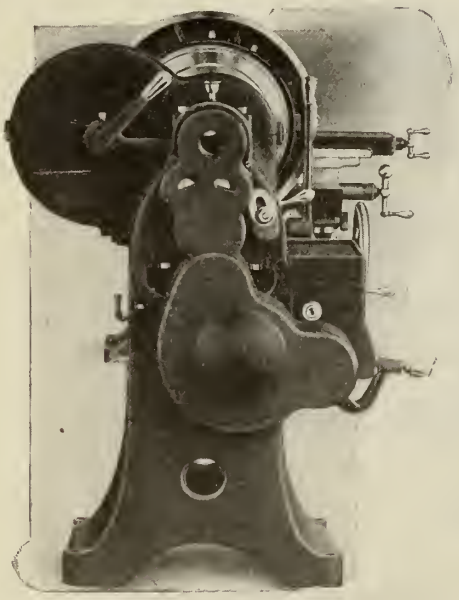


Walcott Lathes—Time Tested

It did not take 38 years to establish a reputation, but you can benefit by that experience.



YOU can subject this 26″ Engine Lathe to any test and at the outcome you will find that 38 years of lathe building have enabled us to present a machine that answers the most rigid requirements.

Reinforced and strengthened at the points of stress, this machine includes such features as: double apron plate, drop forged gear in apron, rigid compound rest, back gear arm reinforced by one-piece gear guard and headstock, not a single tooth exposed, feed gears run in oil, large frontway on bed, and quick change gear box. The lead screw and feed rod are separate.

Made in 14″, 16″, 18″, 20″ and 29″ sizes.

Our experience and co-operation are entirely at your disposal. Write us.

WALCOTT LATHE COMPANY

135 Calhoun St. *Established 1881* **Jackson, Mich.**

Canadian Agents: The Canadian Fairbanks-Morse Co., Ltd., Montreal, Toronto, Ottawa, St. John, N.B., Winnipeg, Calgary, Saskatoon, Vancouver, Victoria, F. H. Andrews & Son, Quebec, Que.

Milwaukee Milling Machines

Give Real Milling Satisfaction

TO meet the varied demands of different classes of work with the speed and accuracy that this day requires, we have incorporated many notable features in Milwaukee Milling Machines which qualify them to successfully meet the most exacting requirements. They are constructed to economically perform all classes of milling light or heavy.

The box section column; solid top, box section knee; double overarm; flanged spindle; automatic flooded lubrication of all bearings and gears in the column, feed box and pulley bracket; automatic cutter lubricating system; constant speed drive—all contribute to "Milwaukee" efficiency and profitable production .

Write for our catalog.

Kearney & Trecker Company

Milwaukee, Wis., U. S. A.

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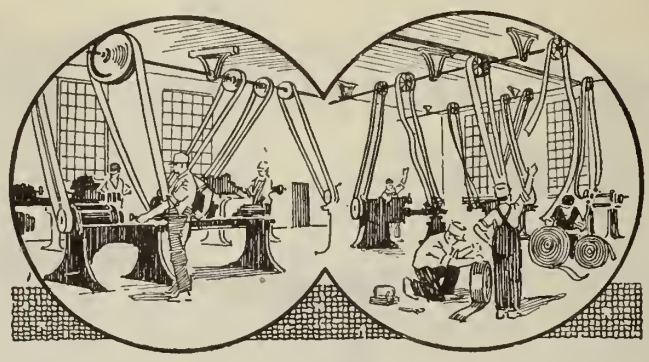


Belt Efficiency Lowers Power Cost

Do you know that many drives in your plant are wasting power? There are a number in most every plant. Each one a leak that is helping to create a stream of lost production dollars. These leaks are called pulley slippage, idle machines, idle employees, spoiled material, undersized belts, poor fabric and worse construction.

Dominion Friction Surface Belting

Will place your transmission equipment on the nearest possible approach to 100 per cent. efficiency that you may ever expect to obtain.

Dominion Friction Surface Belting is saturated with a special friction rubber compound, which makes it water-proof, vulcanizes the plies and practically eliminates all slipping on the pulleys.

Dominion Rubber System Belting Engineers, after thoroughly studying your requirements, without cost to you, will specify the correct belt for each given purpose that all power waste may be eliminated—that idle employees may be forgotten, and that your production may be brought to the greatest volume possible with practically no increase in overhead.

Phone or wire our nearest service branch.

CANADIAN CONSOLIDATED RUBBER CO. LIMITED
DOMINION RUBBER SYSTEM
AND ASSOCIATED COMPANIES

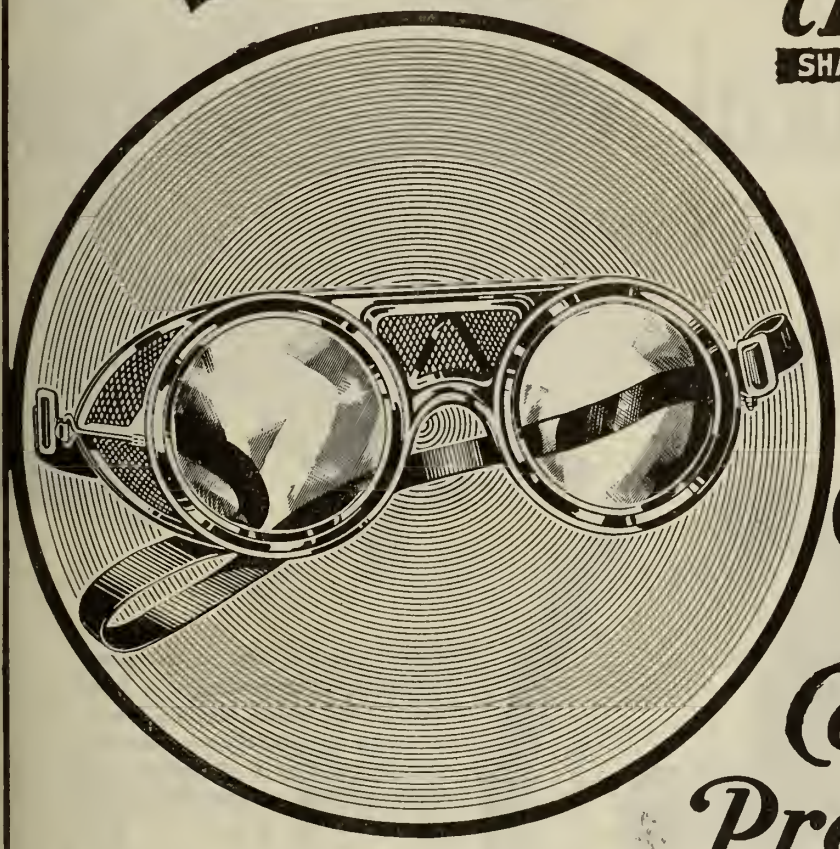
Our Dominion Hose, Packing, and Industrial Rubber Goods are all the Same High Standard as Dominion Friction Surface Belting.

DOMINION RUBBER SYSTEM SERVICE BRANCHES

Halifax	London	Saskatoon
St. John	Kitchener	Edmonton
Quebec	North Bay	Calgary
Montreal	Fort William	Lethbridge
Ottawa	Winnipeg	Vancouver
Toronto	Brandon	Victoria
Hamilton	Regina	

STOCO SAFETY GOGGLES

"CELOGLAS"
SHATTER-PROOF LENS



Sturdy, Durable, Comfortable and Completely Protective

No matter how strictly your protection glass specifications are written, no matter how strongly you stress the three safety goggle essentials—protection, comfort and durability—you will find in the Stoco Safety Goggle every feature you demand.

Price (F.O.B. Geneva, N.Y.)

With Celoglas Shatter-Proof Lenses ....$115.00 per hundred
With optical glass lenses ..... 90.00 per hundred

Black elastic headbands (as illustrated) or easy cable earbows at same price. Each goggle comes packed in cardboard container.

We are always glad to send a sample Stoco Safety Goggle and specimen Celoglas lens to interested responsible people on receipt of request on letterhead.

STANDARD OPTICAL CO.
GENEVA, N.Y. U.S.A.

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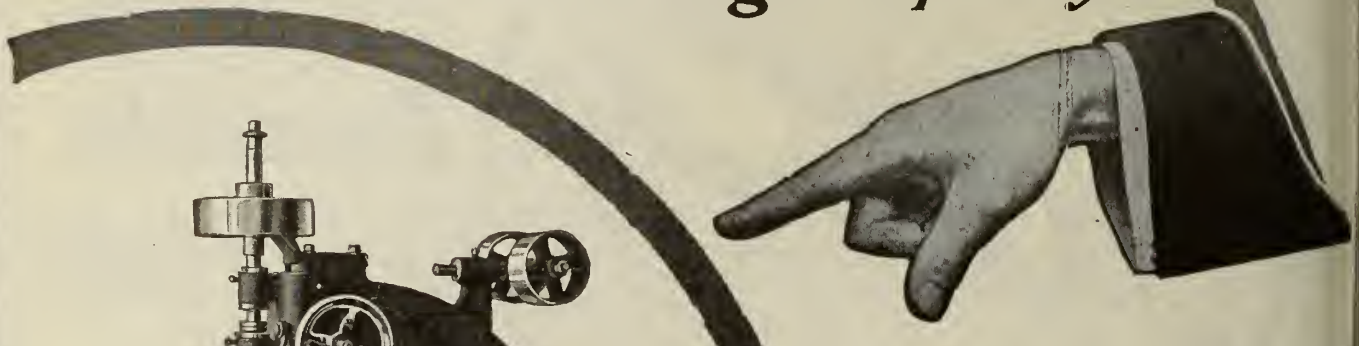
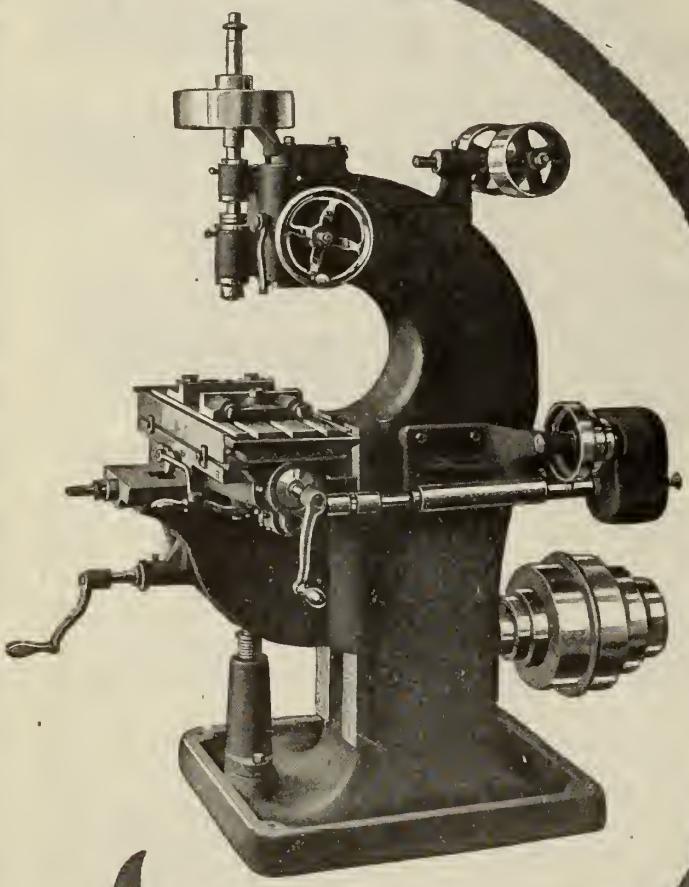
BRISTOOL

Bristol Vertical Milling Machine

A Tool of Large Capacity





Ball Bearings are used at the most important points making it a free running tool, which, combined with its being a belt-driven machine, makes it capable of turning out work on which an extra smooth finish is desired.

The longitudinal table feed is controlled by the gear change box which gives six different feeds for each change of spindle speed. A stop to gauge with micrometer adjustment is used on the head to regulate the depth of cuts.

Learn all about its production capacity.

Write for bulletin giving fullest particulars.

BRISTOL MACHINE TOOL CO.
SUCCESSORS TO C. G. GARRIGUS MACH. CO.
BRISTOL, CONN.

One of the Seventy-nine

Only the *Right* Furnace Will Do !!

Each plant has its own peculiar conditions and needs. The furnace that makes good in one factory may be unsuited for another. When you select a furnace it is vitally important that you have a complete line from which to choose.

BELLEVUE FURNACES

are built for every requirement of heat treating. Seventy-nine different styles and 41 sizes to choose from. If one of these fail to answer—we'll build one to meet your special requirements.

Write for catalogue of complete Bellevue line.

Bellevue Industrial Furnace Co.
703 Bellevue Ave. - Detroit, Mich.
JULIUS C. HINZ, Pres.

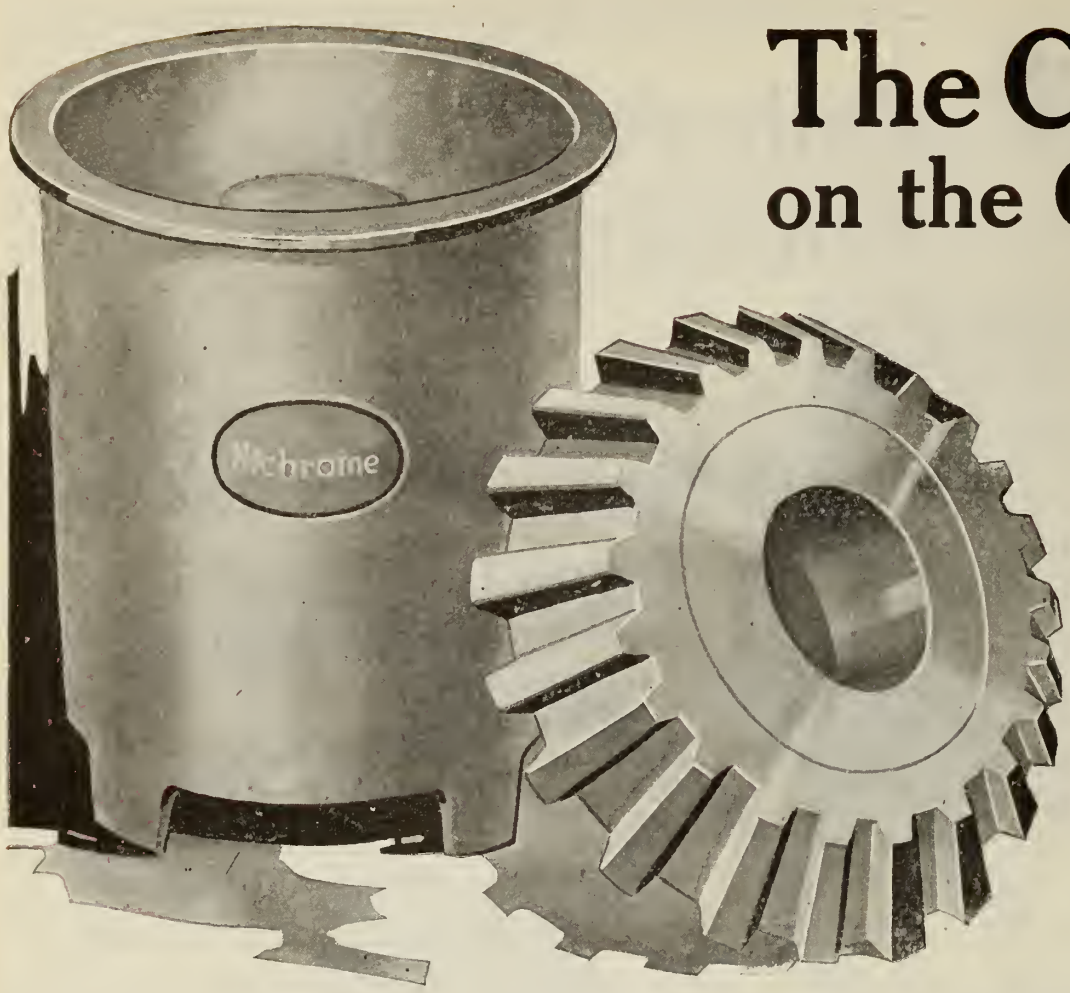
Representative in Canada:
H. W. PETRIE LIMITED, Toronto, Canada

HOSKINS ELECTRIC FURNACES

SIMPLE
EFFICIENT
ACCURATE
ECONOMICAL

Hiram Walker & Sons Metal Products, Limited
Walkerville, Ontario

The Case on the Gear



THE fact that Cast Nichrome Containers do not oxidize, or change in other ways that interfere with uniform heat penetration during the life of the containers, is a long step toward case perfection. Shorter heats and less fuel consumption naturally follow. Cast Nichrome service reaches to thousands of hours at 1,800° F. without cracking, warping, scaling, etc. The Nichrome guarantee assures economy: A TYPE FOR EVERY PURPOSE.

Manufactured under HENDERSON PATENTS by

CANADIAN DRIVER-HARRIS CO., Ltd.

WESTERN OFFICE AND DEPOT CHICAGO 28 So JEFFERSON ST

WALKERVILLE, ONT. CANADA

AMERICAN OFFICE AND WORKS HARRISON, N J

BRITISH WORKS MANCHESTER ENGLAND

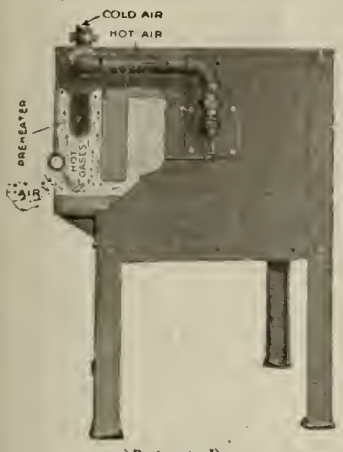
Carbonizing Pots of

Cast Nichrome

ENDURE IN HIGH TEMPERATURE.

Summer—Too Hot to Work

When it's too hot to work—production drops and overhead rises.



(Patented)

Section showing deflection of hot gases, with induced air **toward** the furnace, and the preheating of air for combustion.

A forging is the result of a working combination of machine, furnace **and man.** The man is the weak link in the operation; when he's idle, expensive equipment is idle.

The fatigue of furnace operators is due largely to gases and heat. In the

ROCKWELL ECONOMIZER FORGE

the novel construction of shield deflects the hot gases and—

See illustration, write for Bulletin 34-T, and learn of the many other advantages that make this forge an all-year-round economizer.

Let Us Handle Your Heating Problems

"FURNACE AND FUEL TO SUIT THE WORK"

Canadian Representative:

R. J. McLEAN,
604 Southam Bldg., Montreal, P.Q.

W. S. ROCKWELL CO. INDUSTRIAL ESTABLISHED 1888 FURNACES 50 CHURCH ST. NEW YORK

1/3 to 1/2 Reduction in Milling Cost

This will be the result of taking small milling jobs from your big millers and putting them up to

The U.S. MILLER

The Miller for Small Work

A small machine takes up less space, requires less power, is easier to operate and is more accurate. **The Paramount Miller of its size.** Drop us a line for full details.

United States Machine Tool Company
Cincinnati, Ohio, U.S.A.

VOLTA Electric Furnace

For economy, it is essential that the furnace be so designed and equipped as to reduce to a minimum the refining time and delay between heats.
Volta Furnaces are the result of 10 years' experience **and nothing is spared to make them efficient.**
We are capable of advising you on your steel casting proposition.

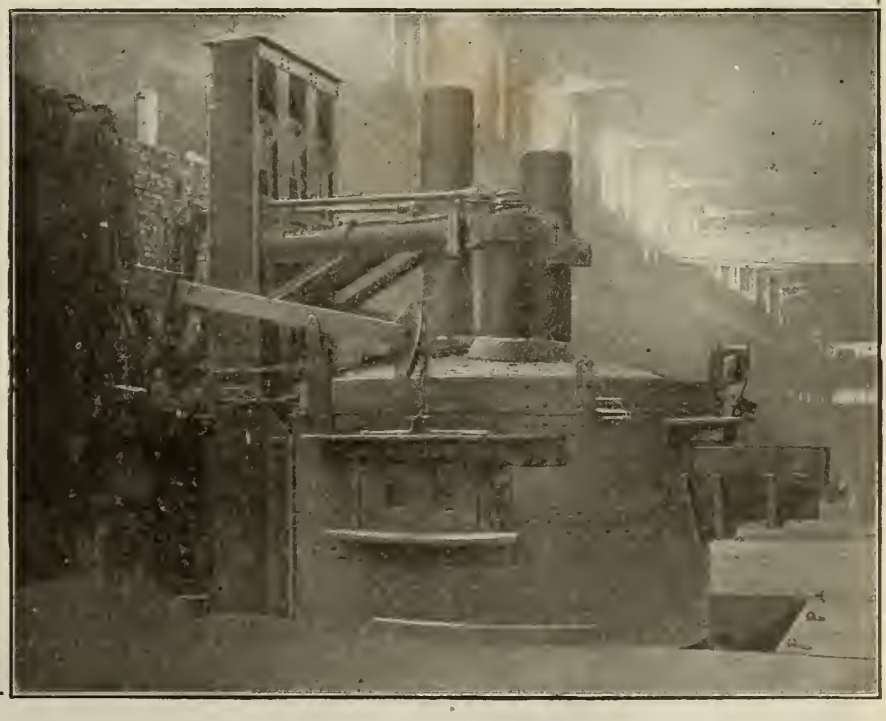
Volta Manufacturing Co., Limited

WELLAND - ONTARIO

BESIDES being cheaper, electric steel castings have other advantages over ordinary steel castings. The product has a particularly homogeneous structure, a fine grain, superior physical properties, and a chemical composition which can be perfectly controlled.

FOR QUALITY CASTINGS

Illustration shows 6-ton VOLTA Furnace in running position.



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LINCOLN ARC WELDER

A Practical Process For Your Plant

Production—peak production is demanded to-day. Anything that tends to slacken the output is discarded. Everything that can "speed up the works" is utilized.

If you could find a process that would maintain and speed up production, that would save its cost many times in a single year, would you consider it?

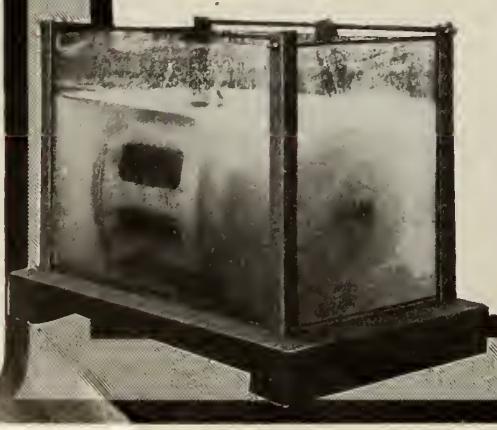
You would.

Then let us tell you about Lincoln Arc Welding. Let a Lincoln engineer inspect your plant—and tell you frankly whether or not Lincoln Arc Welding can speed things up—or save you any money or machinery. This will cost you nothing.

It does not matter what kind of a product you turn out, or what size of a plant you have, just call on us.

Do this now, to-day. We will not waste your time or our own. Phone Main 3768, or write or wire us.

"Link Up With Lincoln"



The Lincoln Electric Company of Canada
Limited

1108 Temple Building - - Toronto
Montreal Branch: Coristine Building

USE ARMCO IRON WELDING RODS

for Oxy-Acetylene and Electric Arc WELDING

The Purest Commercial Iron Known

is the best material for mild steel welding

Many successful welders use Armco Iron *exclusively* for all welding in which pure iron can be employed. With good workmen and "the *guaranteed* welding wire" they turn out welds which convincingly advertise the quality of their work and are a credit to the welding industry.

The chemical and physical uniformity of Armco Iron Welding Rods make for an even flow, an actual fusion with the surface of the work, and a joint which lends itself perfectly to finishing operations.

Armco Iron Welding Rods are carried in stock by reliable dealers in all industrial centers. Ask our nearest sales office for addresses of distributors in your locality.

TRADE MARK ARMCO REG. U.S. PAT. OFF.

AMERICAN INGOT IRON

PAGE STEEL & WIRE CO.

Established 1883 as Page Woven Wire Fence Co.

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Perfectype COMPLETE WELDING and CUTTING Equipment

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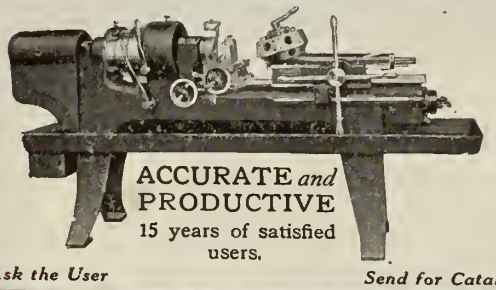

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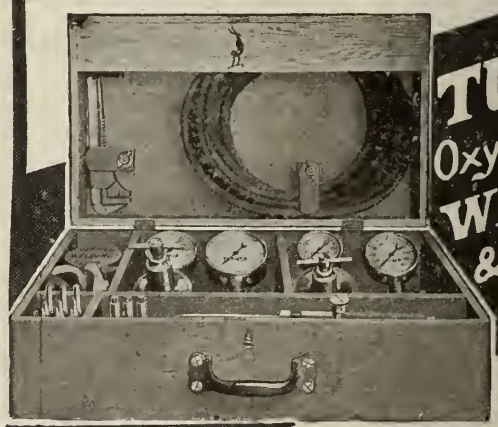

TURNER Oxy-Acetylene WELDING & CUTTING Equipment

These outfits will soon pay their cost in machine parts or tools reclaimed. The sectional extensions of the torch enable the operator to adjust it to any desired length or angle. The location of valves is such that the flame is controlled by one hand, leaving the other hand free for the work at all times.

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Carter Welding Co.

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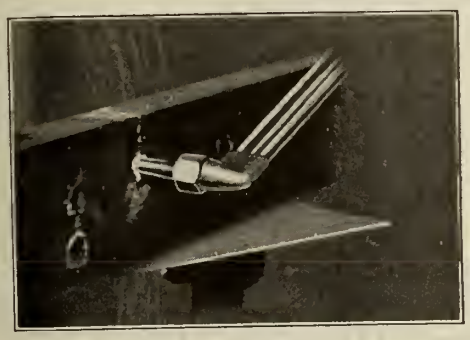
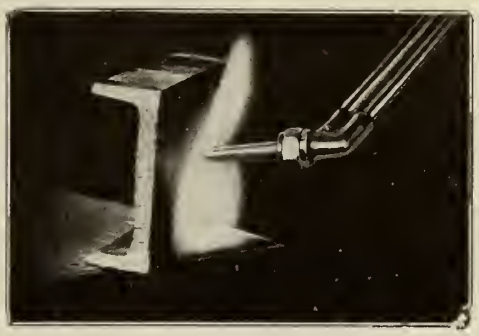
Canadian Agents for

"Rego" Welding and Cutting Apparatus



Cutting channel iron with face of tip flat against material. NO FLASH

Better Welding and Cutting at Less Cost



Welding torch tip **directly** on metal at white heat. Held these until it penetrates. NO FLASH

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Complete With Tips $67.00

Welding torch tip directly against fire brick. No escape for heat waves except against tip. NO FLASH

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Consider the ease with which Oxy-acetylene accomplishes the most trying operation that comes to any ship-yard—repair work on framing and plating.

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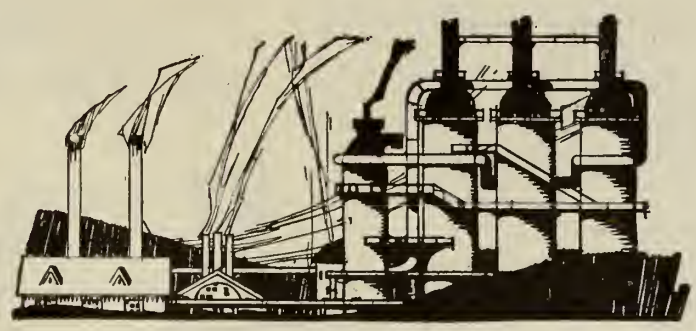

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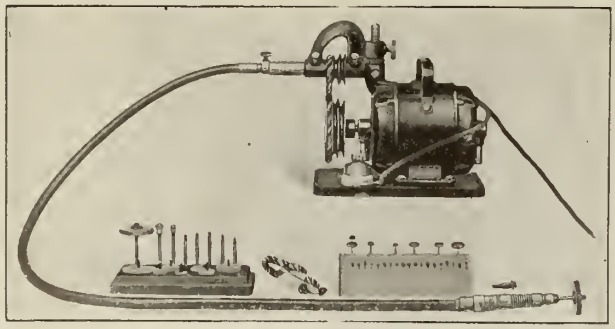

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DYE SINKING EQUIPMENTS

This equipment is especially designed for use in Die Sinking and Tool Work, and is being successfully used in many of the up-to-date plants engaged in this class of work.

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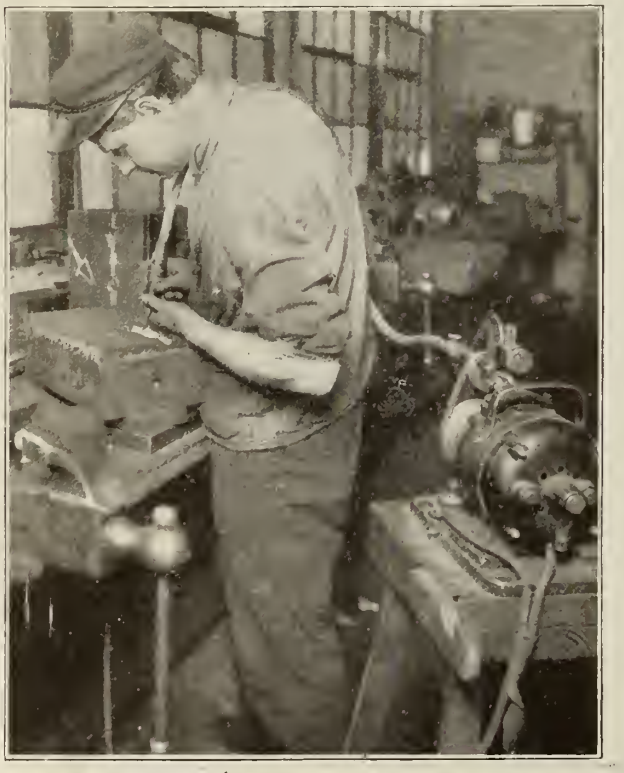

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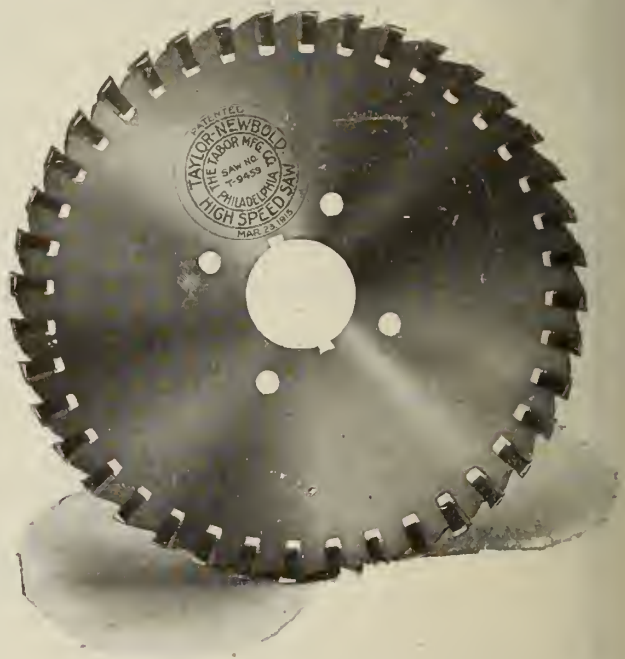

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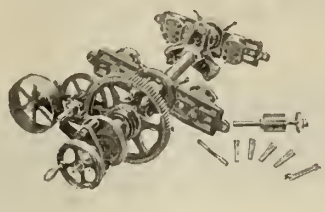

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This bar, which is regularly made in any size, with cutter heads to bore diameters of various sizes, is similar to our other standard portable bars.

Fixtures are furnished to rebore, the cylinders when both heads are removed or with the guide head remaining in place. The equipment is complete with tools, wrenches and pulley, ready for installation when unpacked from the boxes.

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This BLOUNT Motor-driven Lathe is well adapted to all speed lathe uses. It is of late design, and has a number of features in which you will be interested. Provided with constant-speed motor. Lathe spindle made of hollow, high-carbon steel, ground to size and bored for Morse taper. Runs in self-oiling bronze bearings.

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HACK SAWS and their use
The L.S.STARRETT
THE HACK SAW BOOK
CORNERING WORK
In either hand or power work, the efficiency of the saw, when cutting angles, shapes and similar material, is directly affected by the way the material is "cornered," or placed in the vise. A fundamental is to always start the work with the least angle facing the thrust of the saw teeth. Disregarding this point increases
ency of the saw to strip. Too
laid upon the necessity
THE HACK SAW BO
such an extent that it would have been impossible t
a smooth, straight cut. It, therefore, appears th
use of flexible saws in power machines is unavoidably
tended by a loss of time in cutting speed witho
corresponding gain in the life of the blade.
EFFECT OF PROPER REGULATION OF WEIGHT
ON CUTTING SPEED AND LIFE OF SAW
Fig. 8
STARRETT HACK SAW CHART
BLADES FOR HAND FRAMES
MATERIAL TO BE CUT
ALL HARD
BLADES
LIGHT MACHINE
STARRETT HACK SAW CHART
MACHINES
POWER
FOR
MEDIUM MACHINE
HEAVY MACHINE
EXTRA HEAVY MACHINE
THE HACK
EFFECT OF PROPER AND WEIGHT ON CUTTING
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EFFECT OF USING LUF
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The Starrett Hack Saw Book

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If you use hack saws you need this book ~

it's the first—and only—book of its kind in existence.

From cover to cover, it's sheer common sense about hack saws and their use; the combined experiences of machinists, shop foremen, buyers and manufacturers of hack saws. Its chief purpose is to help the man who buys, or the man who uses any brand of hack saw, get everything out of each blade that its manufacturer put into it.

"Hack Saws and Their Use" is brimful of interesting, valuable information such as, how different shaped teeth cut; how "set" and "pitch" affect cutting speeds; "freak" blades; what too little or too much pressure does; the effect of lubricant; figuring cutting costs; average performances; how to test blades; and practical hints on hand or power work.

Sixty-four pages, fully illustrated with charts, diagrams and graphs. Sent free to any address upon request. Ask for copy of Starrett Hack Saw Chart "3" at the same time.

THE L. S. STARRETT COMPANY

The World's Greatest Toolmakers
Manufacturers of Hack Saws Unexcelled
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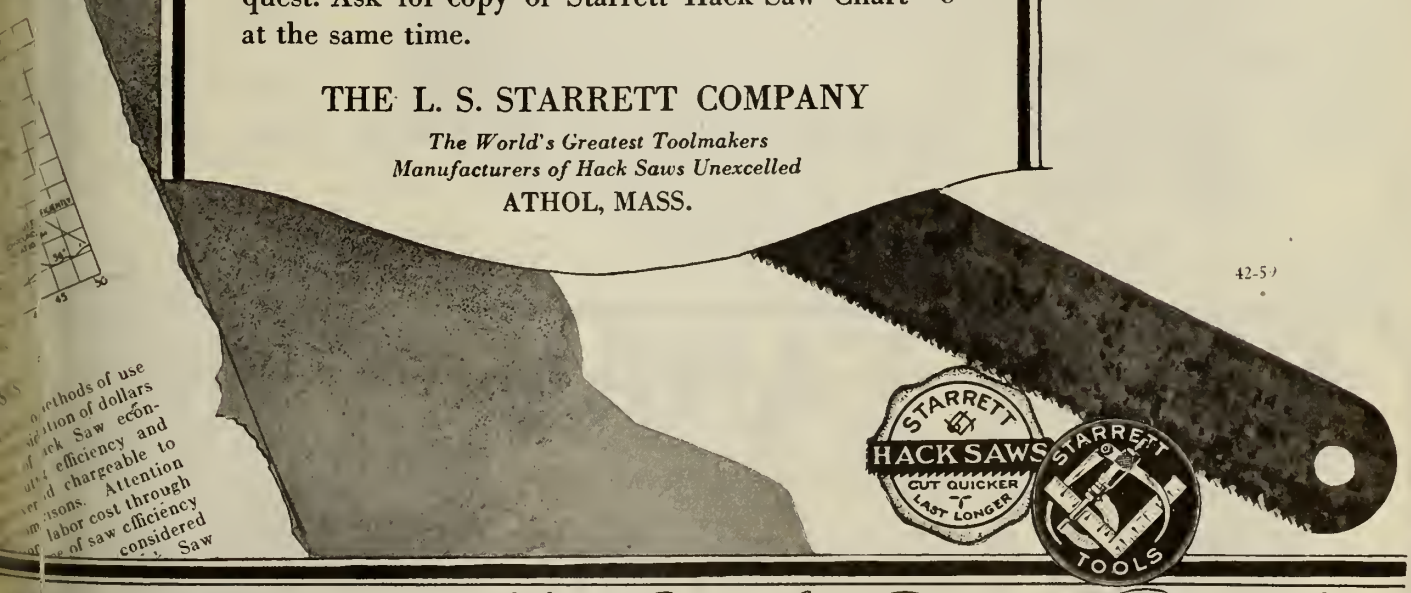

The Starrett Hack Saw Book

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Why?

Morse Chain possesses the exclusive
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Frictionless—Requires no Oiling

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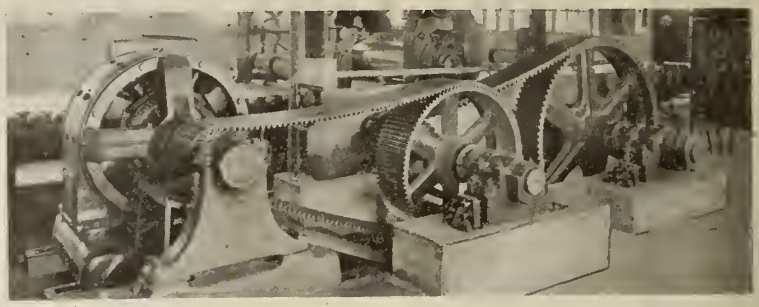
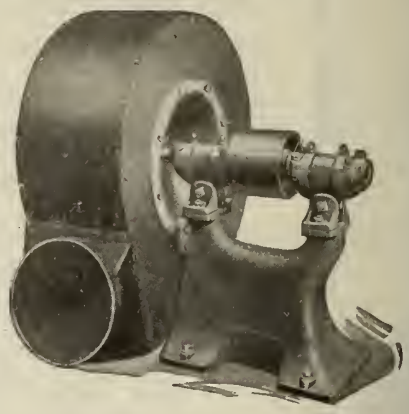


80 H.P. Morse Drive to Rolls, reverses direction every 45 seconds

"CANADIAN" MILL EXHAUSTERS

Handle Any Material



The Canadian Standard Mill Exhauster will handle any kind of material efficiently—sawdust, shavings, cotton lint, or stringy material, gases, fumes, smoke, etc.

They are adjustable to any angle of discharge instantly—have universal type of wheel and carefully constructed self-aligning oil-ring bearings.

Catalog 410-77—gives technical data and prices. Write for a copy.

Canadian Blower & Forge Co., Ltd.
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HEAVY & LIGHT
STEEL PLATE CONSTRUCTION ERECTED ANYWHERE

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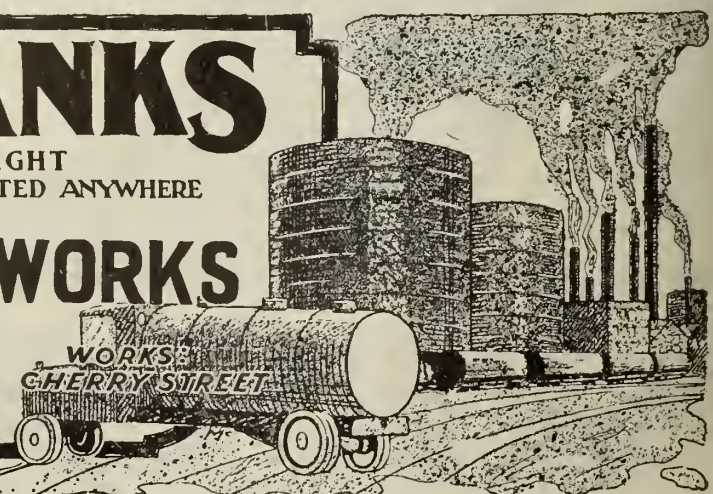

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High grade steel castings of every description. Send us your drawings for estimates.

Our motto is quality and quick service.

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We are the only company in Canada producing steel ingots by the "HARMET" Liquid Process, a process that makes these ingots vastly superior to the ordinary kind, improving the physical properties and reducing the waste of ingot.

We can supply forgings of all shapes and sizes made of ordinary or "HARMET" Fluid Compressed Open-Hearth Steel on the Shortest Notice.

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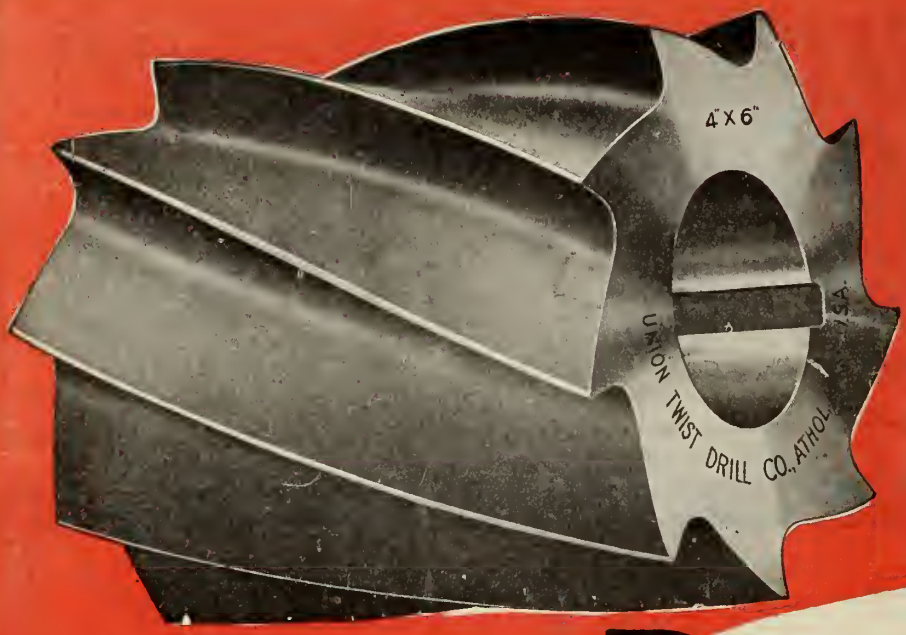

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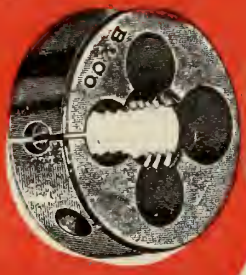

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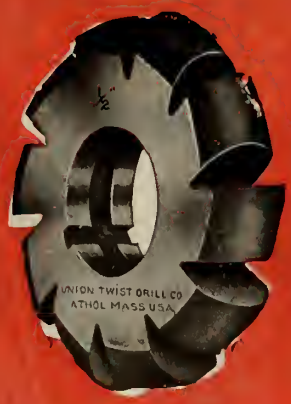

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HE quality and reliability of our product are assured by our long experience, as we have been manufacturing Thread-Cutting Tools for forty years and during that time have built up a reputation for accurate and dependable tools which is "Second to none."

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Butterfield Tools are the choice of men who know and are in universal favour.

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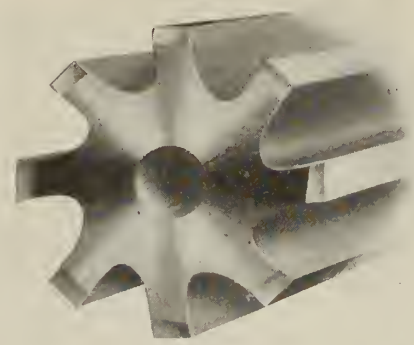
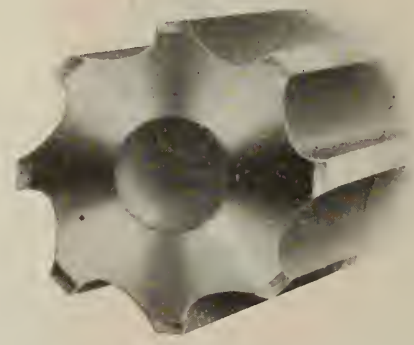


Imco Flute Depth



Average Flute Depth

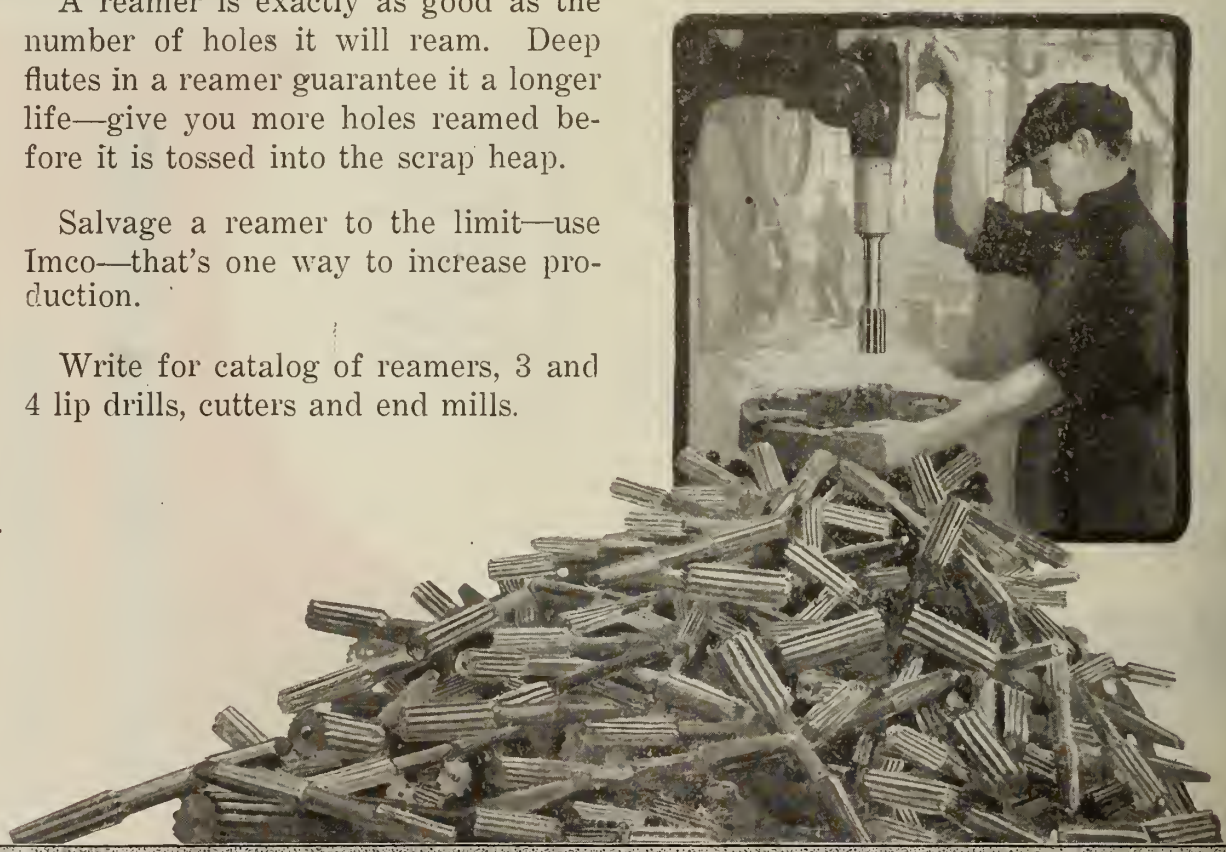
How Many Holes Before the Scrap Heap?

The flutes on Imco Reamers are milled almost twice as deep as those in the average reamer. Consequently the salvage value of Imco Reamers is just about twice as great.

A reamer is exactly as good as the number of holes it will ream. Deep flutes in a reamer guarantee it a longer life—give you more holes reamed before it is tossed into the scrap heap.

Salvage a reamer to the limit—use Imco—that's one way to increase production.

Write for catalog of reamers, 3 and 4 lip drills, cutters and end mills.



INGERSOLL MACHINE COMPANY

INGERSOLL ONT.

CHAS. A. STRELINGER CO., LTD. Windsor, Ontario

Robertson Process Metal

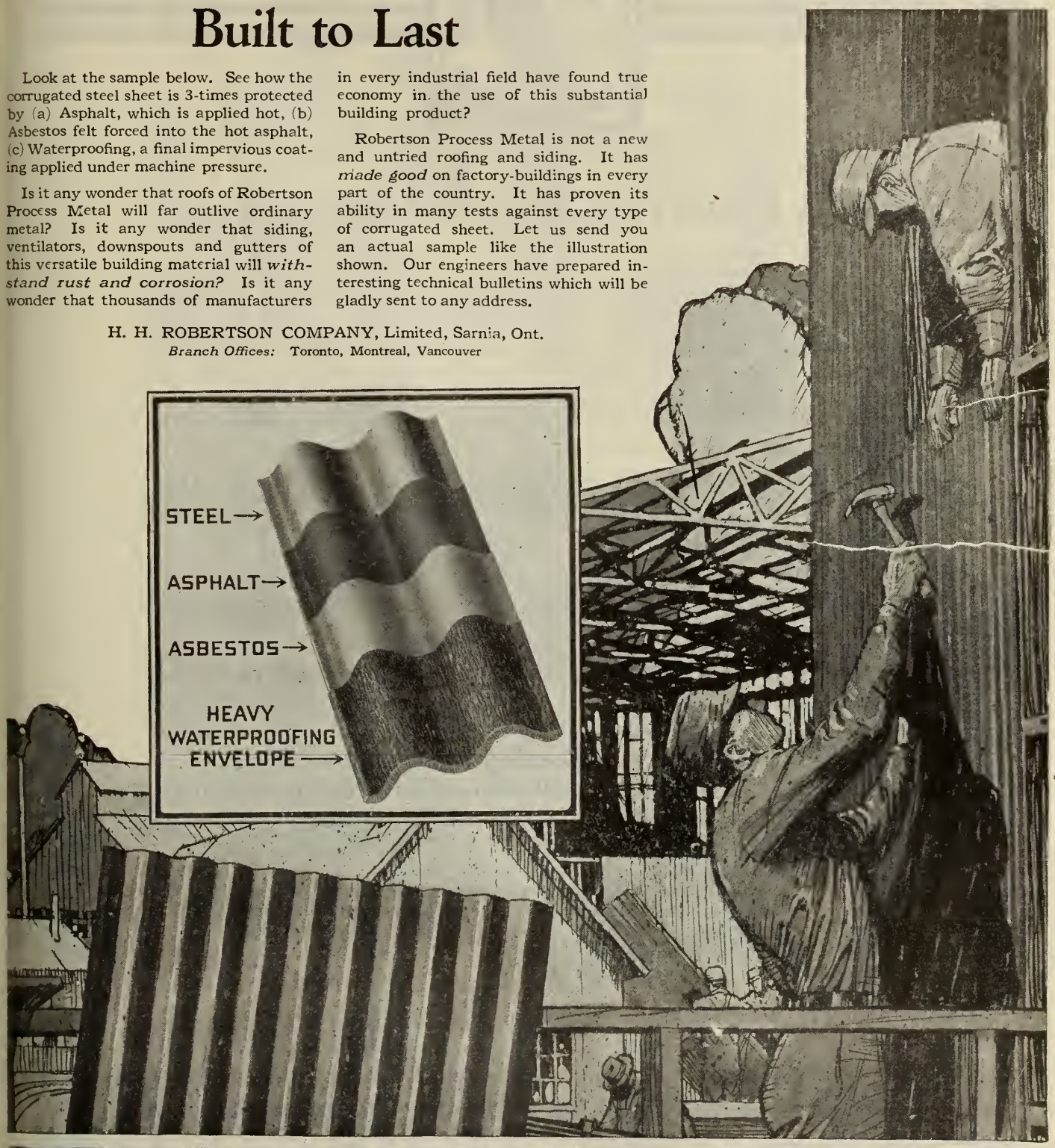
Built to Last

Look at the sample below. See how the corrugated steel sheet is 3-times protected by (a) Asphalt, which is applied hot, (b) Asbestos felt forced into the hot asphalt, (c) Waterproofing, a final impervious coating applied under machine pressure.

Is it any wonder that roofs of Robertson Process Metal will far outlive ordinary metal? Is it any wonder that siding, ventilators, downspouts and gutters of this versatile building material will *withstand rust and corrosion?* Is it any wonder that thousands of manufacturers in every industrial field have found true economy in the use of this substantial building product?

Robertson Process Metal is not a new and untried roofing and siding. It has *made good* on factory-buildings in every part of the country. It has proven its ability in many tests against every type of corrugated sheet. Let us send you an actual sample like the illustration shown. Our engineers have prepared interesting technical bulletins which will be gladly sent to any address.

H. H. ROBERTSON COMPANY, Limited, Sarnia, Ont.
Branch Offices: Toronto, Montreal, Vancouver



ROBERTSON PROCESS METAL FOR ROOFING AND SIDING

TRADE MARK REG U. S PAT OFF

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What Does Overhead Mean to You?

It probably means administrative expense, rent, insurance, taxes, etc.—unavoidable expense, other than labor and materials, that adds to the cost and decreases the profit on every article manufactured.

But to S K F Bearing Engineers overhead also means FRICTION—an invisible drag on machinery that reduces plant efficiency and cuts deep into dividends. For in the average mill, friction destroys at least 25 per cent. of all the power produced or bought.

Yet this enormous waste can be largely eliminated through the aid of our Consulting Bearing Engineers—salesmen only as they serve.

This S K F service is part of a laboratory-built ideal that seeks to co-operate with the manufacturer and furnish advice of a practical and impartial character. The fund of knowledge constantly available in the S K F Research Laboratories is applied to your particular problems in order to cut down that unnecessary and costly overhead caused by friction.

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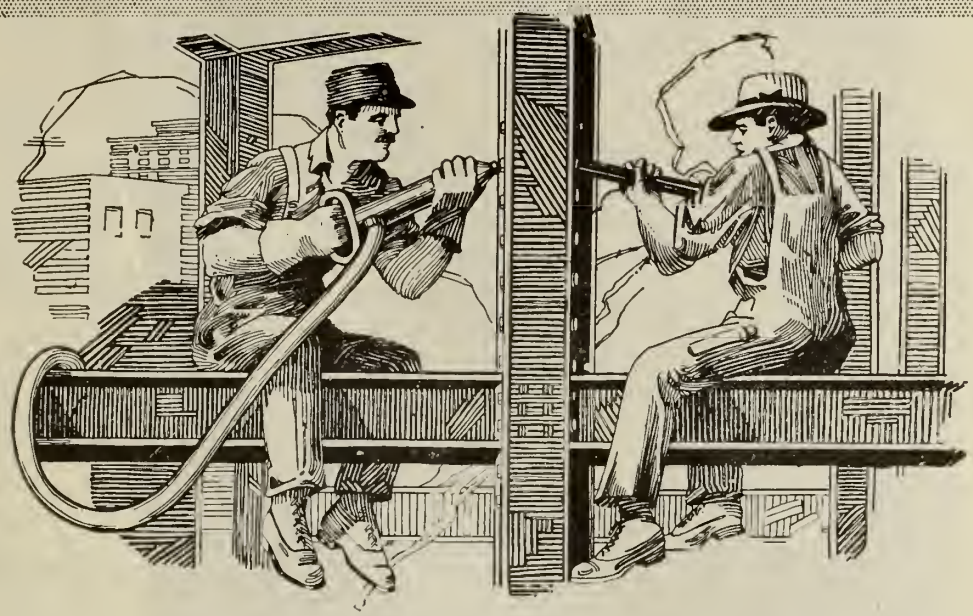


The Policy Behind the Goodyear Cord Tire Built This *Better* Hose

MORE motorists would not be riding on Goodyear Tires than on any other brand, if Goodyear scientists had been satisfied with orthodox methods of tire building.

Neither would Goodyear Industrial Hose possess the qualities that enable it to give longer, more satisfactory service, if old-fashioned methods had been followed in its construction.

Modern industry's methods were studied exhaustively to ascertain the conditions industrial hose must meet in use. Then new formulae were created, new and more exacting standards set—resulting in a better hose, capable of standing up under the severest service.

The long service given by Goodyear Air Drill and Goodyear Pneumatic Tool Hose in mines, quarries, shipbuilding yards and structural work—where it is dragged over rocks and steel girders, beaten by ore and building materials—is evidence of the thoroughness of construction of all Goodyear Industrial Hose.

The cover on any air drill or pneumatic tool hose is prominently responsible for the life of the hose. The extra-heavy cover of tough, white rubber on Goodyear Air Drill and Goodyear Pneumatic Tool Hose resists wear and greatly prolongs the life of the hose.

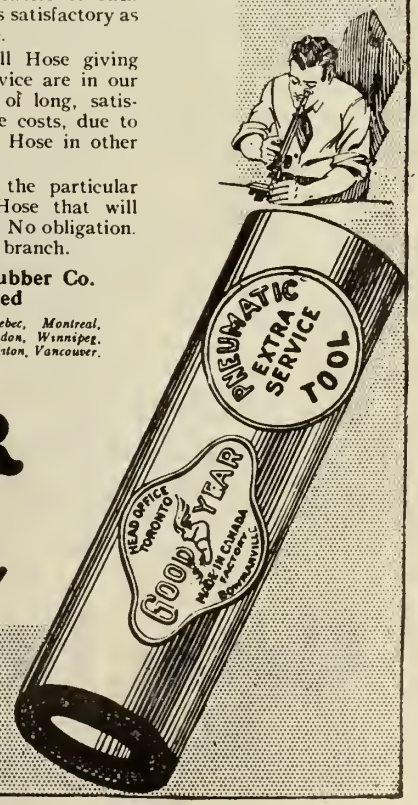
Inside this hard-wearing cover is a special, oil-resisting inner tube, and a fabric of such strength that five-ply is found as satisfactory as six or seven-ply of old-style hose.

Records of Goodyear Air Drill Hose giving from 18 months to 2 years' service are in our files. We have similar records of long, satisfactory service and lessened hose costs, due to the use of Goodyear Industrial Hose in other classes of work.

Let a Goodyear man specify the particular kind of Goodyear Industrial Hose that will lessen hose costs in your plant. No obligation. Phone, wire or write the nearest branch.

The Goodyear Tire & Rubber Co. of Canada, Limited

BRANCHES—Halifax, St. John, Quebec, Montreal, Ottawa, Toronto, Hamilton, London, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Vancouver. Service stocks in other cities.



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The unusual flexibility of P.M.S. Belts gives perfect conformity to pulleys, large or small, and is especially adapted to taper cone drives in Paper Mills —the most difficult belt test known. This unusual adaptability increases pulley contact and prevents loss of power. Where extra heavy loads are carried, P.M.S. Belts are particularly appreciated.

Conveyor Belts and Transmission Belts for All Sorts of Machinery and Conditions of Service

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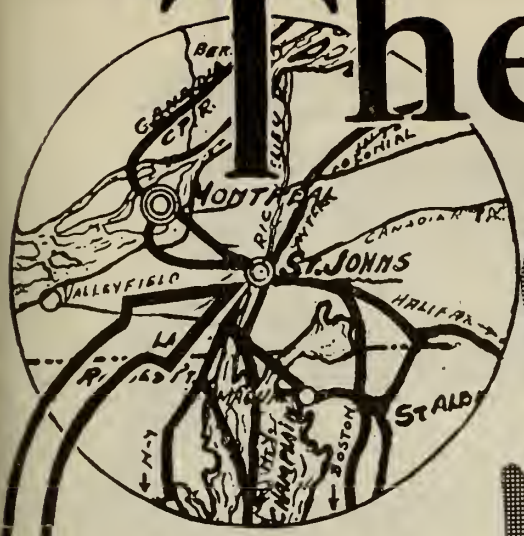

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Merits your careful investigation as a location for your new factory

Located on the Richelieu River, which is a link in the chain of canals from New York to the St. Lawrence, St. Johns enjoys the advantages of a direct water route to the Eastern seaboard of the United States and the Great Lakes.

Seven railroads, including Canada's two great transcontinental lines, run through the city and are inter-connected in the St. Johns yards by a terminal switching company at very low rates.

St. Johns is known as the cheapest labour market in Canada. Skilled and unskilled labour is plentiful and labour troubles are unknown. Cheap electric power is developed at Chambly, eleven miles north-east of the city and the excellent railway connections assure a satisfactory coal supply.

Already an industrial centre, St. Johns is rapidly expanding and now offers extraordinary inducements to encourage the establishment of new industries, such as fifteen years' exemption from taxes, period subject to extension; all public improvements required; a bonus of 5% on your pay-roll for five years. If you desire it, the city will advance this to you, to be applied to the purchase or erection of any building suitable to your purpose.

For more specific information write

The Secretary of the City Council

St. Johns, Quebec, Canada

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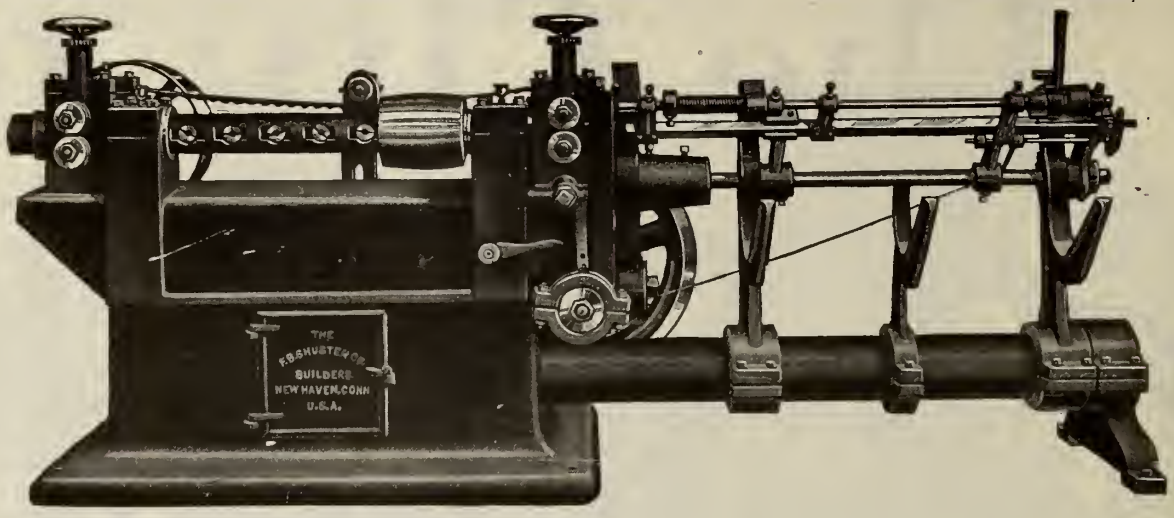

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Catalogue tells more about them, and we will be glad to send you a copy.

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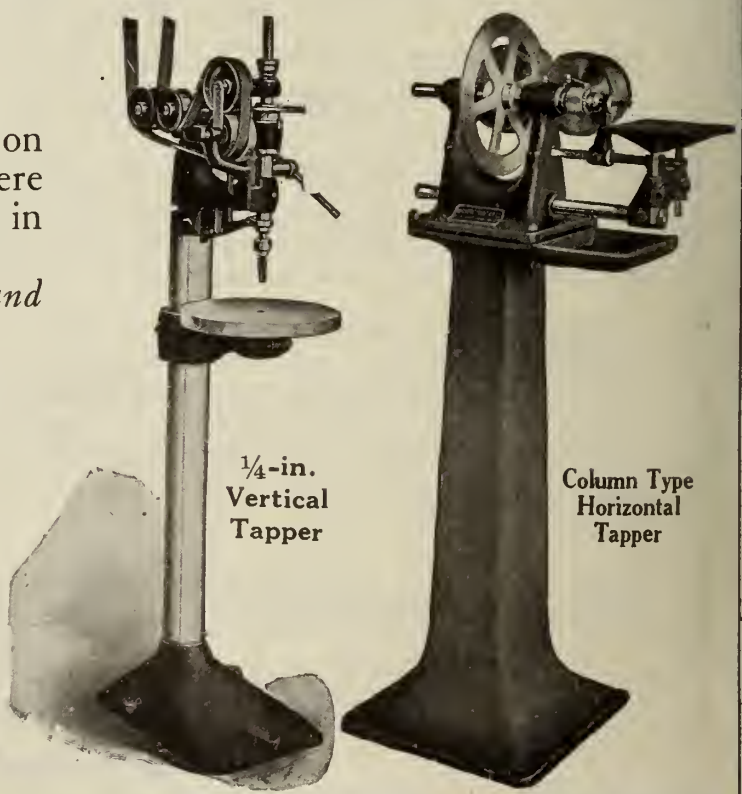
R-S Tappers ensure faster tapping and quicker assembling.

Friction drive, absorbing all the shock, allows a chuck speed of 140 r.p.m. on ⅝-in. work—50 per cent. faster than the usual tapping speed for that size. Uses but 1 h.p.



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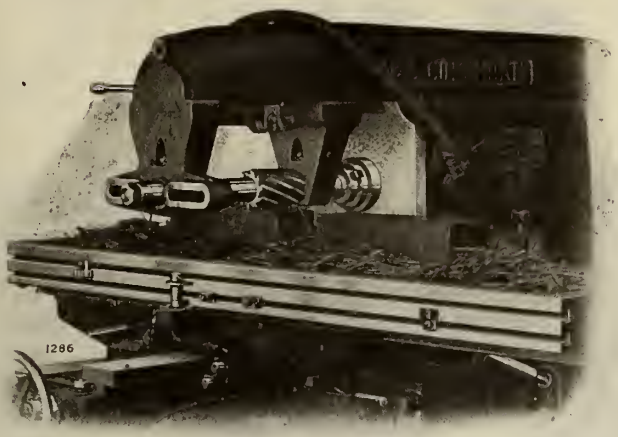

The Rectangular Overarm enables the new No. 5 Cincinnati Miller to take cuts up to its normal rated capacity without the use of braces. Ask for catalog.

Cut ¼″ deep, 5″ wide, feed 19″ per minute, removing 23¾ cubic inches of steel per minute, without the use of braces.

Material — Machinery steel; cutter 4½″ diameter, Cincinnati designed spiral mill 2″ arbor.

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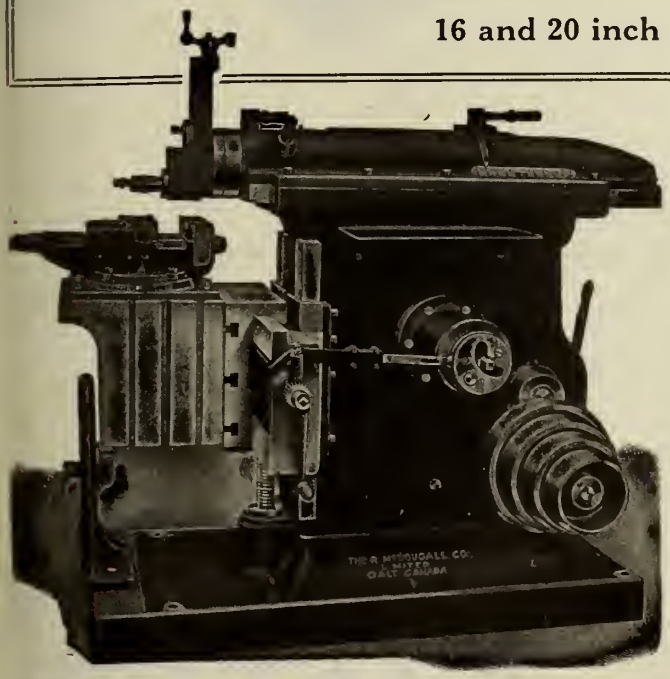
McDougall Crank Shapers

16 and 20 inch

ARE-MAC-DEE IS A GUARANTEE



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The column is massive in construction, well braced and reinforced internally. Exceptional strength is also seen in the ram, which is semi-circular in form and of box type. It can be set forward by crank conveniently arranged.

Slides are square, accurately fitted and with broad bearing surfaces.

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THE R. McDOUGALL COMPANY, LIMITED, Galt, Ont., Can.

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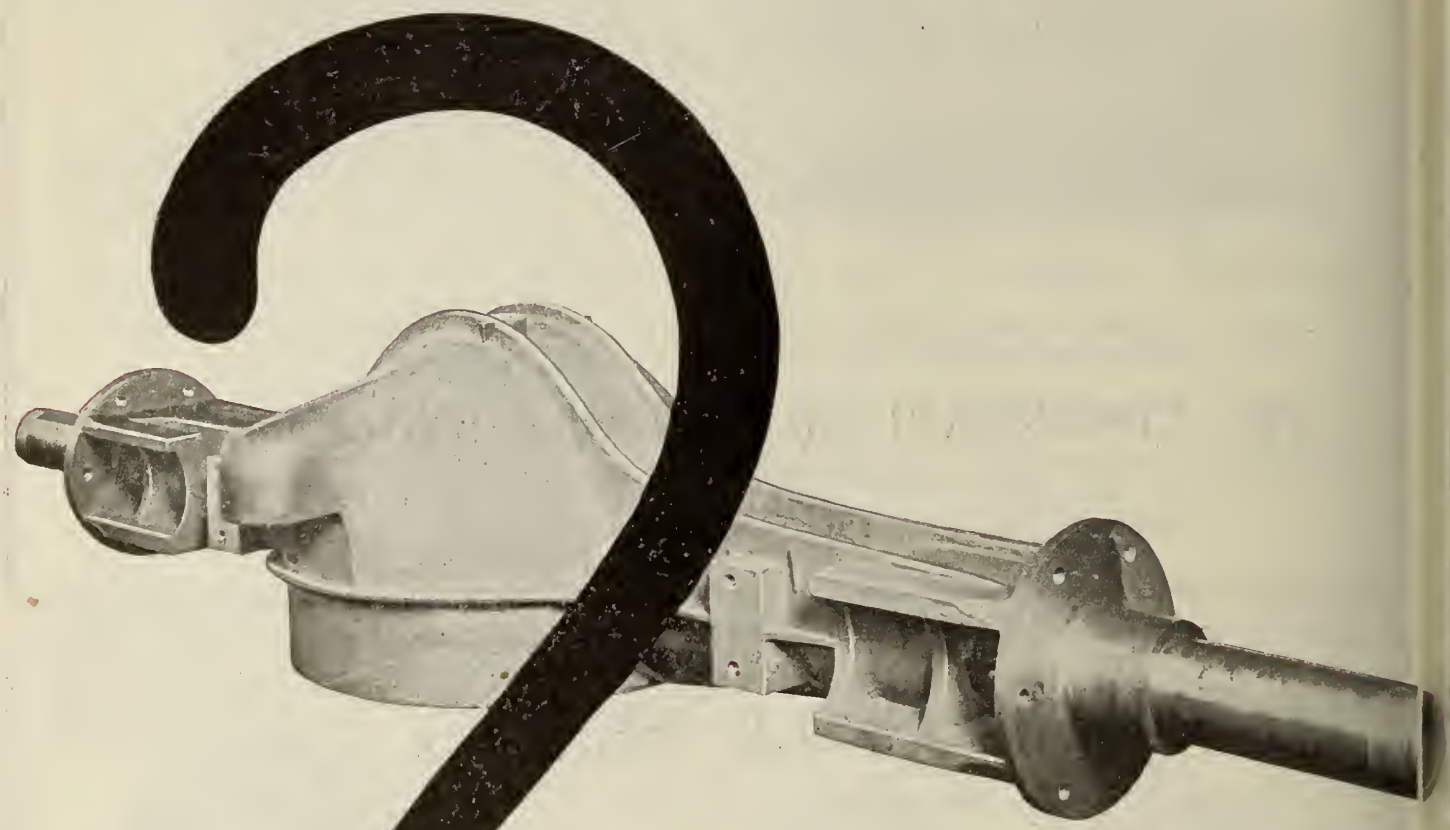
How



How to drill six holes at each end of this auto truck axle housing—and to make a pleasant showing on the credit side of the ledger.

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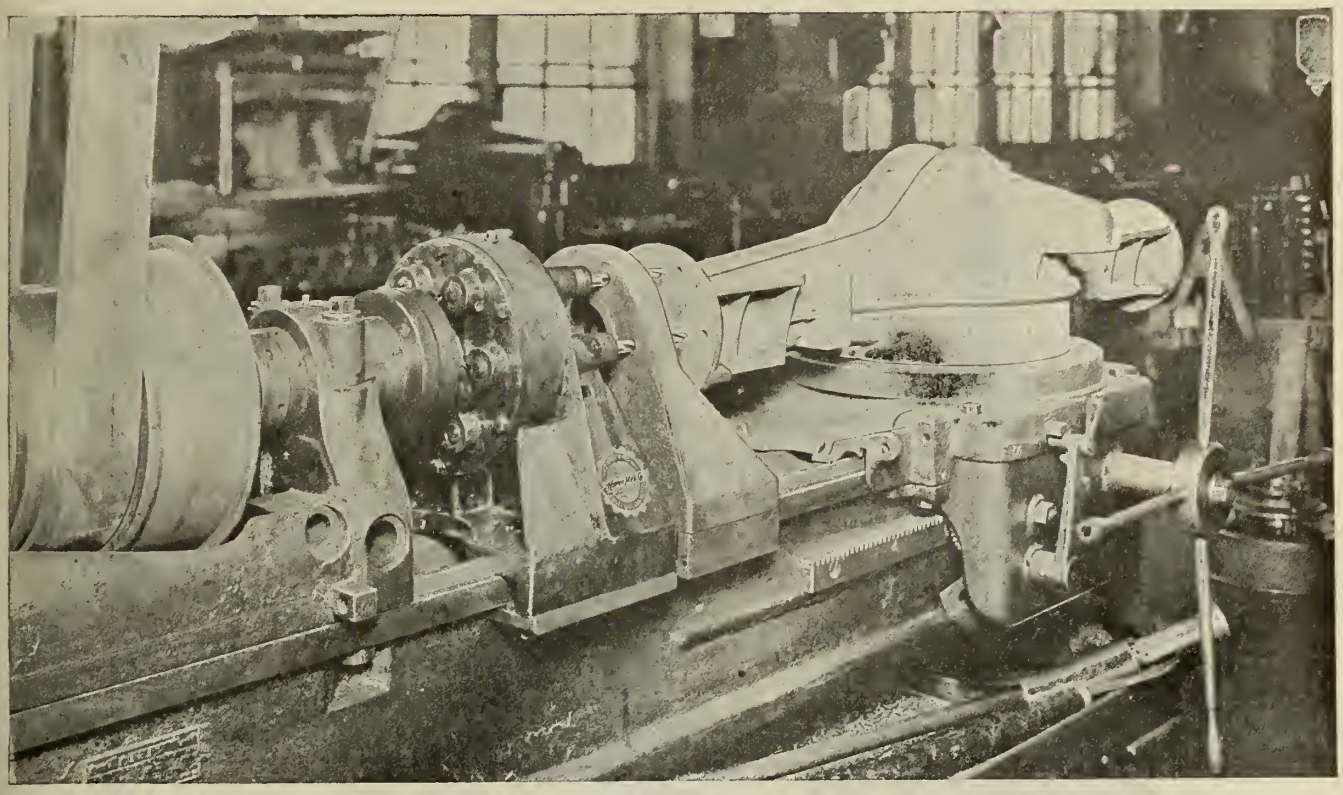

A Hoefer 6-spindle Drilling Head—an unused lathe which the foreman brought to light—a little ingenuity here and a couple of bolts there—and presto! the machine was ready for work, 6 holes at a clip.

Now you are wondering why they didn't install **two** Drilling Heads and clean up both ends of the housing at once.

For two reasons: First, the old lathe bed was too short. Second, the single head gives the output required—at an unexpected profit—for a fraction of what a complete machine tool would have cost.

Not a very complicated problem to be sure. But by solving just such problems, simple or otherwise—by studying the prospective buyer's interests and not the possible size of his order—the Hoefer Organization, through local Sales Engineers, has built up a Service that can give **you** a direct, practical answer to your drilling problems.

If you have holes to be drilled, get in touch with our nearest Sales Engineer. If he can't improve on your drilling methods, he will say so frankly. If he can, he will prove it.

M'F'G CO.
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Sales Offices for Hoefer Drillers: Boston, Factory & Mill Supply Co.; Providence, Brownell Machinery Co.; New York, F. H. Niles & Co., Woolworth Bldg.; Philadelphia, Luster-Machinery Co., 917 Arch Street; Baltimore, Aumen Machinery Co., 107 E. Lombard Street.; Syracuse, C. H. Wood Co.; Rochester and Buffalo, Ogden R. Adams; Pittsburgh, Motch & Merryweather Machinery Co.; Cleveland, Cleveland Tool & Supply Co.; Dayton, John M. Howett, 12 W. Second St.; Indianapolis, E. A. Kinsey Co.; Detroit, Cadillac Tool Co.; Chicago, Federal Machinery Sales Co., 12 N. Jefferson St.; Milwaukee, Badger-Packard Machinery Co.; Minneapolis, F. E. Satterlee Co.; St. Louis, Colcord-Wright Machinery & Supply Co.; Atlanta, Walraven Co.; Birmingham, Young & Vann Co.; New Orleans, Oliver H. Van Horn Co.; Seattle, Portland, Ore., San Francisco, Los Angeles, Eccles & Smith Co.; Montreal, Canadian Fairbanks-Morse Company (head office), for all Canada.

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MACHINE OUTPUT

The performance of a machine should be figured by the year, not merely by the hour. The expected output should properly be based on what the average good operator working with normal effort can produce in a day—not what an expert can do on a short time production "stunt."

This involves fundamentally correct design. In a grinding machine it means rigidity, power, sturdy wheel slide construction to take heavy cuts; well proportioned bearings and careful heat treatment of vital parts to insure freedom from trouble and delay. It means simple and easy operating control which assures continuous production without fatiguing the operator.

All these factors were amply provided for in the design of Norton Cylindrical Grinding Machines. The final result is a machine that has revolutionized grinding production—a consistant rapid producer of uniformly accurate work.

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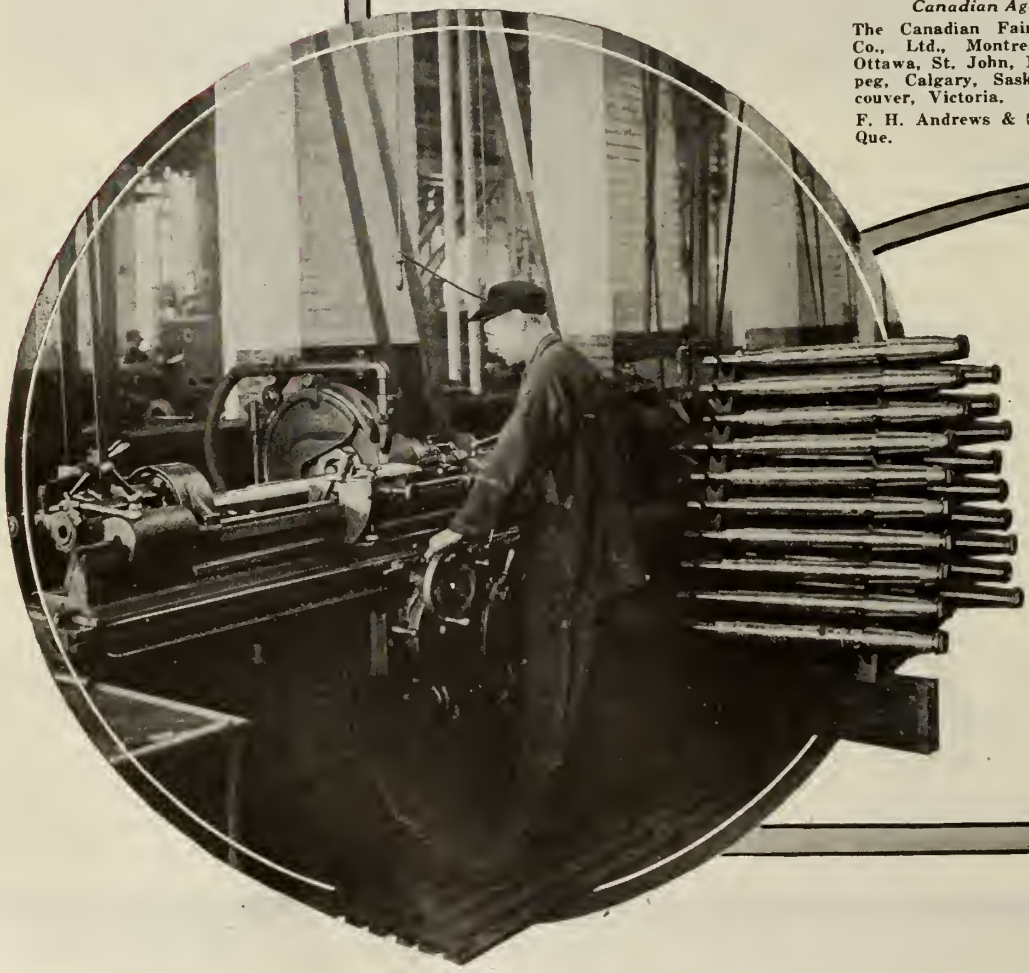

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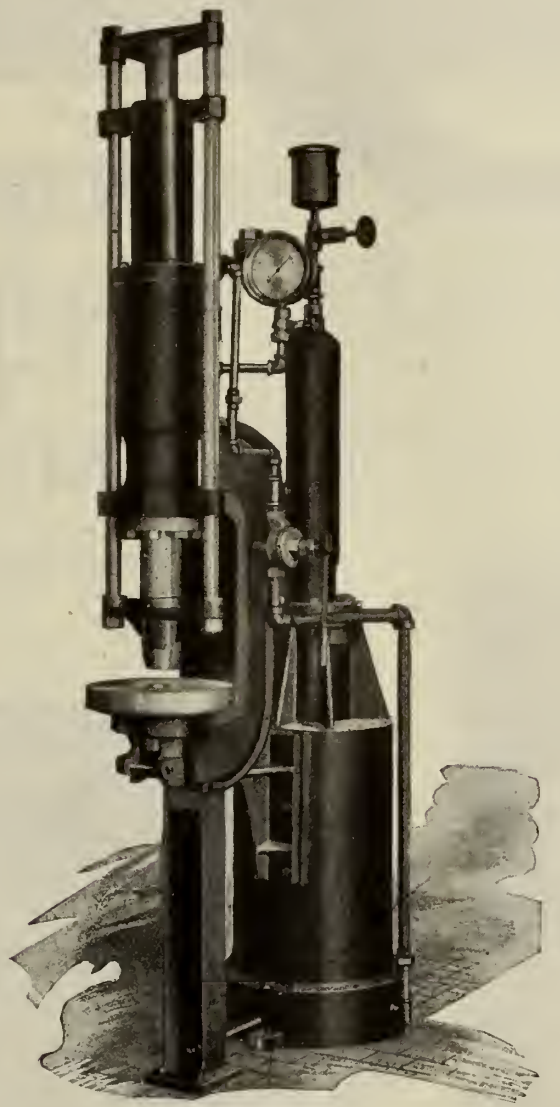
is Characteristic Always of

"METALWOOD"

DESIGNS and DEVELOPMENTS



The "Metalwood" line of these Quick Operating Hydro-Pneumatic Presses comprises a variety of styles, types and sizes.

By performance through a period of years, these presses have established themselves in a wide range of industries as standard tools for light straightening, broaching, forcing and assembly operations.

The "R-149" style press of 20-ton capacity shown here is described in our bulletin B-47.

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High Speed Hydraulic and Hydro-Pneumatic Machinery

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EXCLUSIVE SALES REPRESENTATIVES:

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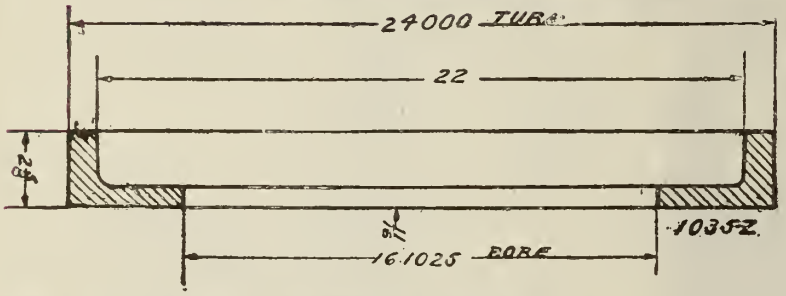
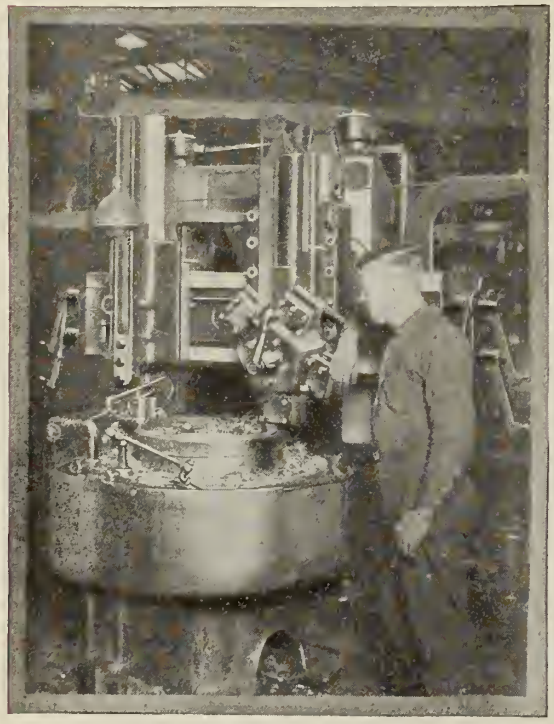
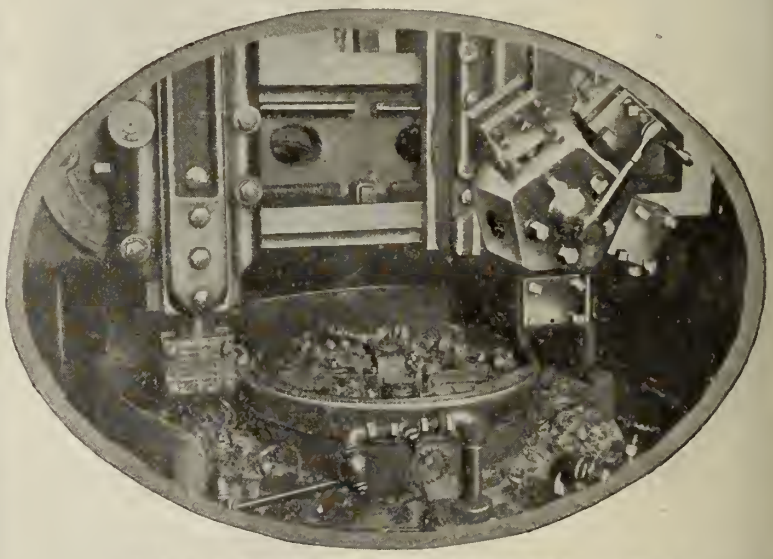
GIS



Getting 40 Minutes

First Operation 15 Minutes
2nd " 15 "
3rd " 10 "





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Imagine this 42-in. Vertical Boring Mill in your shop finishing similar work.

How would this production influence the cost of your work?

Our representative is ready to tell you how Gisholt Boring Mills will help on your work.

Don't you think that it would pay to find out whether you can better your present methods—and how much?

This service is gladly rendered without cost or obligation.

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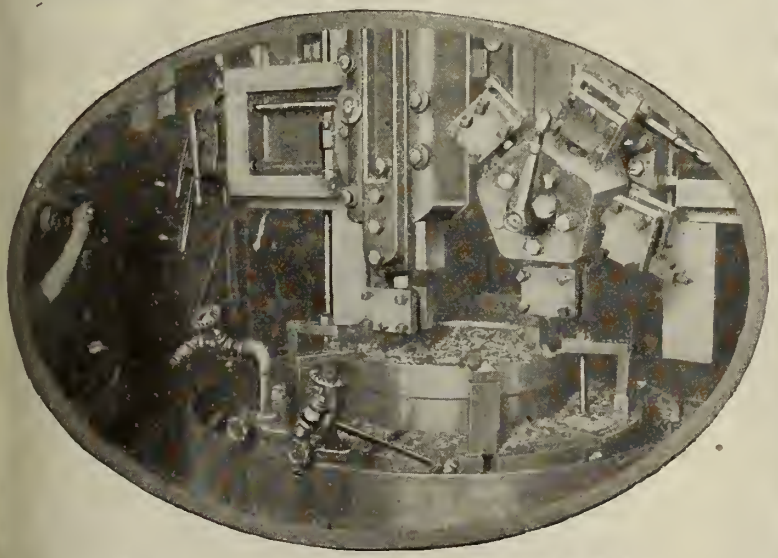
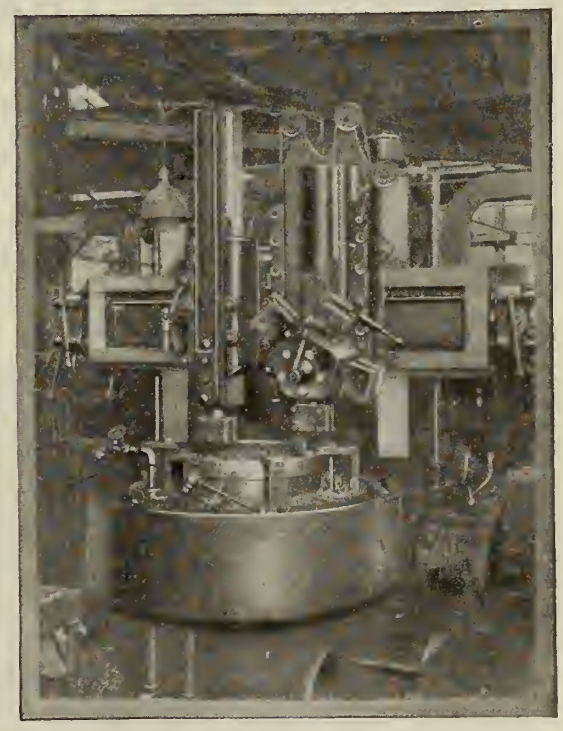
Suppose you wire or write us for an appointment.





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Turret Lathes, Vertical and Horizontal Boring Tools, Special Machinery, etc.
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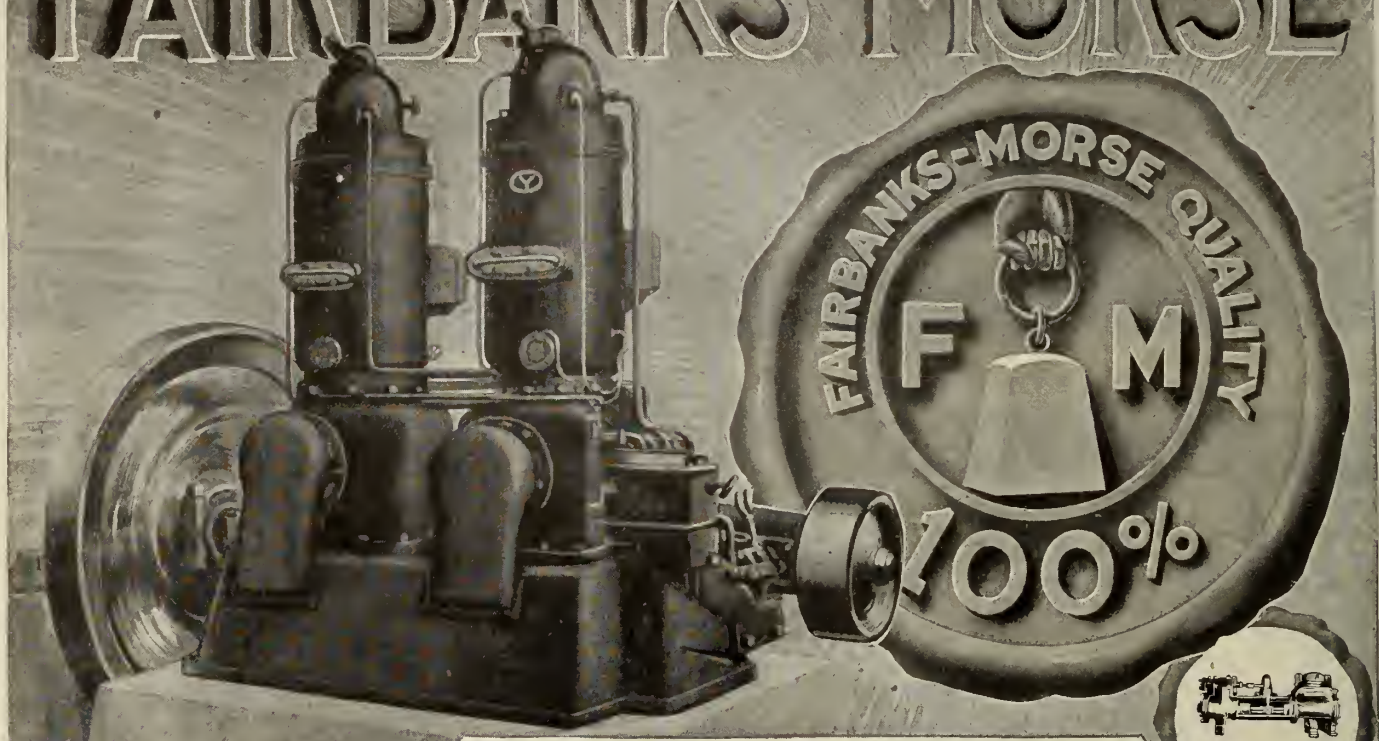

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POWER—mechanical force—harnessed, transmitted and utilized in its most economical phase—is always associated with The Canadian Fairbanks-Morse Co., Limited, whenever the modern oil engine is mentioned.

Wherever boats ply the waters the Fairbanks-Morse C-O engine is found. In the fishing boat the sturdy Type "M" does it duty. A quarter of a million farmers are helping to increase the world's supply of food with the Type "Z". In hundreds of the country's great industrial plants the powerful Fairbanks-Morse Type "Y" is furnishing the power that is speeding up production, keeping down costs, and helping the world of commerce right itself.

Saving time and labor, lowering operation cost, and giving a service that is as near 100% as possible is the record of Fairbanks-Morse engines, for behind each Fairbanks-Morse engine is that 100% quality standard on which the Fairbanks-Morse institution is founded.

Back of every Fairbanks-Morse oil engine is the service of our experts. Avail yourself of this quality and this service. Concentrate your buying and make the Canadian Fairbanks-Morse catalogue your guide.

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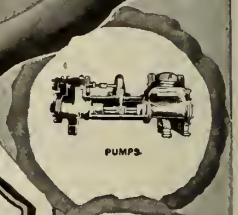
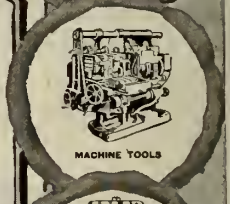
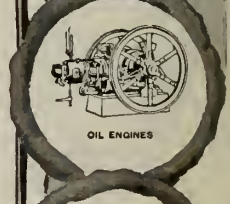






CANADIAN MACHINERY
AND
MANUFACTURING NEWS

Vol. XXIII., No. 23 June 3, 1920

Manufacturing Accurate Screw Products

Herein Is Described Portion of Plant of the John Morrow Screw and Nut Co., Ltd., Devoted to the Manufacture of Screw Products. Examples of Work, and Interesting Fixtures Are Shown.

—By J. H. MOORE

A WELL lighted factory, interesting work amid pleasant surroundings, together with adequate wages, all make up for contented workmen. This combination of conditions is not found as easily as one would imagine, but every one of the already named requisites are present and self-evident in all plants under the control of "The John Morrow Screw & Nut Co., Ltd., Ingersoll, Canada."

The factories are divided into three sections; the screw department, the drill department, and the nut department. Each section carries a factory number and for the purpose of this article we will take up the screw producing section first, this portion being known as Plant No. 1.

The first important point that impresses one on going through the plant is the construction and adequate light provided. Every corner of the various floors receives good natural light and the question of proper arrangement of artificial lighting has also been carefully attended to.

Another feature clearly noticed is the well-laid-out lines of machinery. No haphazard methods have been adopted, for each machine has been placed according to a well-thought-out plan. Sufficient aisle space has been allowed in every case, so that there is no congestion of material around the machines.

To prove our contention and illustrate how carefully the subject of machine layout has been considered let us refer to Fig. 1. This view shows a portion of the ground floor, where the cross drilling, tapping, head finishing, etc., etc., is performed. Girls operate the majority of these machines, and the well-laid-out machinery and the wide aisle space, etc., need no further comment, as all these details can be noted from the photograph.

It can be easily understood that a plant of this nature requires a considerable number of jigs, fixtures, form tools, and so on. This class of work is accomplished in the tool room and Fig. 2 illustrates a small portion of this room. Expert mechanics and first-class equipment ensure the very best of fixtures, etc., coming from the department.

Any attempt to mention the variety of work handled by this concern would be futile, so we will content ourselves by repeating what they replied to our query, "How many types of screws, etc., do you manufacture?" If it's a screw, a pin, a nut, or in fact if it's a job for the automatic or turret lathe, we can manufacture it. We are ready to manufacture all classes of milled screws, and special milled work from iron, steel, or brass."

This covers quite a large field, but of course, as can be readily be understood, they carry their standard lines of Button Head, Hexagon Head, Square Head,

FIG. 1—SHOWING A PORTION OF THE GROUND FLOOR.

FIG. 2—A SMALL SECTION OF THE TOOL ROOM.

FIG. 3—ILLUSTRATING ONE OF THE MANY LINES OF AUTOMATIC MACHINES.

Round Head, and Flat Head cap screws. Collar screws, coupling bolts, hollow set-screws, ordinary set-screws, studs, taper pin, thumb screws, etc., etc.

Screw work is generally accomplished on automatic, or semi-automatic lathes. Fig. 3 gives a good idea of the appearance of a small portion of one of these lines of machine tools. Note the accurate layout, also the quarter twist belt drive. Every variety of screw conceivable is made on these machines and one operator usually attends to a battery of machines.

Some Examples of Work

Fig. 4 illustrates an example of cap screw work on a single spindle machine. By closely looking at this picture, the finished product can be noticed, heaped up on the cross slide.

At Fig. 5 we show a Radical Multi-Spindle automatic making 9-16 in. S.A.E. plain nuts. Briefly the tooling operates as follows: The first station is that of centering. Next comes drilling part way. Thirdly, the hole is drilled the remaining distance. Now comes the chamfering and part way cut off, Last of course comes the final cut off, and setting of stock to new position. In this machine the work heads revolve and not the tooling. The production from the machine is in the neighborhood of 2,300 to 2,500 nuts per ten hours.

The example shown at Fig. 6 is that of manufacturing S.A.E. castle nuts on a B. and S. automatic. The operations consist of centering, drilling, forming and cutting off. While the cut-off tool is at work, the arm A goes down, and by means of a little jaw, picks the nut away from the bar stock as soon as it is cut off. This arm now rises, and places the nut in the castellating attachment. This attachment is operated from the wheel B partially shown in the photo. By means of an indexing cam plate, together with a small cutter, the six castellations are made in the nut, and it drops a finished product with the exception of inspection.

Fig. 7 shows a 5-spindle automatic of the plant's own make. They have quite a number of these machines in use, and it might be well to add at this point that they often make their own machinery when advisable. The work being performed in this picture is the producing of hanger set screws. These screws have 4 in. of thread, and are ¾ in. in diameter. The operations are obvious, namely, turning, forming head, and threading. Two dies are used for threading in order to ensure a perfect thread.

The next view, shown at Fig. 8, is another example of set-screw work. In this case the work is turned up part way and necking tool operated from cross slide. Next comes a combination tool which turns the balance of the screw, also points the cup end shown. Third comes the first threading die. Fourth comes the second and final threading operation, while the fifth position feeds out the stock.

Some Interesting Fixtures

It has always been the policy of this firm to simplify as much as possible their various fixtures. In place of using huge gang fixtures, they prefer to use single purpose fixtures. From experience gained they have proven this to be the best method, as the set up is simpler, the tooling is easily replaced, etc., or in other words the benefits are numerous.

Take for example the castellating fixture shown at Fig. 9. This is rigged up on a small hand miller and is almost ridiculous in its simplicity, yet wonderful in results. The fixture consists of a body A through which goes a spindle. On the end of this spindle towards the cutter is placed a jaw of similar shape to the nut to be castellated. On the other end of the spindle is placed an indexing wheel B. This wheel has six slots cut into its rim, 60 degrees apart. Directly below the wheel is a pin or spring plunger which indexes the wheel as it comes around. The idea is obvious, so no further explanation is given on this point. Note the pin at C. This is what is termed an ejector pin. On the nut being completed, the operator brings his table back until this pin hits a bracket (shown on photo). This pin then ejects the nut without the operator's hand going near it. To make sure that the nut is kept in position while being castellated, a small spring steel finger holds it securely in position. This finger cannot be seen on the photo as it is between the milling cutter and the nut.

Before installing this fixture the firm under discussion tried numerous ways to speed up production, and still get a perfect product. Gang fixtures were made and tried out, but the upkeep of cutters, and the expert set-up necessary, etc., were very objectionable features. Since having this fixture in operation, production has increased three times the former figure. On the ⅜ in. size nut

FIG. 4—A SINGLE SPINDLE AUTOMATIC ON CAP SCREW WORK

5,000 to 6,000 nuts can be castellated in a 10-hour day. High speed cutters are used, and this production figure is an enviable one indeed. It is impossible for the operator to go wrong once the machine has been set, for there is a positive stop on the side of the table to regulate the depth of cut.

Another feature of unusual note is shown at Fig. 10. This could well be called a centreless grinding machine. As can be noticed it consists of an ordinary wet grinder rigged up for a special purpose. Briefly it consists of a guide block with three strips to hold the work in position. Each of these guides are adjustable, so that any diameter within the range of the jaws can be accommodated. Piston pins, king pins, or in fact any ordinary pins without shoulders can be ground on the fixture. Various sets of jaws are made, ¼ in. to ½ in. capacity, ½ to ⅞ capacity, ⅞ to 1⅜ capacity, and so on. In the picture shown we have removed the splash guard in order to illustrate clearly the construction of the fixture.

In operation the procedure is very simple. Feed the work in at one end, and the motion of the wheel carries the work with a revolving motion to the other end, when it falls out into a box as shown. It is hardly necessary to enumerate the advantages of a fixture of this nature, for it does away with all centering operations. Over the former method of grinding these pins, on the regular type grinder, this fixture has saved the firm considerable money, as it is 500 per cent. faster.

The Oil Supply System

It might be well to touch on the system adopted for supplying and reclaiming oil. It can be easily understood that a firm of this size are large users of oils, so it is imperative that a close tab be kept on expenses of such nature, and these held to a minimum.

Underneath the floor of the plant is placed a 10,000-gallon tank of screw cutting oil, and a 12,000-gallon tank of fuel oil for the furnaces. A large tank for reclaimed oil is also placed on the roof. The new oil from the lower tank is drawn by Bowser pumps whenever necessary, but if at all possible, reclaimed oil is used.

This reclaimed oil is saved by the separating process; and Fig. 11 illustrates one of these machines.

Not only is oil reclaimed in this room, but the product, which often loses itself in the cuttings. This is especially true if the product is small. The method of procedure is as follows: The cuttings are brought in on trucks from the factory, and placed in riddles, which rest on the three bars shown on the photograph.

The workman now shakes the riddle until the finer cuttings have dropped out, when he can readily see if any of the product has been hidden in the coarser cuttings. If so, he picks them

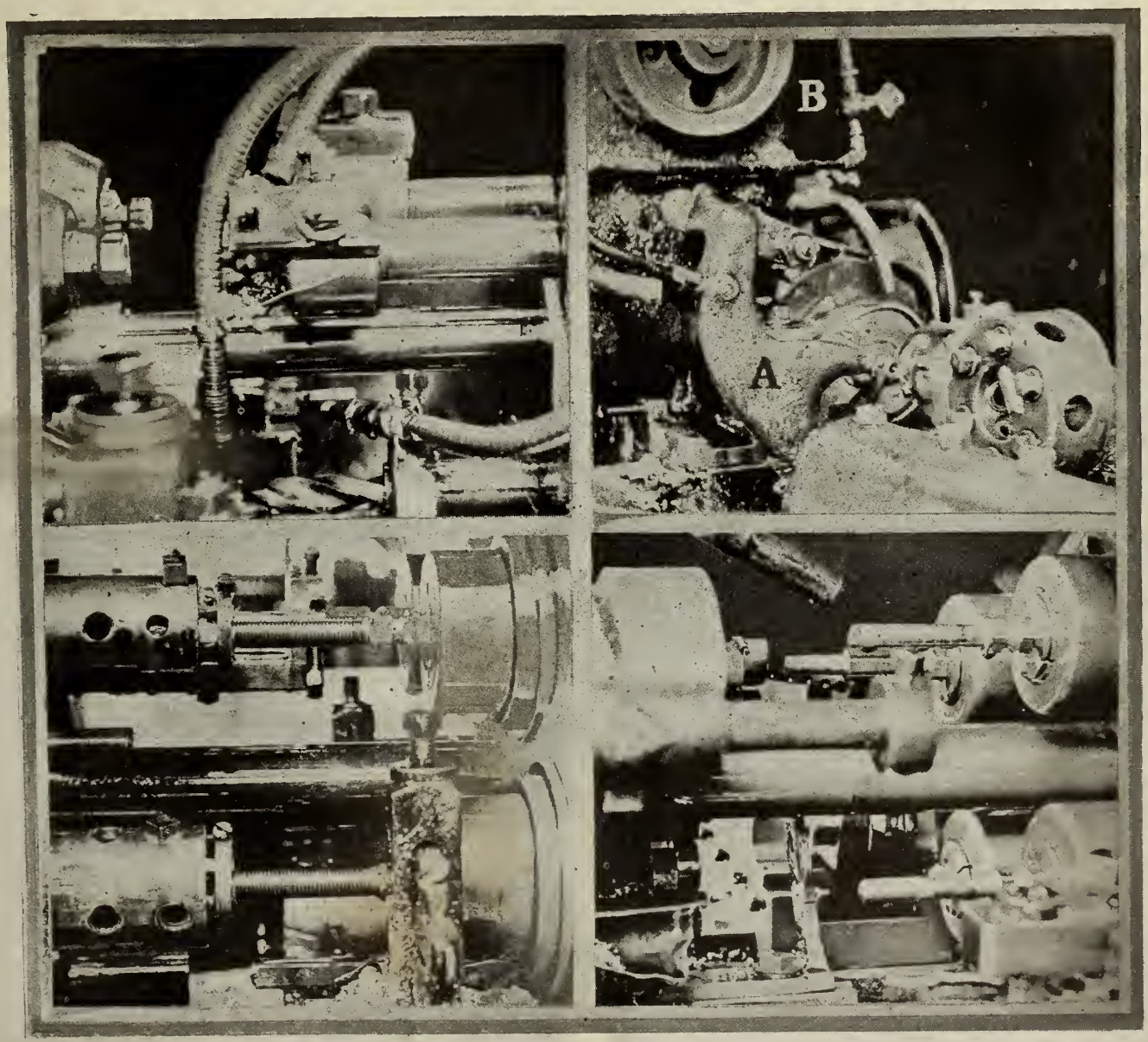


FIG. 5—UPPER LEFT, SHOWING THE MANUFACTURE OF S.O.E. PLAIN NUTS.
FIG. 6—UPPER RIGHT, SHOWING THE MANUFACTURE OF S.A.E. CASTLE NUTS.
FIG. 7—LOWER LEFT, SHOWING A FINE SPINDLE MACHINE PRODUCING SET SCREWS.
FIG. 8—LOWER RIGHT, ILLUSTRATING ANOTHER EXAMPLE OF SET SCREW WORK.

out, drops them down the chute shown at the side of main bin, where they fall into a tin pan underneath ready to be washed.

The cuttings are next piled in the separator bucket, lowered into the machine and the oil extracted. Usually two minutes completes this operation When oil has been reclaimed it is put in a tank and cleaned and purified before being pumped up into the tank on the roof. On each floor are placed Bowser pumps in handy position to the machines, and the operator can draw whatever quantity he desires. This oil comes from the upper tank by the natural law of gravity, and the arrangement described results in quite a saving, as there is practically no waste oil whatever.

Other Features of Interest

The method of storing the stock for their various products is well worthy of note. Special racks are used with spaces of about 2 ft. square. Each section is numbered and indexed as to size and length of bar. Close tab is kept of stock used, and stock on hand. In this way they know exactly where they stand, how much stock is used every month, and how much new stock is required to replenish the rack.

When an order goes out to the factory a card is filled out to that effect, and if necessary the promised date of delivery

FIG. 11—ILLUSTRATING HOW THE OIL IS RECLAIMED FROM CUTTINGS.

is marked on this card. With each order to the shop, an envelope containing a sample of the piece desired is sent out. On the envelope is stated all particulars, so that the machine operator and foreman thoroughly understand what is wanted.

For carbonizing and case hardening, this company have installed five furnaces of their own make. Fuel oil or natural gas or oil is used and the supply is drawn from the tank in the basement.

To facilitate handling the various products, tote boxes are employed throughout the entire plant. These boxes are really the old style boxes used for toting around shells so that here is a peculiar case of a war-time article used for a peace-time industry.

Double disc grinders are employed for grinding the heads of cap screws, and other similar work, and where necessary oscillating grinders are adopted for special grinding of tappets and cones.

A very handy system of loading the cuttings on cars is employed at this plant. After the oil has been separated the dry cuttings are shovelled down a chute alongside of separating machine. This chute leads to the railway siding and of course the material drops right into the cars.

In addition to the regular departments there is a plating room, where products can be plated if necessary.

Storerooms are located at variou points throughout the plant, with a view to efficiency, and they have been so arranged that the desirable condition of no lost motion has been obtained.

Another point worthy of mention is

FIG. 9—A CASTELLATING FIXTURE USED ON A HAND MILLER

FIG. 10—A NOVEL CENTERLESS GRINDING MACHINE.

the thought exercised in the planning of the different equipment. On the ground floor is placed the hand machines, turret lathes, finishing department, and inspection room. The second floor is devoted to single and multiple spindle screw machines, while the third floor is taken up by the tool room.

Inspection Department

A very important portion of the plant is the final inspection department. Of course, as can be understood, numerous sub-inspections transpire throughout the process of manufacture, but the final inspection is both important and exacting.

In this room every screw is carefully gone over and the product must be perfect before it receives the inspector's approval. The concern spoken of pride themselves on the quality of their goods, and they can well afford to, as their system of inspection is very exacting.

A clever card system is employed to keep track of work passing through the plant. A card is made out, and kept in the office. On this card is marked the order No. and the customer's name, each operation, description of piece, workman's number, kind of steel used, the weight of same, the total cost, and the number of pieces received and finished. In this way tab is easily kept on any loss of stock and the reason for the loss.

In concluding the article on the screw manufacturing portion of this plant, let us ask readers what may seem a peculiar question: "Have you ever had the pleasure of watching a college boat crew rowing their college to victory on regatta day?" If so you will have noticed the harmony and willing spirit shown by each member in the crew. The strokes were even and definite, each stroke counting in the final victory. Many a race has been lost through an uneven stroke.

From college boat races to a manufacturing plant seems like a strange jump, but the only parallel that appeared suitable to conditions existing in the plant we refer to, was the college crew. Just the same as they pull together, every employee in this organization pulls together. A very new and novel bonus system is in force throughout these plants, and the workers benefit favorably when the production reaches the maximum point. A certain production figure is decided upon, and all over that mark is divided in a very fair manner to all employees; but not to the executive staff. The writer of the article personally heard such remarks as "Hey, Jack, speed up, will you, remember it's near the end of the month." "Say, there, get a hustle on, will you, you're holding the next operation behind." There were quite a few remarks overheard, but why repeat them. These two give a fair idea of the go-ahead spirit existing, so that all we can add is, that this same spirit exists in all the plants under the Morrow management.

In our next article we propose taking you through the drill-making section, which is especially interesting.

How Should We Lubricate Ball Bearings?

Conclusion of an Article on This Subject Presented in Previous Issue. Various Tests Are Described, and the Make-up of Lubricating Greases for Ball Bearing Use Is Given.

By H. R. TROTTER

EMULSION Test.—This test gives a very definite indication of the presence of sulpho compounds in an oil (sulphuric or suphonic). There are several methods for carrying out this test, but for routine work the following method for motor oil specified by the War Department in Specification No. 3502 issued April 24, 1918, should be followed:

One ounce of the oil shall be placed in a standard four-ounce bottle with one ounce of distilled water. The mixture shall be heated to a temperature of 180 deg. Fahr. and then shaken vigorously for five minutes. After standing for one hour the oil must be clear and of the same color as before the test. All of the water must have settled and appears only slightly cloudy.

This method is simple and gives valuable indications as to degree of refinement of the oil. Highly refined oil shows a thin white line of demarcation between the oil and clear water below, thus indicating the absence of sulphuric acid compounds. Impure oil mixes permanently with water, appearing often as a curdled mass floating on milky water. The curdled portion contains what is frequently called a sulphuric acid soap, and the extent to which it is present is an indication of the quantity of the "sulpho" compounds left in the oil, due to improper refinement. Oils containing appreciable amounts of these sulphc compounds are unsuitable for ball bearings.

Heat Test.—This test is conducted by heating a small portion of the oil in a flask or beaker up to the flash point and holding it at this temperature for fifteen minutes. A comparison is made between the heater and unheated oil. Highly refined oil darkens slightly but does not deposit sediment on standing twenty-four hours. Oils that contain sulphuric acid compounds turn black and deposit carbon-like substances. Such oils are not suitable for ball bearings.

Inflammability Test.—A flash point of 300 deg. Fahr. (open cup) is the lowest limit considered safe for ordinary work, and, on installation subject to high temperatures, oils having a flash point above 100 deg. Fahr. should be used. The fire hazard is the factor to be considered in specifying the flash and fire tests.

Cold Test.—For installations running at low temperatures asphaltic-base or low-pour-test oils are recommended as this type of oil shows pour test of 5 deg. Fahr. or below, while the paraffin-base oils do not ordinarily run below 30 or 35 deg. Fahr.

Lubricating Greases for Ball Bearings

Most of the high-grade mineral oils conform quite closely to the above specifications. In connection with lubricating greases, however, the problem is more difficult. Many of the greases now on the market are entirely satisfactory for general purposes, but lack certain characteristics which experience shows to be highly important for successful ball-bearing lubrication. Tables 1, 2 and 3 show the variations to be found in a number of lubricants on the market, and it includes a sufficient number of analyses to show characteristic variations

TABLE 1—LIME-SOAP GREASES

Mark	Mineral Oil,	Neutral Saponifiable Oil, per cent.	Lime Soap (calc. as calcium oleate), per cent.	Free Lime, per cent.	Free Acid (calc. as oleic acid), per cent.	Moisture and Undetermined, per cent.	Melting point, deg. fahr.
130,849	67.23	0.42	27.18	1.53	0 05	3.56	210
131,859	84.56	0.10	10.72	0.15	0.04	4.43	190
131,860	86.35	0.32	8.76	0.09	0 04	4.44	165
131,574	88.31	1.55	8.15	0.19	0.07	1.73	103
141,537	74.04	0.95	19.13	0.21	0.03	5.64	182
142,543	74.49	2.03	17.94	0.30	0.08	2.16	170
141,544	82.00	4.72	10.72	0.03	0.07	2.46	151
132,255	65.76	5.64	21.29	0.53	0.76	6.02	202
132,254	81.62	0.56	15.85	0.20	0.14	4.65	158
141,533	78.88	1.95	17.82	0.22	1.16	2.94	157
141,535	75.46	1.11	17.82	0.37	0.51	4.73	177
143,098	83.09	1.10	13.12	0.23	0.30	2.07	174

TABLE 3—SODA-SOAP GREASES

Mark	Mineral Oil, per cent.	Neutral Saponifiable Oil, per cent.	Soda-Soap (calc. as sodium oleate), per cent.	Free alkali (calc. as sodium oleate) per cent.	Free Acid (calc. as oleic acid), per cent.	Moisture and Undetermined, per cent.	Melting Point, deg. fahr.
132,736	98.13	0.60	0.70	absent	0.05	0.52	Fluid at rm. temp.
132,738	95.02	0.32	3.69	0.01	absent	0.96	98
134,136	92.60	0.30	6.10	absent	0.06	0.94	110
135,863	53.60	28.88	5.17	absent	0.14	12.21	108

TABLE 2—LIME-SODA GREASES

Mark	Mineral Oil, per cent.	Neutral Saponifiable Oil, per cent.	Lime-Soap (calc. as calcium oleate), per cent.	Soda-Soap (calc. as sodium oleate), per cent.	Free Acid (calc. as oleic acid), per cent.	Free Alkali (calc. as sodium hydroxide) per cent.	Free Lime, per cent.	Moisture and Undetermined, per cent.	Melting Point, deg. fahr.
134,705	74.28	0.42	19.09	1.78	absent	0.014	0.65	3.76	205
134,710	77.30	...	0.71	19.76	absent	0.013	0.52	1.697	205
134,711	85.38	0.40	11.02	0.95	absent	0.002	0.13	2.118	192
134,712	90.44	0.53	6.80	0.77	absent	0.006	0.04	1.414	114
134,713	84.26	0.50	2.17	11.04	absent	0.002	0.22	1.808	160
141,536	72.82	1.20	18.42	1.88	0.57	absent	0.05	5.06	186
141,538	84.70	2.15	9.12	1.14	0.42	absent	0.40	2.43	183
141,540	78.00	3.95	14.34	1.52	absent	0.004	0.57	1.606	189

in the different types of greases available.

A large number of greases contain lime soap as thickeners, a few are of the soda-soap type, while others are a combination of both. The lime greases are valuable in that they can be used without harmful results where moisture is present. Their consistency, however, is more easily changed by heat than greases of the soda type.

Using the tests previously mentioned as a basis, we can very easily arrive at a suitable specification which will insure the production of lubricants suitable for ball bearings without putting any undue burden on the lubricant manufacturer. The following specifications are accordingly suggested:

Free acid (calc. or oleic acid), maximum, 0.10 per cent.

Free alkali (calc. as sodium hydroxide) maximum, 0.10 per cent.

Free lime (calc. as calcium oxide), maximum, 0.5 per cent.

Neutral saponifiable oil, maximum, 1.0 per cent.

Viscosity of mineral oil (minimum 200 sec., Saybolt Universal, 100 deg. Fahr.).

Abrasive particles (sand, etc.), absent.

The determination of acidity in a grease containing lime soap require special treatment and the following modification of Marcusson's method is strongly recommended:

Ten grams of the grease are carefully weighed into an extraction flask and dissolved in 88 deg. gasoline by shaking cold (it is well to dissolve cold, as by heating or boiling some of the free lime may combine with the free acid). Allow the soap to settle and pour clear gasoline solution on medium larger filter without stirring the soap; treat the insoluble soap, lime, etc., again with gasoline; thoroughly shake and allow to settle clear; pour on filter paper and when filtered wash soapy residue into filter paper and wash several times with gasoline until all soluble is washed out. Filtrate and washings are caught in an Erlenmeyer flask of sufficient capacity; the gasoline solution is slowly distilled off on electric hot plate, being careful not to carry down too far so as to break up the oils. The residue is washed into a stoppered bottle with a small amount of gasoline and 50 cc. of 50 per cent. neutral alcohol added and titrated with standard N/100 sodium hydroxide solution, shaking the mixture thoroughly after each drop of solution is added, using phenolphthalein as an indicator. By this method, the acid content can be determined within 0.02 per cent., calculated as oleic acid.

Ball bearing manufacturers are quite agreed that the limit of free acid in a grease should not exceed 0.10 per cent. calculated as oleic acid, and from the foregoing tables it is evident that there are plenty of greases available which meet this requirement.

It is essential that the grease be comparatively free from unsaponified fatty oil, or, as expressed in the analyses, "neutral saponified oil." This specification is imposed because the unsaponified fatty oil has a tendency to become rancid or develop an acidity with age in service, particularly when operating at high temperatures. We have established a limit of 1.0 per cent., and the above tables shows that this can be met in most of the compounds which are suitable in other respects.

One feature of grease lubrication which cannot be too highly emphasized is the importance of using a high-grade mineral oil conforming to the tests for purity as previously outlined. A grease may be perfect in every other respect, yet if a poor grade of mineral oil is used the life of the bearing will be shortened.

Some manufacturers take advantage of the fact that a grease made with kerosene looks much the same as one containing high-grade oil and cheapen their product by using inferior light oils. It is desirable that a highly-refined oil showing about 200 sec. viscosity Saybolt Universal at 100 deg. Fahr. be used in the ordinary grease formula

In view of the high polish necessary on ball bearings, the elimination of abrasives such as sand particles, etc., is manifestly important.

At the present time there is no generally accepted method for determining the consistency or melting point of a grease. Grease manufacturers have adopted systems of nomenclature peculiar to their product, but not directly comparable to any other manufacturer's product. In the absence of a standard test, the adoption of the method for determining the melting point described by Gillett is urged. (See "Journal Industrial and Engineering Chemistry," 1909, page 351.)

This method makes use of an open capillary tube 4 mm. inside diameter and about 8 cm. long, graduated at 1 cm. and 5 cm. from one end. The tube is stuck into the grease, and, if necessary, suction is used at the same time to draw up a plug of grease 1 cm. into the tube. The tube is then attached with a rubber band to a thermometer so that the grease plug is beside the bulb. The thermometer and tube are immersed in a beaker of water so that the bottom of the tube is 5 cm. below the surface of the water, and the water is heated at a rate of 3 to 4 deg. per min. When the melting point is reached, the plug, which is under a pressure of 5 cm. of water, slides upward in the tube.

By itself this test means very little, but when made in conjunction with a complete analysis of a grease it enables one to check up the uniformity of the manufacturer's product on various lots of the same grade and gives some idea of the temperature under which the grease will operate. The melting point as determined above is dependent upon the nature and amount of soap, oil, and water in the grease as well as the processes used in combining the various constituents of the grease.

It is also desirable to keep the free-lime content of the grease down to a minimum as any excess detracts from the lubricating qualities of the grease. Experience indicates that 0.5 per cent. is a desirable limit. In some of the greases that the author has examined, small lumps of free lime were discovered to be distributed throughout the grease.

The highest-grade ball-bearing greases are put through a milling process after compounding. This treatment insures very intimate mixing of all constituents and pulverizes any chance impurity to an impalpable powder. It is strongly re-

commended that all greases for ball bearings be so treated.

Graphite as a Lubricant

Graphite, despite its unctuous qualities, cannot be regarded as a true lubricant. It can, however, be used with success in plain bearings as it fills in the interstices in the bearing surfaces and allows the true lubricant to operate efficiently. A modern well-made ball bearing with mirror-like finish has, however, practically no interstices in the balls and raceways. A perfectly finished ball shows no scratches when magnified 100 diameters, and, furthermore, were there irregularities present graphite would not eliminate them as there is considerable difference between the sliding action of a plain-bearing and the rolling action of a ball bearing.

Graphite, moreover, has a tendency to pack in the ball retainers and raceways, and a bearing which has been lubricated with graphite grease generally has a distinct wavy appearance in the ball paths. A recent brief test of a grease containing graphite revealed the fact that while the graphite did not pack in the raceways, and the wavy ball paths were absent, the complete raceway presented a burnished appearance quite different from that obtained by the use of ordinary greases. The graphite packed hard in the ball retainer and could not be removed by dipping in gasoline.

The use of graphite in ball bearings cannot, therefore, be regarded as beneficial, and its application is purely a question of economics. Its use in ball-bearing automobile transmissions and rear axles is advisable only if the increased efficiency and life of the gears offset any possible harmful effect on the bearings.

Analysis of Lime-Soap Greases

The procedure for analyzing lime greases is not a simple one and the following suggested form may prove of interest. The ordinary constituents of a lime grease are:

(a) Mineral oil
(b) Saponifiable oil
(c) Free lime
(d) Free fatty acid
(e) Moisture
(f) Soap.

} Original state.

Determination of Total Fatty Matter.—Weigh 10 grams of the grease into a 250-cc. extraction flask, add 50 cc. water and 5 cc. of hydrochloric acid. Boil on hot plate for one hour or until the soap is completely broken up. Make sulphuric ether extraction, leaving:

(a) Mineral oil
(b) Neutral saponifiable oil
(d) Fatty acid.

} Second stage

Determination of Total Acidity.—Add 50cc of neutral alcohol, heat under reflex condenser for fifteen minutes to dissolve fatty acids and titrate with standard alkali using phenolphthalein as indicated. The standard alkali used in the titration is calculated to oleic acid which gives a total of fatty acids combined as soap and free fatty acids existing in the grease, leaving:

(a) Mineral oil
(b) Neutral saponifiable oil.

} Third stage.

Determination of Neutral Saponifiable Oil.—To the contents of the flask from the above determination, add 25 cc. of standard alcoholic caustic potash solution and boil under reflex condenser for two hours. Titrate the excess of caustic potash with standard hydrochloric acid and calculate the number of milligrams of caustic potash used up by the neutral saponifiable oil. The neutral saponifiable oil is then calculated from the saponification number, leaving

(a) Mineral oil } Fourth stage.

Determination of Mineral Oil.—Add 10 cc. of standard alcoholic caustic potash solution to the contents of the flask used in the previous determination and boil under reflex condenser for one-half hour. Cool and make petrolic ether extraction. Ether extract contains the mineral oil.

Determination of Ash Content. — Weigh 10 grams of grease in a platinum dish. Burn to ash over gas burner. Residue may contain lime, lead, sodium, sand, potassium, silicates, iron, aluminum, mica, tac, or mineral filler. Weigh residue and add hydrochloric acid. Heat and filter. Residue contains sand, silicates, mica, talc, etc. The filtrate contains iron, aluminum, calcium, sodium potassium, etc., and should be made alkaline with ammonia, then boiled and filtered. Residue is iron and aluminum. Filtrate contains calcium, sodium, and potassium. Add excess of ammonium oxalate to filtrate, and filter. Residue contains lime in form of calcium oxalate, filtrate contains sodium and potassium.

While the bases used in the soap may be determined by the usual chemical methods as indicated above, microchemical methods are quicker and more delicate for qualitative tests and in some instances the latter method represents the only practical means of determining very small amount of the bases used. Chamot in his book on Elementary Chemical Microscopy gives a complete and detailed account of the methods to be used in microscopic analysis.

It might be of interest in this connection to examine the microphotographs of various greases, and for that purpose Fig. 10 is given in which A shows the crystals of calcium sulphate obtained from a lime-soap grease; B crystals obtained from a soda-soap grease; C crystals obtained from a lead-soap grease, and D crystals obtained from a potash-soap grease.

In conclusion, the author would like to point out the need for further investigations to obtain data so that lubricating-grease specifications may be standardized. The lubrication problem is essentially a chemical problem and we should welcome the assistance of the chemical societies in this matter.

For the purpose of clearing away the debris in the headings of a tunnel being constructed in California, steam navvies worked by compressed air are being used. The tunnel, 3¼ miles long, is for a hydro-electric scheme, has a section 17ft. by 17ft., and is driven largely in solid granite. The shovels have dippers of 21 cubic feet capacity on 13ft. booms, and, on the average, clear away the 150 cubic yards of rock brought down at each blast in eight hours.

FIG. 10—MICROPHOTOGRAPHS OF VARIOUS TYPES OF GREASES.

Locomotives for Use in Norway and China

This Data Will Be of Particular Interest to Our Railroad Readers, Who Will More Than Likely Compare the Specifications of These Engines With Those of American Practice.

DURING the past year, says "Engineer," the Baldwin Locomotive Works of Philadelphia, Pa., U.S.A., has continued to construct a large num-

This locomotive trade, which was tives for export. This trade, which was well on the road to development before the war, received a considerable impetus during the general dislocation, when America was one of the most important suppliers in meeting the requirements of the Allies for this class of product. Since then the trade has continued at a brisk level, and during 1919 the Baldwin Works turned out for foreign buyers both engines built in accordance with their own practice and also to the specifications and designs of the purchasers.

In Figs. 1 and 2 are illustrated two such locomotives recently completed. The first is a 4-6-0 type superheater locomotive for the Norwegian Trunk Railway, while the second (Fig. 2) is a 4-6-2 locomotive for the Peking-Mukden Railway, China. The former locomotive follows in a general way American practice, while the latter follows European practice to a greater degree.

The Norwegian engine is one of two built for passenger service. The average weight on each driving axle is 16 tons, and the tractive force exerted, calculated on 85 per cent. boiler pressure, is 26,300 lb. The ratio of adhesion is approximately 4. The boiler pressure is 170 lb. per square inch, and the cylinders are 22.05 in. by 23.62 in. stroke. The boiler has a comparatively short barrel, the length of the tubes being 12 ft. 6 in. The frames are of the bar type, of cast steel, and the fire-box is placed above them, and between the driving and trailing wheels. This gives a box rather wider than is possible in European practice, but a good deal narrower than modern American practice. The grate, however, is 26.4 sq. ft., which is ample for a boiler of this size. The tubes and fire-box are of steel. The crown sheet is arched and radial-stayed. The coupled wheels are equalized. Driving and crank-pins have been heat treated. The pistons are of cast steel. The weight of the reciprocating and revolving parts has been reduced as far as possible. The valve motion is of the Walschaert type, controlled by screw gear. The equipment of these locomotives include the vacuum brake, with auxiliary hand brake, speed recorder, mechanical lubricators, etc. The cab is arranged so that it can be entirely closed in, and will be seen to afford the men good protection. The tender is six-wheeled, with one pair of wheels in horn-blocks and the other two in a diamond-frame bogie. The following are some of the leading particulars of these engines:

Engine—	
Gauge	4 ft. 8½ in.
Cylinders	22.05 in.x23.62 in.
Valves	9½ in. (piston)
Wheels, driving	63 in.
Wheels, bogie	38.9 in.
Boiler barrel, diameter	62 in.
Fire-box, length	90 in.
Fire-box, width	42¼ in.
Fire-box, thickness	
Side sheet	⅜ in.
Back sheet	5-16 in.
Crown sheet	⅜ in.
Tube sheet	½ in.
Water space, front	4 in.
Water space, sides and back	3 in.
Tubes	1¾ in. and 5 in.
Tubes, 1⅞ in., number	146
Tubes, 5 in., number	24
Tubes, length	12 ft. 6 in.
Heating surface, fire-box.	141 sq. ft.
Heating surface, tubes	1,279 sq. ft.
Heating surface, total	1,420 sq. ft.
Superheating surface	343 sq. ft.
Grate area	26.4 sq. ft.
Working pressure	170 lb. per sq. in.
Wheelbase, driving	12 ft. 6 in.
Wheelbase, engine	24 ft. 9 in.
Weight on coupled wheels.	47.8 tons
Weight on bogie	9.7 tons
Total engine weight	57.5 tons
Tender—	
Tank capacity	3,450 U.S. gals.
Fuel capacity	3.5 metric tons
Engine and tender	
Wheelbase, total	45 ft. 2 in.
Weight, total	90 tons

The 4-6-2 engine for China (Fig. 2) is a fairly large one, and is designed to inaugurate a new passenger service of heavy trains on fast schedule. This engine develops a tractive force of 26,800 lbs. (at 85 per cent. boiler pressure), and, as the weight of the driving wheels is 43.15 tons, the adhesive weight is fully utilized. The frames are of the plate type. The fire-box is of steel. A superheater of 24 elements is provided. The fire-door is operated by compressed air. The valve gear is of the Walschaert type, with screw reversing gear. The pistons are of cast steel. The coupled wheels are equalized. Further particulars are given tabulated below. The tenders for these locomotives have been built in the shops of the railway company, from material furnished by the Baldwin Locomotive Works:

Engine—	
Gauge	4 ft. 8½ in.
Cylinders	20 in. x 26 in.
Valves	11 in. (piston)
Wheels, driving	66 in.
Wheels, bogie	37½ in.
Wheels, trailing	43 in.
Boiler barrel, diameter	68 in.
Fire-box, length	90 3-16 in.
Fire-box, width	66¼ in.
Water space, front	4 in.
Water space, side and back	3½ in.
Tubes	2 in. and 5⅜ in.
Tubes, 2 in., number	172
Tubes, 5⅜ in., number	24
Tubes, length	19 ft.
Heating surface, fire-box.	146 sq. ft.
Heating surface	2,343 sq. ft.
Heating surface, total	2,489 sq. ft.
Superheating surface	559 sq. ft.
Grate area	41.4 sq. ft.
Working pressure	200 lb. per sq. in.
Wheelbase, driving	11 ft. 8 in.
Wheelbase,	31 ft. 9 in.
Weight on coupled wheels.	43.15 tons.
Weight, bogie	19 tons
Weight, trailing wheels	14.5 tons
Total engine weight	76.65 tons
Tender—	
Tank capacity	6,000 U.S. gals.
Fuel capacity	8½ tons
Engine and tender—	
Wheelbase total	59 ft. 9 in.
Weight, total	128.12 tons

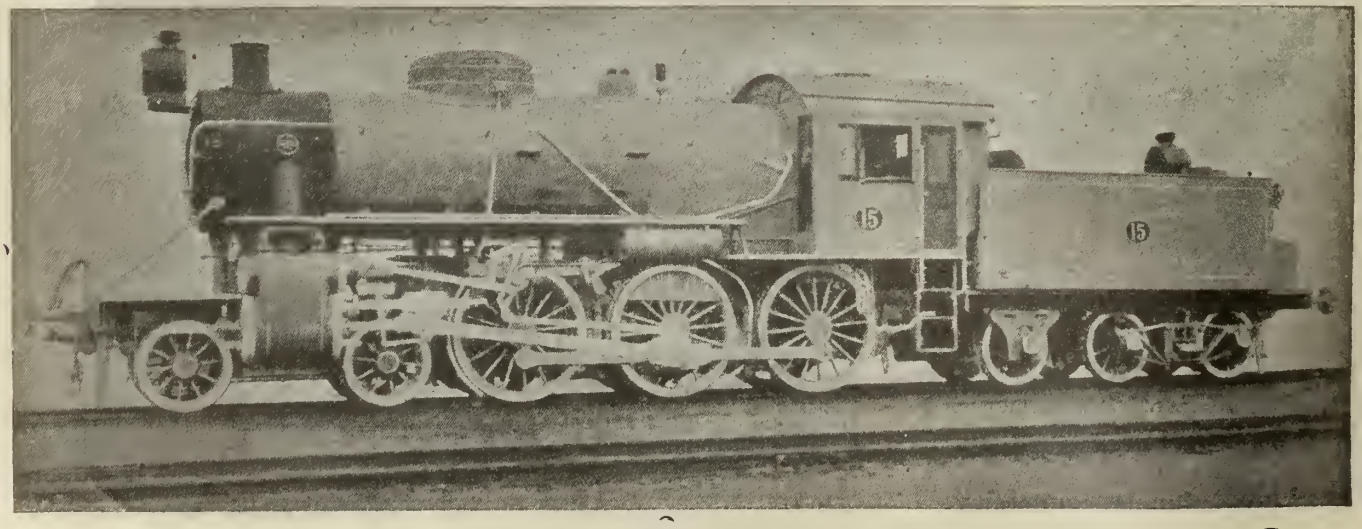


FIG. 1—4-6-0 TYPE SUPERHEATER LOCOMOTIVE FOR THE NOWEGIAN TRUNK RAILWAY.

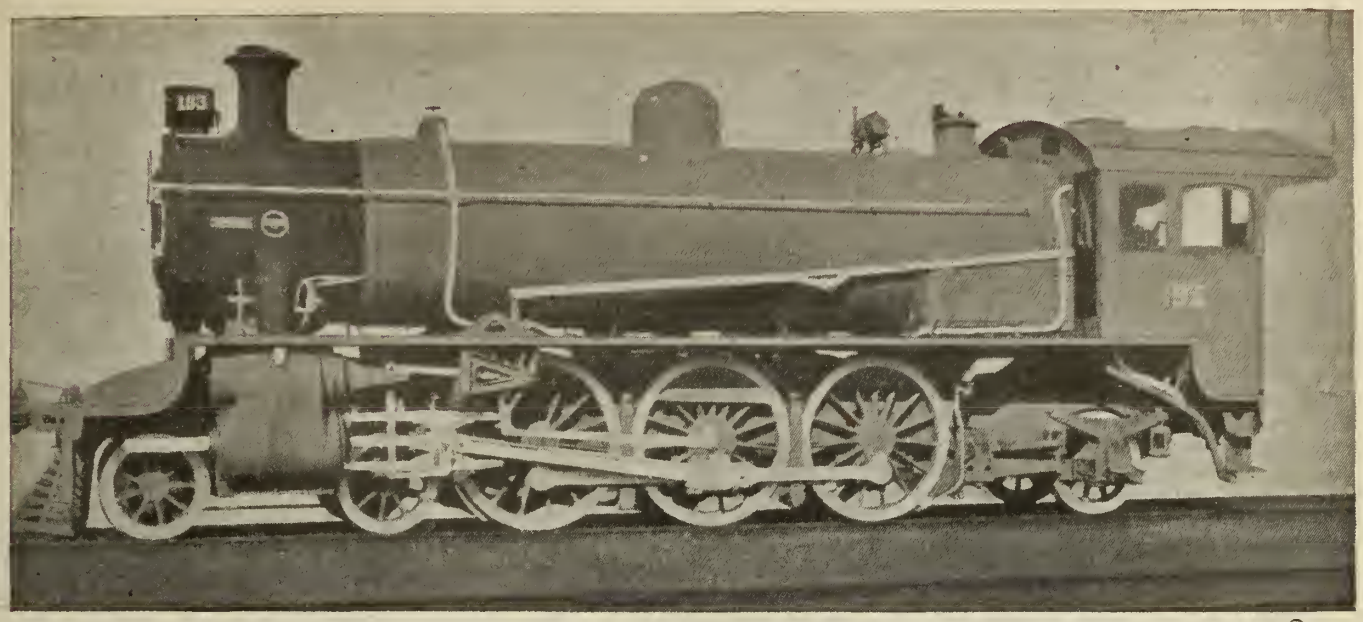


FIG. 2—4-6-2 TYPE LOCOMOTIVE FOR THE PEKING-MUKDEN RAILWAY, CHINA.

How Many Sizes of Shafting Should We Have?

IN ANSWER to the above query, the American Society of Mechanical Engineers recommend that fourteen sizes of transmission shafting be used. The committee of this society devoted to War Industries Readjustment, state that an immense amount of steel is continuously tied up in manufacturers' and dealers' stocks of shafting and that a corresponding amount of cast iron is also held in stock in the form of hangers, bearings, couplings, collars, bushings, pulleys, etc. At the suggestion of the chairman of the committee on War Industries Readjustment, a committee was formed to investigate the subject of the standardization of shafting sizes. The personnel of the committee is as follows: Cloyd M. Chapman, chairman; George N. Van Derhoef, Hunter Morrison, Louis W. Williams, and Russell E. Nelles.

This committee was confronted with two distinct but closely related problems, namely, standardization of the diameters of shafting used for transmission of power, such as lineshafts, countershafts, etc., and the standardization of the diameters of shafting used by machinery manufacturers in making up their product. The first of these problems seemed to be the simpler of the two. While a large number of sizes of transmission shafting are now listed and stocked, it was believed that comparatively few of these are in extensive general use. Accordingly, a letter was sent to thirty-six of the largest manufacturers and dealers in transmission shafting asking for statistics on the consumption of each size of shafting handled by them. About twenty of the largest concerns in the industry furnished complete statements of their sales over periods of time chosen by themselves. These data were reduced by the committee to a uniform basis of percentages. The amount of each size sold was expressed as a percentage of the total sales, both on a weight basis and on a lineal-foot basis. From these data, plotted in the form of a diagram, it was evident which of the sizes were popular and generally used and which were more rarely called for. A tentative list of twelve sizes was prepared from this diagram and sent to forty-six other dealers in transmission shafting and shafting supplies, from whom twenty replies were received.

In the letters to these firms, the committee expressed the opinion that the custom of using shafting 1/16 inch under the unit sizes is so firmly and so nearly universally established in this country, that it would be unwise to attempt to adopt sizes in even inches and fractions as standard. It was pointed out, also, that certain sizes stand out pre-eminently as "popular sizes" and that others are sold in relatively small quantities. It therefore seemed feasible to reduce the number of sizes now listed by the trade from fifty or sixty down to twelve or fifteen.

The response to these letters was practically unanimous in opinion. The transmission shafting users and dealers approved the plan of standardization, and the sizes suggested were generally approved except that the diameters 1 11/16 inches and 2 3/16 inches were in many cases requested to be included. After due consideration the committee decided to include these two sizes in the original list, making the fourteen sizes now adopted as standard.

Shafting Sizes Used in Machine Design

The second problem was a more intricate one. The number of sizes now produced by the rolling mills for use in machinery is very large. Almost every sixty-fourth of every inch up to three inches is drawn. If a reasonable number of these sizes could be eliminated or classed as "specials" and a comparatively few sizes selected as standard or stock sizes, a great saving would be effected. In order to get the opinion of leading consumers of shafting for machinery purposes, the committee decided to lay the plan before 225 large consumers of this material. It was explained that it was not intended that the adoption of certain sizes as standard should make it impossible to secure any other size required on special order.

In the case of machinery shafting the users were equally unanimous in their approval of the plan to standardize sizes, but recommendations as to size intervals varied greatly. However, these recommendations, in so far as they were definite and specific enough, were tabulated and a diagram constructed showing the relative popularity of the various size increments for each inch of diameter.

With these data accumulated and sifted down to usable form, the committee felt that it was in a position to present its information and preliminary deductions to representatives of other interested organizations. Accordingly, invitations were issued to twelve societies and associations requesting them to consider the proposed lists of standard sizes and to appoint representatives to confer with the committee before its report was finally formulated. The seven organizations listed below responded, and the standard sizes which follow have the unanimous approval of these representatives and, as far as can be learned, of their associations: American Hardware Manufacturers' Association; American Railway Engineering Association; American Supply & Machinery Manufacturers' Association; National Association of Manufacturers of U. S. A., National Association of Purchasing

Continued on page 530

Interesting Tool Set-Ups for Turning of Pistons

—By J. H. Moore

IN the production of any kind there are always different methods of accomplishing results. Some swear by some series of operation, while others might be inclined to pooh-pooh the very method adopted and approved by the first enthusiast.

It is this striving after maximum production that is responsible for the modern machine tools that are on the market to-day, and one might add that this struggle after production has been in reality a blessing in disguise, for it has brought out tool equipment of such ingenious construction as to be almost unbelievable.

One field that has benefited considerably is that of concerns turning out pistons of any nature. In the old days the method of producing pistons was to laboriously turn up the product by means of a single tool on an ordinary lathe, Sometimes the lathe was none too good, with the result that the piston was almost round. The fitting of such pistons created splendid amusement (?) for the erecting department. Conditions, however, have changed since those days when anything was good enough, and to-day the demand is not only for speed, but for accuracy.

Believing that readers would be interested in the description of a rapid method of producting pistons, we have secured data on one of the systems used by the Jones & Lamson Machine Co., on their Fay automatic lathe. If not familiar with this style machine, a glance at Fig 1 will give a good idea of its general construction.

The Actual Operations

The main feature in the description to follow is the simplicity of the tooling, the small number of operations, and the performing of the operations automatically wherever possible, thus allowing the use of unskilled labor.

The casting on coming from the foundry is set over a centering mandrel in a sensitive drill press and centre drilled true with the rough core, drill being guided by a bushing. The skirt, or open end of piston, is not finished at this time, as it will only have to be done over again after roughing out, owing to the distortion in "seasoning." It is held sucarefully for rough turning, true with the core without holding by the skirt.

The piston should be provided with a large boss as shown, so that a deep, heavy centre can be used. It is a good plan to take heavy cuts and several of them at once, and a small centre hole is not sufficient for such a procedure. The next operation is to mount on expanding and centering air operated mandrel lathe as shown at Fig. 2. The outer end is held in place by air operated tailstock, as shown in photograph at Fig. 1.

In Fig. 2 the three plungers A centre the open end of piston with the core, while the closed end is centered by the dead centre B, drilled true in the first operation. The inner end of the core stops against plug C, giving a uniform thickness of wall to the piston head. Driver D engages the wrist pin lugs and gives a positive drive. The piston is thus centered on the core, stronogly supported and strongly driven by a fast operating air mechanism. One air valve operates both mandrel and tailstock.

The rear tool holder feeds in radially and carries facing tool E, rough ring grooving tools F and oil groove tool G. Tool H faces the open end. The front carries the three turning tools J which feed in to depth on an angle as shown by the arrow and divide the rough training between them.

As many tools J are used as are needed to complete the turning in the time it takes tool E to face the end. In other words the piston is completely roughed out over its entire exterior surface in the time it takes to face the end only. The benefit of this arrangement is self-apparent.

Third Operation

The wrist pin holes are now rough drilled in a jig which centres on the rough turned exterior, stops against the rough faced end, and lines up by the bosses on the inside. This operation completes the removal of the bulk of the material and of the scale.

The next, and fourth operation is that of annealing, for this is the logical time to anneal. With scale and material removed, there is the best possible chance to eliminate all strains and remove every chance for future distortion. It is somewhat objectionable to remove the pistons from the machine department to an outside heat-treating shop, but this may not be necessary. A modern, continuous feeding automatic furnace can be installed in the shop, right in the production line. Suitable heat insulation and forced ventilation will make this arrangement comfortable even in hot weather.

Now comes the proper time to finish face and bore the skirt or open end. With strains removed and stock roughed off there is no danger of further distortion. This skirt finishing is done in an air chuck as shown in Fig. 3. The back arm moves in the direction shown by the arrow, so that tool A first rough bores, then tool B finish faces. The rough facing was done by tool H in Fig. 2. The front carriage carries only the finish boring tool C, unless it is desired to break or bevel the corner, in which case a tool D shown in dotted lines is added for the purpose. At the conclusion of the cut the tools both front and back withdraw, without scoring the work, to a point which leaves plenty of room to remove the work.

In this operation the work is held by the outside diameter and stopped on the face of the closed end. Since these surfaces were made true and of even dimensions with the core in Fig. 2, the finished bore skirt will also be true and of the proper dimensions with the core, and may therefore be used from now on for locating the piston. Being held with the skirt projecting well beyond the jaws, there is no distortion from the chucking.

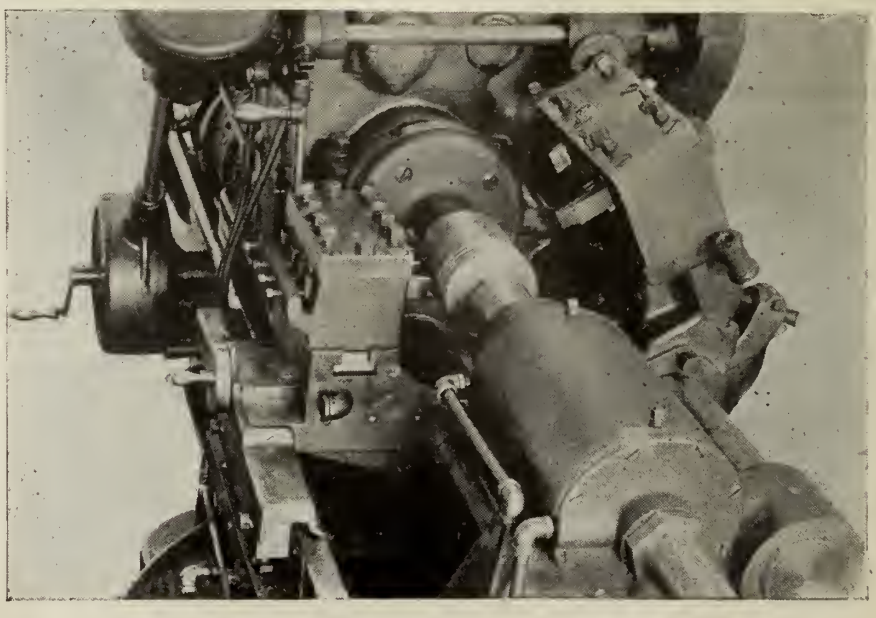


FIG. 1—A VIEW OF MACHINE FROM THE TOP.

Sixth Operation

Finish turning complete comes next. The piston is now seated on a hardened and ground plate on the spindle, and held there by a floating centre in the quick-acting tailstock. The centre has a ball thrust, and is made floating to obviate the necessity for re-centering true with the skirt. This method has been found to be as accurate as holding by draw-rod and loose wrist pin, it avoids the loose piece, and is much more rapid in operation. The drive is by equalizing driver D, engaging the wrist pin lugs. In this operation there are three tool holders, as shown in Fig. 4. The front and back holders are tooled about the same as in Fig. 2. There is an additional grooving attachment carrying tools for grooving the rings. This attachment is strongly supported on the tailstock casting and is operated by the forward movement of the carriages.

In the grooving attachment, tools H give a second roughing cut to the piston grooves. In the rear holder tool A finish faces the end of the piston and tools B finish the ring grooves. In the front carriage tools C, three of them, finish turn ready for final grinding. It will be noticed that with this arrangement the ring grooves are given three cuts in all, permitting great accuracy in the finished surfaces. The complete finish turning, grooving and facing operations are also completed in the time it takes to face down the end only. The ring grooves, as will be noted, are finished on centres, eliminating all end play of spindle. This of course goes to produce a perfect gas seal, making it entirely unnecessary to go to the engine lathe for a final grooving operation.

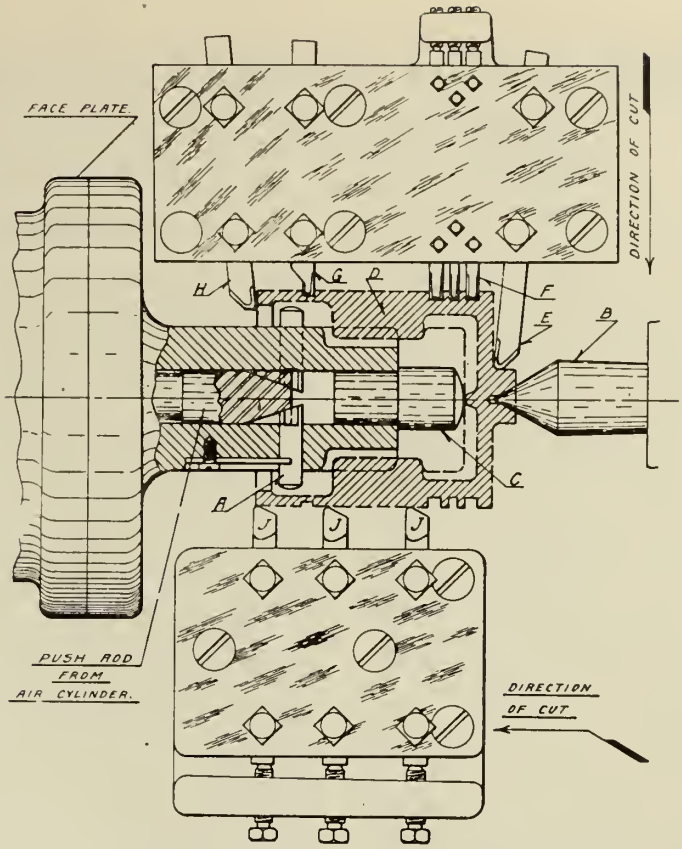


FIG. 2—FACING, ROUGH GROOVE, AND OIL GROOVING OPERATION.

The piston next has the wrist pin holes finished and then goes to the drill press for miscellaneous drilling of oil holes, etc. The centre boss is next sawed off in a hand mill, and finished off on a disk grinder. Some firms remove it entirely by disk grinding. It is now ready for the final grinding, which is done on a face plate, holding by the draw-rod and a loose wrist pin. This operation being completed, the piston is ready for the rings to be fitted.

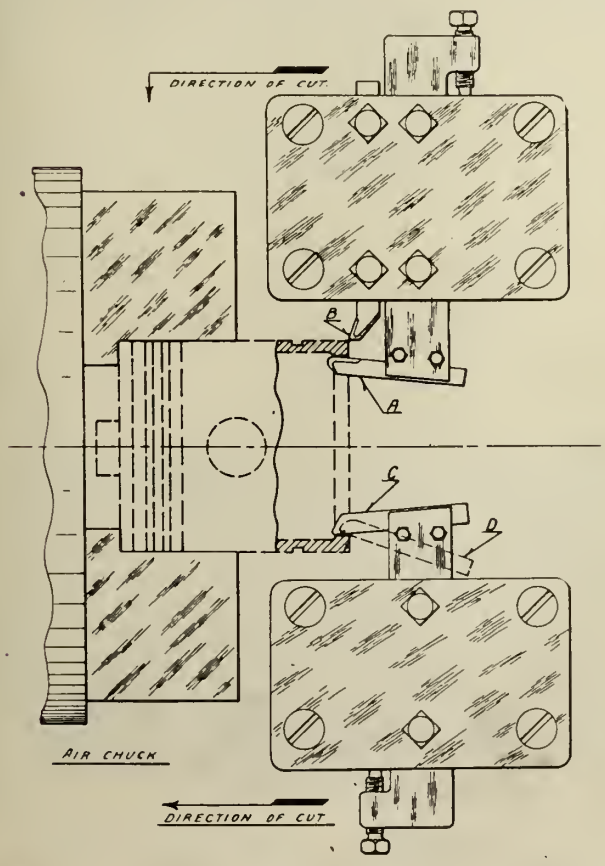


FIG. 3—THE SKIRT FINISHING OPERATION.

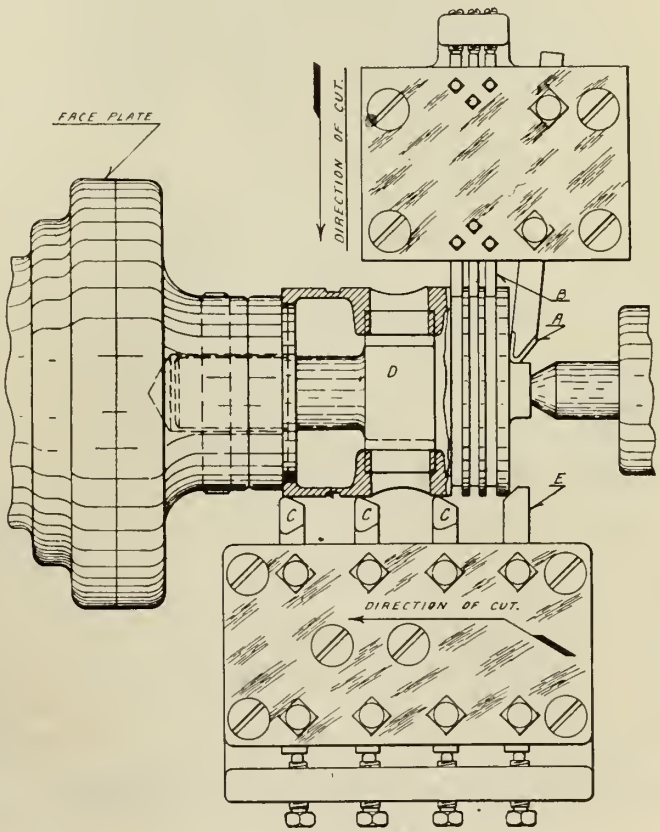


FIG. 4—THE FINISHING OPERATION.

Friction and Spreading Forces in Rolling Mills

The Subject of Friction Losses Is One of Considerable Importance and the Author, Who Is Director of the Bureau of Rolling Mill Research, Is Well Fitted to Speak on This Question.

By W. B. SKINKLE

THE need of accurate knowledge of the forces acting on rolls and the friction losses on roll necks in different types of rolling mills has prompted the author to respond to the editor's request for an article with a description of a device soon to be tried out on the experimental mills of the Bureau of Rolling Mill Research at the Carnegie Institute of Technology.

By means of this equipment it is expected that experimental data will be secured which will give positive, accurate knowledge, not only of the relative values of the various lubricants and bearing metals used on roll necks, also of the spreading forces acting on the rolls; from which the stresses in rolls and housings may be calculated to a far greater degree of accuracy than is at present possible.

The device consists of two hydraulic supporting cylinders marked Cylinder No. 1 and Cylinder No. 2 in Figs.1 and 2, located in the bottom of the roll-housing window and so arranged that they can easily be removed and replaced by a filler.

The carrier for the bottom roll rests on the plungers of these cylinders in such a manner that the forces acting on the roll neck are recorded by the resulting hydrostatic pressure in these cylinders.

In Fig. 1 is a diagram showing the arrangement of these cylinders and their relation to the rolls. A bloom is shown between the upper and lower rolls with the lower roll carrier and cylinders. The full lines indicate the position of this carrier under static conditions (condition of rest). The conditions existing at the neck of the lower roll are greatly exaggerated for the purpose of illustration.

The total spreading force F, due to the bloom being pinched between the rolls, will cause a heavy force P to be applied, about as indicated in Figs. 1 and 2. Under static conditions this force would be transmitted from the body to the neck and would be applied to the bearing as indicated by the arrow A in Fig. 1. Such an application of forces would cause one-half the load P on each bearing to be carried by cylinder No. 1 and the other half by cylinder No. 2.

The proportion of the total force F which is distributed to each neck of the rolls will depend on the location of the pass in the roll body and can readily be figured by the well-known principles of beam reactions.

Where rotation starts, and the bloom is being rolled, the point of contact between roll neck and bearing changes to some other point, the force P is then applied to the bearing as indicated by the dotted arrow B, and the lower roll carrier has a tendency to assume a position indicated by the dotted lines, using the roller C as a fulcrum point; the roller D lifting off its seat. The position indicated by these dotted lines in Fig. 1 of course is greatly exaggerated for the purpose of illustration. It is vitally important, however, that the bearing be perfectly free to rotate as indicated, and that no forces other than cylinders Nos. 1 and 2 be interposed to prevent this rotating tendency. (In actual practice it is expected that not more than 0.003 in. or 0.004 in. of movement will be obtained on these cylinders between no load and their maximum carrying capacity of 250,000 lb. each).

When the contact point has moved to a place where it slides back as rapidly as it tends to climb, the angle of sliding friction has been reached and a condition of equilibrium is again established. These conditions are shown and analyzed in Fig. 2. The pressures on the supporting cylinders will no longer be equally distributed, as in the case of static conditions, but will be much heavier on cylinder No. 1 than on cylinder No. 2.

Analysis of Conditions

In the analysis of these conditions the following symbols will be used:

P=Total resultant force on the roll necks in pounds.

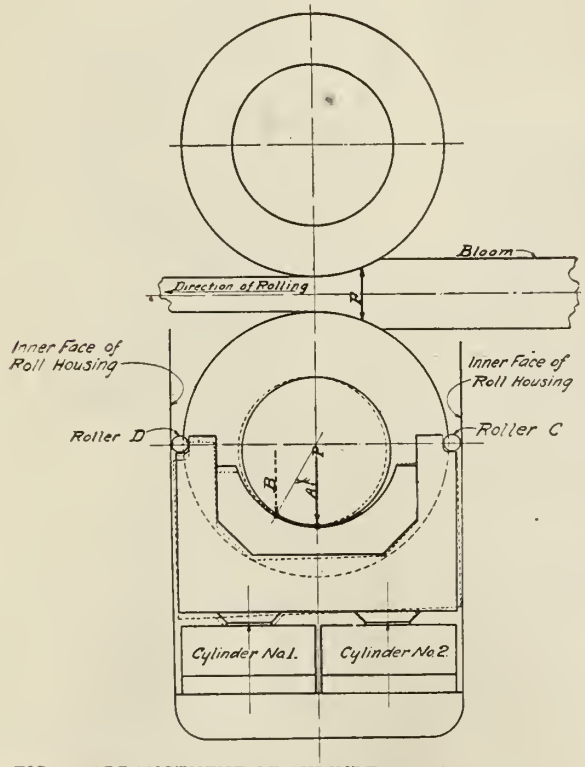


FIG. 1—ARRANGEMENT OF CYLINDERS AND THEIR RELATION TO THE ROLLS.

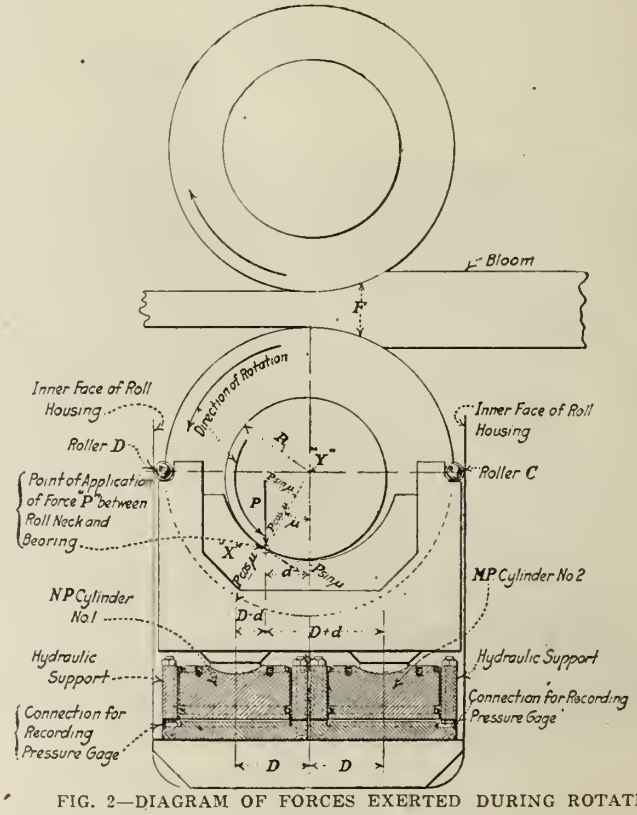


FIG. 2—DIAGRAM OF FORCES EXERTED DURING ROTATION.

R=Radius of the roll neck in inches.

U=The angle whose tangent is the coefficient of friction.

D=Distance from centre line of roll housing to centre line of supporting cylinder.

d=Distance from centre line of roll-neck bearing to the point of contact between the neck and bearing.

N=Some fraction of P greater than ½.

M=Some fraction of P less than ½.

If equilibrium in a "free body" is maintained the following conditions must be met:

1. The sum of all horizontal or vertical forces acting on the body must be equal to zero.

2. The sum of the moments of all forces acting on the body taken about any point must equal zero.

Fulfilling the first condition, as applied to the vertical forces on the lower roll neck bearing, we have $-P+N\ P+M\ P=0$, whence $N\ P+M\ P=P$. Cancelling the P's we have

$$N+M=1$$

This shows that for each increase for over half the total load carried by cylinder No. 1 there is a corresponding decrease in the load carried by cylinder No. 2 and that the sum of the pressures on cylinders Nos. 1 and 2 must be equal to the force P. This same fact can be shown by taking moments about the point x where the roll neck applies its load to the bearing. In this case the force P has no lever arm. Its moment would therefore be zero, and it may be neglected. Taking moments about x we have

$$+N\ P\ (D-d)-M\ P\ (D+d)=0$$

which expands into

$N\ P\ D-N\ P\ d-M\ P\ D-M\ P\ d=0\ldots[1]$

Taking moments about Y the centre of the roll neck we have

$-P\ d+N\ P\ D-M\ P\ D=0\ldots\ldots[2]$

The foregoing is true only if the hydraulic support cylinders are frictionless. If these hydraulic cylinders were of the ordinary hemp-packed plunger type the results obtained would be almost useless as the friction of the packing on the plunger would be very large and the exact amount of this friction would be very difficult if not impossible to determine.

It will therefore be necessary to produce a frictionless hydraulic support cylinder. This, the author believes, has been practically obtained in the cylinder shown in Fig. 3. While it is recognized that no machine can be absolutely frictionless, this cylinder so nearly approaches this ideal state that for all practical purposes it may be considered as frictionless.

The cylinder consists of an upper guide cylinder A securely bolted to its base B by sixteen ¾-in. bolts G. The base, which is really the cylinder proper, has a groove 9¼ in. inside diameter cut into it. The centre portion of the base is then faced off to allow just a film of fluid not over 1-16 in. in thickness to act on a special stretched-steel diaphragm C, which is securely held in place by the friction between the parts A and B of the cylinder and is made tight on its lower side by a soft lead gasket. By this means the fluid is completely confined in the cylinder, the only escape being through the orifice leading to the recording pressure gage. The plunger D does not come in contact with the fluid in the cylinder but rests on the upper side of the steel diaphragm C. These contacting surfaces must be very flat and true.

In order to avoid friction between the plunger D and the side walls of the guide cylinder A the plunger is turned ⅛ in. smaller in diameter than the guide cylinder on its upper parts, and 0.005 in. smaller in diameter where it rests on the diaphragm.

In order to prevent lost motion or the plunger from tilting and shearing the diaphragm, and further to prevent the plunger from getting "off centre" and having a rubbing contact with the cylinder walls, two rings of fifty-six ½ in. diameter steel balls each, marked F, are provided.

The inside diameter of the guide cylinder A is ground to as nearly a perfect circle as possible and the grooves for the balls are ground and polished to an accurate fit.

When the plunger moves downward due to the application of a load these steel balls tend to lift off their seats and establish a rolling contact between the plunger and cylinder walls.

The only friction on this cylinder is the friction of these ball-bearings, the internal friction of the steel in the diaphragm and the friction of the fluid in the pipes leadng to their recording gages. These quantities are so small when compared with the maximum load of 250,000 lb. which each cylinder is designed to carry, that they may be neglected.

The displacement of fluid by the plunger when under load is equally small. Marks' Mechanical Engineers' Handbook, page 251, gives the following information: "A pressure of 1 lb. per sq. in. compresses liquids in volume as fol-

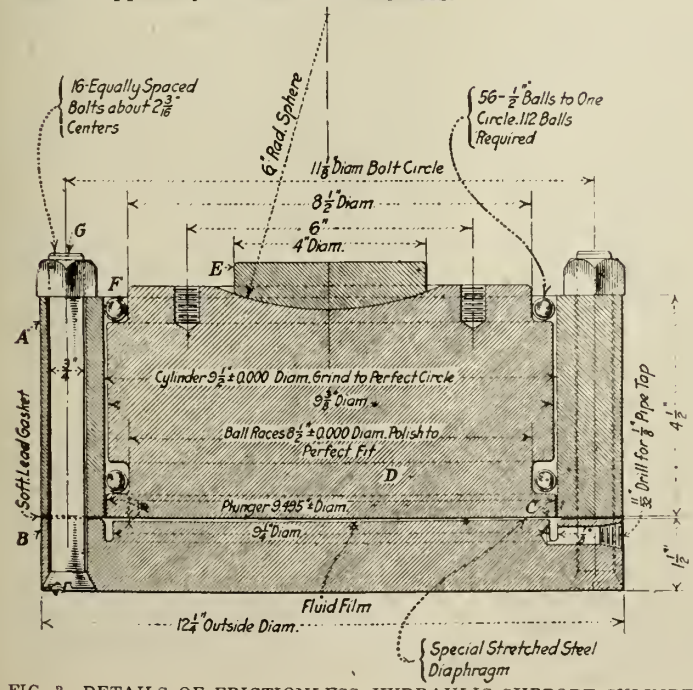


FIG. 3—DETAILS OF FRICTIONLESS HYDRAULIC SUPPORT CYLINDER

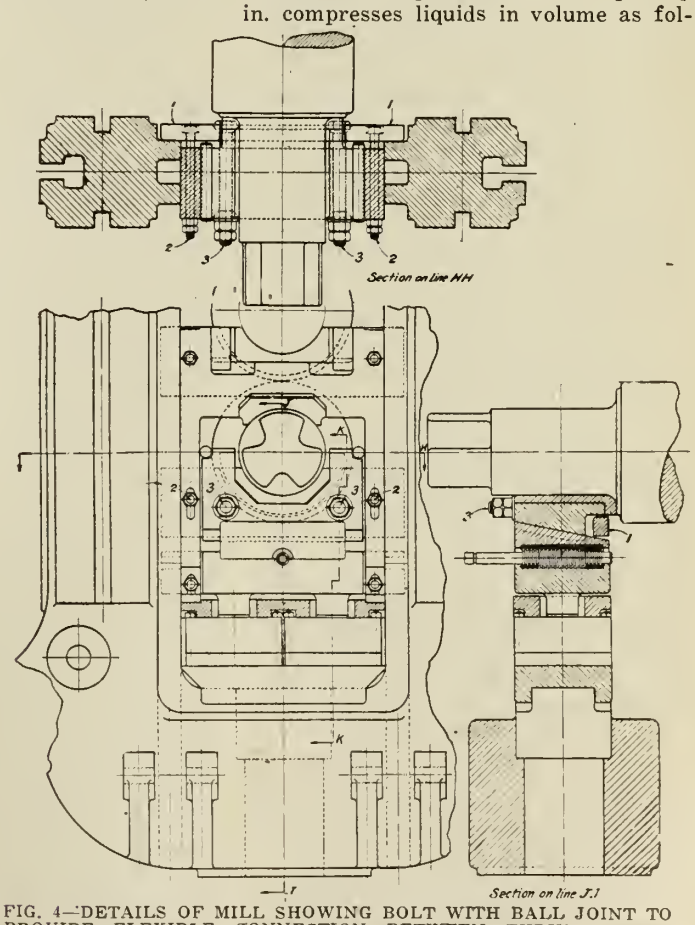


FIG. 4—DETAILS OF MILL SHOWING BOLT WITH BALL JOINT TO PROVIDE FLEXIBLE CONNECTION BETWEEN THRUST PLATE AND LOWER ROLL CARRIER.

lows: Water 1 part in 300,000; mercury 1 part in about 4,700,000. For water in an iron pipe this corresponds to a compression of 2 in. per mile of length for a pressure of 10 lb. per sq. in."

It will easily be seen that such a compression of the fluid will not disturb the roll setting. The only other factors entering into the plunger displacement are the quantity of fluid necessary to move the needles of the recording gages and the expansion of the short pipes leading to these gages. Both of these factors are so small that they may be neglected.

The idea of this frictionless diaphragm cylinder is not new, but has had several stages in its development. It appears to have been originally invented by Mr. Emery, who first applied it to the well-known testing machine bearing his name. The general application of this invention was delayed by the fact that Mr. Emery measured the pressure in his hydraulic supports by means of a complicated balancing and weighing mechanism. The hydraulic support was made accessible to general use by the research work of Dr. A. Martens at the German Government materials-testing station, who measured the pressure in the hydraulic support by means of Bourdon pressure gages and who proved conclusively that the combination of hydraulic support and pressure gages forms the most accurate and desirable means for measuring without friction or lost motion, forces of any magnitude and of any suddenness of application.

Prof. W. Trinks, head of the department of mechanical engineering at the Carnegie Institute of Technology, first conceived the idea of applying cylinders of this type to roll necks sometime early in 1916, and made drawings of a special roll housing for this purpose.

When the author was placed in charge of the organization of the Bureau of Rolling Mill Research and of the designs of the experimental mill he carried the development one step further by designing the present cylinders in such a manner that they would fit in the window of an ordinary roll or pinion housing, and could easily be replaced by a filler casting in case experiments not requiring their use were to be made.

The first cylinder of this type is now in the course of construction and will be carefully tested and calibrated under a 600,000-lb. compression testing machine before the final design is produced for the experimental mill.

Diaphragms varying in thickness from 1-64 in. to 3-64 in. are on hand and their relative merits together with the relative merits of mercury or water for the fluid will be carefully investigated before the final selections are made.

Fig. 4 shows these cylinders applied to the 18 in. three-high bar mill, which are somewhat different from those shown in Figs. 1 and 2. These last-mentioned figures were taken from the 24-in. sheet mill with the neck brass "faked in" for the purpose of better illustration of the mechanical principles involved.

There is one more important item which should be considered before bringing this article to a close. That is the friction of the end of the roll-neck brass on the roll body.

The "thrust plate" marked "1" in Fig. 4 is held firmly against the inside of the roll housing by bolts 2 and 3 and, unless a flexible connection between the lower roll carrier and this thrust plate were provided, would offer a very substantial resisting force acting against the rotating tendency of the lower roll carrier.

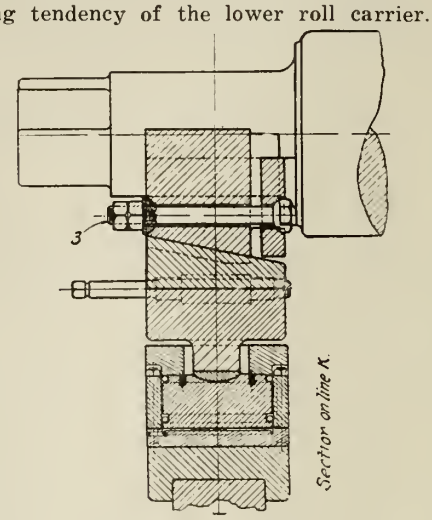


FIG. 5—DETAILS OF BOLT SHOWN AT FIG. 4.

To overcome this bolts 3 are made with ball joints at their inner and outer ends. In this manner any retarding action due to the stationary thrust plate is avoided. Fig. 5 is a section through this bolt and clearly shows the construction.

The importance of careful experiments on roll-neck friction will be realized when it is stated that, according to the best information at present available, between 40 and 50 per cent. of the total work of a blooming or bar-mill engine is absorbed in friction on the roll necks. These figures represent the best working conditions in roll-mill practice. For mills such as plate, skelp or sheet mills rolling wide, thin sections, which are often cold, the work lost in friction on the roll necks is frequently between 70 per cent. and 80 per cent. of the total work of the engine or motor.

The designs of the experimental mills are being worked out with extreme care, which of necessity involves a slow rate of progress. They offer a great many problems similar t othe one just described. It is expected that these designs will be completed during the next three or four months and will be given to the public very shortly thereafter.

The Carnegie Institute of Technology is throwing open to the members of the Bureau nearly $400,000 worth of building and equipment, free of all charges for rentals, etc. More than half of the money necessary to add this experimental rolling mill has already been definitely subscribed and the remainder is in sight. The completion of this experimental mill will make the Bureau of Rolling Mill Research what is probably the largest and most complete steel research laboratory in the world.

INTERESTING FACTS TO BE FOUND IN THIS WEEK'S ADVERTISING SECTION

How to secure economical production.

That a man is sometimes the weak link in operations.

How to secure all information regarding blast gates.

The cause of fatigue in furnace operators.

How to drill square or hexagon holes.

That a reamer is exactly as good as the number of holes it will ream.

How to save tap breakage.

A reamer that is claimed to be never scrap.

How to get best results from a hack saw.

A saw table that saves time and space.

How to remove metal without braces on a miller.

One meaning of overhead expense.

How the performance of a machine should be figured.

A shop system that cuts hours to minutes, dollars to cents, and makes absolutely no mistakes.

How to learn all about metal cleansing.

That it pays to watch for leaks.

How 30 hours' time, and the labor of 16 men, was saved.

SIZES OF SHAFTING

Continued from page 525

Agents; National Machine Tool Builders Association; and Southern Supply & Machinery Dealers' Association.

Report on Shafting Sizes

On January 14 the committee submitted to the council a report in which it recommended the approval and adoption of the following lists of sizes as standard for the society:

Transmission Shafting—15 16, 1 3/16, 1 7/16, 1 11/16, 1 15/16, 2 3/16, 2 7 16, 2 15/16, 3 7/16, 3 15 16, 4 7/16, 4 15/16, 5 7/16, and 5 15/16 inches.

Machinery Shafting—Size intervals extending to 2½ inches, by sixteenth inches; from 2½ to 4 inches inclusive, by eight inches; and from 4 to 5 inches by quarter inches. The council approved the report and accepted the recommendations.

Extend Working Day.—Canada Foundries and Forgings, Limited, announce that their Canadian Billings and Spencer plant at Welland, after two weeks shut down on acount of strike, has once more resumed operations in full; the Employees having agreed to the company's terms, which include an extension of the working day from an eight to nine hour basis.

Interesting Facts Regarding Molybdenum

IN the new steel invented by Dr. J. O. Arnold, 6 per cent. of molybdenum is substituted for 18 per cent. of tungsten. Dr. Arnold's discovery followed up his previous invention of vanadium steel—the best high-speed steel, which contains roughly 6 per cent. of carbon, 18 per cent. of tungsten, and, say, 3½ per cent. of chromium. The result of the substitution of molybdenum for tungsten was that he produced exactly the same steel with one-third of the amount of the most expensive element, and got equal, if not better results—say a 10 per cent. better result. The importance of this from the point of view of the cost of the steel is manifest.

A representative of "The London Times" has had a conversation on the subject of Dr. Arnold's new steel with Mr. Alexander J. McConnell, who, during the period of the war mission in America, was director of raw metals purchases for the mission in the United States and personal adviser of His Majesty's Government on sources of supply of molybdenum and molybdenite ore. Captain George Sykes, who was present at the interview, was the director of purchases of aeronautical parts for the British War Mission in America.

Mr. McConnell, who was sent to America in December, 1916, by the Minister of Munitions, said he noticed that Dr. Arnold, in his references to the discovery, confined himself to the steel-hardening qualities of molybdenum, and to that extent endorsed the value of molybdenum, in a way that every high-speed steel tool-maker would appreciate. But if Dr. Arnold stopped there, then he thought it would be known that the United States had gone far beyond us in advocating molybdenum as the most valuable alloy, probably, that has ever come under the attention of the steel industry. At this moment the great Fifth Avenue Omnibus Company, of the city of New York, is using exclusively springs made of molybdenum steel. In the opinion of Captain Sykes, molybdenum gives steel springs greater dynamic and impact value over chrome vanadium steel springs, which had previously been the standard springs of the steel trade. It is significant, added Mr. McConnell, that a number of the largest alloy steel manufacturers in the United States—among them the Crucible Steel Company, the United Alloy Steel Corporation, and the Carbon Steel Company—are now unreservedly advocating the use of molybdenum in steel because it is the toughest and strongest thus far developed in the alloy steel industry.

Dr. Arnold has, probably, only published the results of his researches, so far as a man of his distinction in his profession would commit himself to, but he is very likely aware, said Mr. McConnell, of the value of molybdenum beyond its steel-hardening qualities. The United States contemporaries of Dr. Arnold pronounce molybdenum steel as: (1) Combining lightness with strength; (2) lending itself to easier machining with a much wider range of heat treatment; (3 possessing a greater tensile strength and a greater elongation, with a higher dynamic and impact value. In short, the Americans are adopting a slogan regarding molybdenum steel to the words "lightness with strength." An important economic aspect of recent developments in the use of molybdenum, interpolated Captain Sykes, was that the steel can now be produced in a basic open hearth furnace, as against the previous limitation of an electric furnace. Captain Sykes also committed himself to the considered opinion that the future of our motor-car industry is wrapped up in the use of molybdenum steel, his own experience being that in axles, cranks, shafts, connecting rods, cam shafts, transmission and differential gears, roller bearings, ball bearings, and other fitments, this steel gives a result that has never hitherto been reached by any other alloy steel.

Mr. McConnell, continuing, said it would probably be found that scientific men have been working along similar lines without ever having been in consultation, meeting the same difficulties together and having the same proportion of success. It would, however, be a calamity if proprietary rights were established over the manufacture of a form of steel essential to the general engineering and manufacturing business of our country; and nothing, he imagined, was further from Dr. Arnold's purpose.

To the English steel maker the problem was: "Can I obtain an adequate and regular supply of molybdenum at a fair price and be protected over a period of years against being 'caught short' in such an essential element?" It should not be beyond the ability of our country to have a call upon a sufficient proportion of the world's supply of molybdenum to put our steel industries outside the range of anxiety in the matter of supplies. If this problem is overcome, as Mr. McConnell is convinced it can be, then British steel makers need have no fear of holding their own in quality against all competitors, but promptitude in finding sources of supply of molybdenum is absolutely imperative. The largest and the most consistent of the ore deposits on the American continent are at Climax, in the state of Colorado. There are pockety formations in other states and in the Dominion of Canada, particularly in the province of Quebec, but the Climax molybdenum deposits are the most extensive. They are at an altitude in the Rocky Mountains of no less than 14,000 feet above the sea level, and it was formerly thought they could only be worked during a limited period of the year. By a process of tunneling, however, and by great engineering skill the deposits are now capable of being drawn upon for regular production.

Mr. McConnell's practical advice to the steel-makers of this country is: "Secure your supplies of molybdenum from a strong producing company that will guarantee delivery, and whose contractual obligations can be absolutely relied upon."

Following is a record from the United States patent office regarding the patent grant to Charles Harold Wells, Detroit.

"It is the purpose of my present invention to provide a commercial alloy steel which at the same time has the super-excellent qualities of certain of the special steels, and retains all of the other characteristics necessary to bring the productive qualities of their maper cent. to 1 per cent. or a little higher. the steel within the commercial class; these desired results being obtained at a great saving in cost and reduction in losses, as will appear.

"I accomplish the foregoing by the use of molybdenum, as an added element to alloy steels, in fractional percentages, ranging substantially from between 0 I am aware that molybdenum has been used in what is known as molybdenum high-speed steel, to give such steels increased toughness and hardness, and other good tool-working qualities. Such steels are, of ccurse, impractical for commercial purposes, and their field of use strictly limited. The percentage of molybdenum used in such steel is also quite high, and the steel has not met with extended use because of certain defects which develop. Relatively high percentages of molybdenum have also been used in the production of magnet steels, and in other special steels such as armor plate. big gun steel, and the like. mainly for the purpose of replacing a portion of the tungsten, and that extensive experiments have been made to observe the effect of molybdenum on iron. In so far as I am aware, however, no one has made use of molybdenum in the production of commercial steels to obtain the results and advantages herein set forth; this probably because the experiments of early investigators, of the effect of molybdenum on steels in the normal state led to certain conclusions indicating the presence of questionable properties from a commercial standpoint. I have found, however, that the molybdenum commercial steels, upon being heat treated, apparently do not follow the laws of metallurgy, and that results are obtained opposite in character to those which would be naturally predicted from the steel in the normal state.

"By the use of molybdenum in alloy steels, in small percentages. I find, in so far as the manufacture of the steel is concerned, that all the requirements are well met, and that, in addition to molybdenum does not segregate and apparently has a tendency to prevent segregation

Continued on page 102

WELDING AND CUTTING

Lessons on the A.B.C. of Good Welding

The Effect of Alloys in Steels Is Taken Up in This the Fifth Lesson.

By W. B. PERDUE*

THREE things are important in the welding of steel: First, that the metal added must be similar in its analysis to the original metal; second, that none of the essential physical characteristics of the original metal shall be destroyed by the execution of the weld; and third, that the grain of the weld shall be equally fine as the original section welded.

In the former times the welder gave little thought to the production of a weld having the same strength as the parts welded, and this matter was often passed over with the remark, "The metal you put in the weld is in a cast condition, you can not make it any stronger than a casting." However, by the use of selected material and proper manipulation of the torch and rod welds are being produced by the acetylene process equal in tensile strength to the finest of steel. It seems logical to believe that repetition of the same processes will produce similar results. In fact, certain welders are meeting with such success in this particular line that those who are unable to attain similar successes are forced to admit either the inferiority of their knowledge of such matters or the inferiority of their equipment.

It may be well to remember that the old practice of blaming all troubles on the torch is not a very good one. We do not use fluxes in welding steels except, in some cases, to prevent surface oxidation. Vigorous manipulation of the added material is therefore necessary, both to produce a fine grain and to remove impurities. Regulators must be given the attention and care outlined in a previous chapter and the torch kept in the same good condition in which it was delivered by the manufacturer. Accumulations which form within the bore of the welding tips—the more especially those not made of pure red copper—must be carefully removed in such manner as to leave no ragged or scarred surfaces within. This can not be done by means of a brass or copper wire as many have suggested; but must be done with a steel broach or drill of proper size carefully handled; inserted if possible from the rear end of the tip. This leaves a smooth surface and does not cause the accumulations to cut the metal of the tip.

Welding Steel

Right here it may be stated that any welding equipment which does not deliver a stabilized mixture of stirred gases to the welding flame is unsuited for use in welding steel or any other metal. Impurities in the form of unburned gases driven through the welding cone are particularly harmful. Knowing this, and knowing the deficiencies of their equipment, many manufacturers have been strong in their recommendations of charcoal or electrolytic irons for welding rods to be used in welding steels. The words Norway or Swedish iron applied to such rods do not necessarily mean that these products are imported. In fact, American products are made which excel by far any imported article which can be procured. These terms merely apply to the process of producing iron with a minimum of impurities such as sulphur and phosphorus.

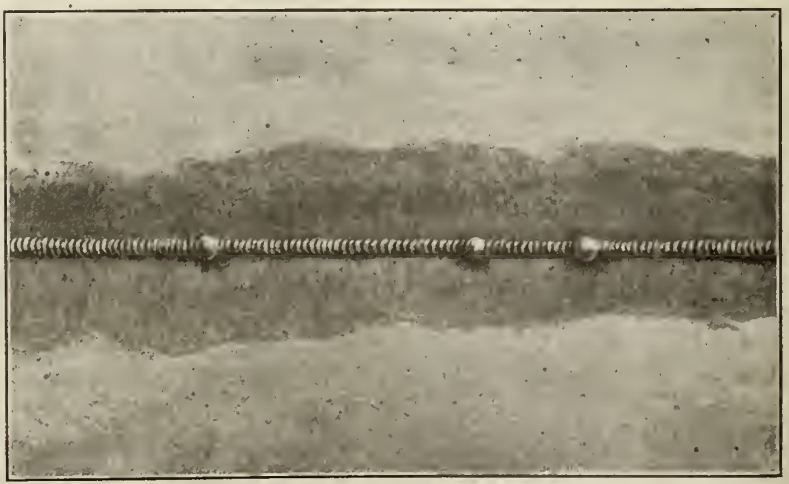
Steel may be defined as iron alloyed with carbon. Pure iron has a tensile strength of from 40,000 to 60,000 pounds per square inch. Steel with a few tenths of one per cent. of carbon has a much greater tensile strength, which with a carbon content of 1 per cent. may be in excess of 125,000 pounds.

Strength Increased

The old idea of the use of a wrought iron rod for the execution of welds in steel was that the absorption of carbon from the impurities passed through the welding flame would change the iron into a steel and thus increase the tensile strength in the weld. Those who advanced this theory seemed to forget that in so doing these impurities also united with the melted edges of the steel which already contain the required amount of carbon. By charging these edges of the weld with an excess of carbon they produce a brittle structure, the result being that when strains come upon the parts a new break develops parallel with and close to the weld. This is because the carbon deposited by the torch is present as an impurity, and does not form a true alloy with the metal in the weld.

Not only does the unburned carbon forced through the welding flame have an injurious effect, but that of the excess oxygen is even more pronounced. When heated to redness steels or irons oxidize quite rapidly unless protected from contact with the surrounding air by means such as the oxygen-consuming envelope of the properly adjusted welding torch.

The surface of the metal in a weld



*Director Welding Dept., Heald's Engineering School, San Francisco, Cal.

NOTE.—Cut accompanying this chapter should have been shown with lesson three.

that is being executed in a proper manner will, therefore, be free from scale and of a beautiful silvery color. It may well be repeated that the presence of bubbles beneath the surface of the melted metal indicates the absorption of gases which may be quite common where excess carbon is driven into the weld. Frothing or foaming indicates oxidation. The ill effects of this foaming may to some extent be reduced by vigorous manipulation of the welding rod.

To Unversed Operators.

To the operator unversed in the different alloys of steel the author recommends the purchase of a small quantity of each kind of welding rod or samples which should be kept separated and properly labelled. Judgment should be passed on the grade of steel before grinding; the color of the sparks given off in grinding should be noted, after which as a check upon his judgment the end of the supposed similar rod should be ground and comparison made with the characteristics of the spark given off by the article to be welded.

With this precaution and the further precaution to keep a considerable area of metal sufficiently heated to prevent sudden changes in the vicinity of the weld, the student should be able in a very short time to execute dependable welds in almost any finished grade of alloy steels.

In this connection it should not be forgotten that many of these steels are produced in their finished state by means of careful heat treatment, and that after the execution of the weld the entire piece must be properly heat-treated if the weld is such that it must be of exactly the same physical nature of the parts welded. Tests must be frequently applied to specimen welds made for that purpose. A dozen jobs successfully executed will not rebuild the reputation injured by one failure.

An increase in the carbon content of steels diminishes its ductility and malleability; whereas, on the contrary, the tensile strength, elastic limit, and the hardness produced by tempering are rapidly increased. Certain other alloys are used for other and specific reasons.

Vanadium

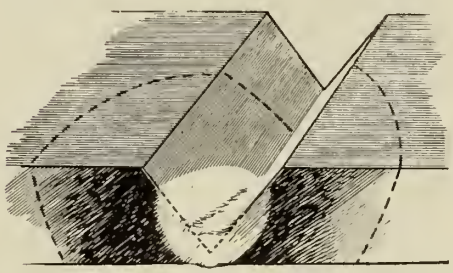
Vanadium added to steel increases the elastic limit and tensile strength, the former mare than the latter. It is used as an alloy where great strength, resistance to vibration, impact and torsional strains and stresses are needed. It tends to make the grain of the metal finer and to raise the tempering point of the metal higher than that of straight carbon steel. In this connection it must be borne in mind that no alloy steel should be tempered with the latent or dying heat produced by welding, but that the piece must be re-heated for tempering.

One of its advantages is that it does not render the steel more sensitive to prolonged high heat. This is contrary to what might be expected from the pearlitic nature of the alloy. In welding, vanadium acts as a deoxidizing and denitrifying agent, thus tending to eliminate impurities from the vicinity of the weld. This action will often be accompanied by a scum of decided oily appearance on the surface of the melted metal. In all cases vigorous manipulation of the rod is necessary, and extreme care is necessary to prevent the formation of adhesions by reason of insufficient fusion of the edges of the weld.

The importance of a vanadium alloy for welding if often over-emphasized, and it should by no means be adopted as a "cure-all" for the welding of all grades of alloy steels.

Nickel

Nickel is added to steel as an alloy to give increased strength and greater



toughness than is found in ordinary carbon steels. In welding this alloy care must be taken to avoid abruptly heating one part while another adjoining portion is at comparatively low temperature. It has a natural tendency to assume a laminated structure and seams may be produced in the weld or its vicinity by lack of caution in this particular respect.

One particular misfortune in the welding of nickel alloys is the apparent ease with which the molten parts flow together. The metal as originally manufactured had very great shock-resisting tendencies, and its ability to resist the stresses is greatly enhanced. Hence the failures, and in many cases serious accidents, which may result from defects in the welds many months after their execution. Shock tests, rather than tensile or bending strains, should be used as tests of welds in nickel steels. Etching by means of an iodine solution composed of iodine 1 part, potassium iodide 2 parts, and distilled water 10 parts, will be found particularly useful.

Care Necessary

In the preparation of surface for this test extreme care is necessary to secure a perfect polish, which after being finished with a "dead smooth" file should be further polished with the finest emery paper that can be procured. The surfaces should not be allowed to touch the hands or any other substance that may import oils or greases. The etching solution should be applied with a brush and washed off in running water 10 minutes after its application. If desired to make a microscopic examination at some later date a coat of transparent varnish may be applied.

Other alloy steels, less frequently encountered, are those of chromium and manganese. A special study of these metals is now being made by the author and the results of his investigation will be given out at a later date. This article will also contain the results of his investigations in overcoming the ill-effects of phosphorus and sulphur.

Mild steels, such as are used in ordinary stetel plate, do not require other than a mild steel rod of the best grade procurable. The conscientious welder, with a good torch and reliable regulators at his service, who once makes an exhaustive study of the advantages derived from the selection of steel frillers of the proper sort to execute a perfectly homogeneous weld will never return to the old hit or miss practice of using an iron filler.

The subject of alloy steels merits consideration and study, and the author respectfully invites other welders to tell him of their experiences along this particular line. Such communications may be addressed in care of this magazine, or to his address at 1220 Post Street, San Francisco.

ACID-RESISTING LEAD AND COPPER

In a paper read before the London Section of the Society of Chemical Industry by Mr. C. E. Barrs attention is directed to the influence of minute proportions of copper alloyed with lead. Where lead is to be used for the concentration pans of sulphuric acid it has generally been assumed that the maximum possible purity of the lead was desirable, though it has been frequently conceded that a small percentage of copper might be admissible, and even advantageous. According to Mr. Barrs' investigations, a lead containing 0.002% of copper, and otherwise practically pure, was vigorously attacked by sulphuric acid at 250 deg. C. (482 deg. F.), whereas an otherwise similar lead carrying 0.021 of copper resisted the action of the acid until a temperature of 296 deg. C. (569 deg. F.) was reached. Generally, it appeared that small percentages of copper, silver, and arsenic increased the acid-resisting power of the lead, while the effect of bismuth and sulphur was to lower it, the influence of antimony being negligible.

The welding of locomotive cylinders has become a regular operation in American railway shops. A paper by a foreman of a Pennsylvania railroad claims that hardly any discovery has meant so much to the railways in the way of economy as the various methods of welding broken or defective cylinder and other castings. The question arises as to the cost of such work as compared with a new cylinder, and it is estimated that for an ordinary weld with acetylene the cost may range from $50 to $175.

DEVELOPMENTS IN SHOP EQUIPMENT

HOB GRINDER

The H. F. Harris Engineering Co., Bridgeport, Conn., have placed on the market what is to be known as their No. 815B automatic hob grinding machine. The function of this machine is to grind hobs with any number of flutes up to 26 flutes, and not exceeding 8 inches in diameter and 10 inches in length. It makes no difference whether the flutes are straight or spiral (helical), both right and left hand spirals are taken care of, without changing gears, by a ball crank handle, shown to the left of the machine, which controls a very fine adjustment through worm, gear, pinion and sector to the forming slide, which is coupled to the work spindle in such a way as to rotate the hob the required amount to obtain the desired amount of helical movement during the longitudinal movement of the work table. This adjustment can be made while the machine is running, as well as when at rest, and the graduated dial, with thirty divisions, reads to half minutes, one complete turn of the ball crank handle equalling ½ degree.

Although no changing of gears are required, it is necessary to change the index plate, putting on one having the same number of notches as there are flutes in the hob. The index plate is readily accessible by removing or lifting off the cover over the index head. This is very simply changed by loosening a knurled nut and taking off index plate, replacing it with another. The indexing is done automatically, and is always done in the same position of the work table, no matter what the length of the hob, or angle of its flutes may be. Photograph shows machine in indexing position.

Index is operated by a pawl and ratchet, which takes whatever friction or shock there may be from the operation and brings the index proper in position for the indent lever to drop into the correct index notch. In this way the indent lever and index plate are protected from wear or hard service and maintain their initial accuracy.

The table travel can be operated either by hand or automatically. Referring to the photograph, the short lever seen on the extreme right controls the automatic table feed and reverse mechanism. When this is in the right-hand position it throws in the automatic table drive and reverse, and the large hand wheel shown below this lever is then inoperative. In the photograph, the short handle spoken of is shown thrown to the left. In this position the table may be operated by hand with the large hand wheel, or the long reversing lever shown extending upwards to the stops on the table carriage, and to the left of the short lever, can be used by hand to move and reverse the table back and forth, or any desired amount.

Back of the above reversing lever is shown a large oil well, which connects by means of brass tubes to the internal mechanism, oiling the working parts.

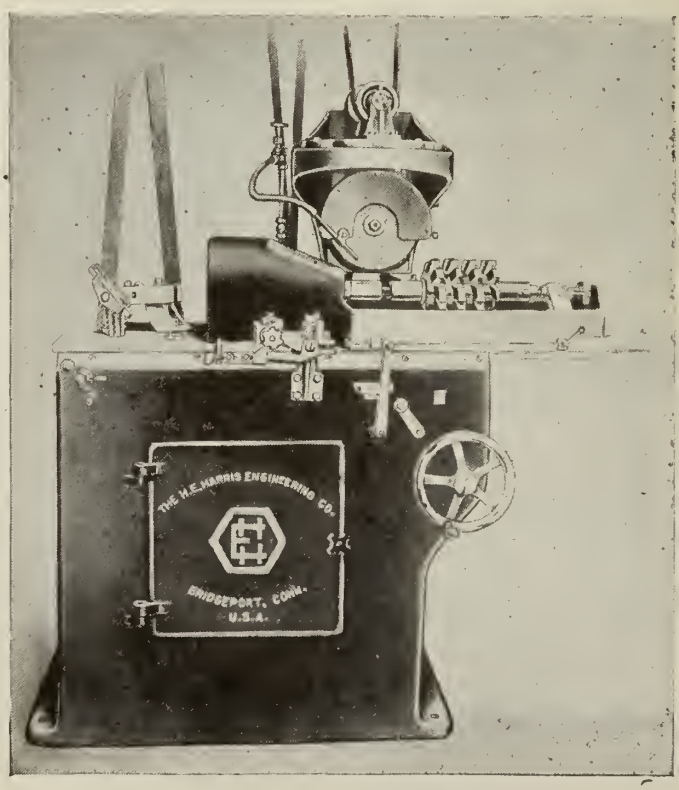
The grinding wheel is set up to suit the work by means of fine vertical and horizontal adjustments, operated by the ball crank handles at the right-hand of the column. These ball crank levers drive a pinion in a rack fastened to the slides, through means of worm gearing.

The grinding head mounted below and the jack shaft mounted above are carried on a heavy circular table that swivels horizontally, so that the wheel may be set to the required angle of the hob.

Truing Attachment

To assist in truing of grinding wheel and setting its cutting face radial, there is provided a diamond tool truing attachment, which is shown resting on the left-hand side of the work table, together with a small hob. This diamond truing device is so arranged that it will true either side of the grinding wheel to any angle required, and will also true the periphery of the wheel and can be used without interfering with the set-up of the hob or cutter in the machine.

After wheel has been trued, a radial gauge is supplied, which is used in setting it to position desired. After wheel has been set in the correct position for grinding, the hob is brought up against the wheel by means of a fine adjusting screw operated by a knurled knob shown at about the centre of front of work table. This rotates the hob about its axis to the emery wheel, always keeping the face of the teeth in the same radial position. When machine is started, there is an automatic feed which operates on the gun lock princi-



GENERAL VIEW OF THE MACHINE.

ple, and which operates once every time the hob is indexed around one complete revolution, and can be set to operate the fine adjusting screw which feeds the hob around against the emery wheel a greater or less amount, according to the amount it is desired to grind off the face of the teeth at each stroke. Besides the fine adjusting screw which feeds the hob is ground at each stroke during each complete revolution, provision has also been made so that a pre-determined amount may be ground automatically through successive revolutions of the hob, and then the machine, when this amount has been ground off, will automatically stop grinding. This means that the machine may be left alone by the attendant while he is performing other work.

The machine is supplied with a self-priming, non-clogging pump, which throws a copious stream of coolent upon the hob at point of grinding. The flooded lubrication also keeps the hob cool, preventing "burning" or flying emery dust or sparks, and speeds are figured to give the best results. The necessary adjustments are all easy of manipulation from the front of the machine, and are so simple that it does not require a skilled tool-grinder to set-up and operate.

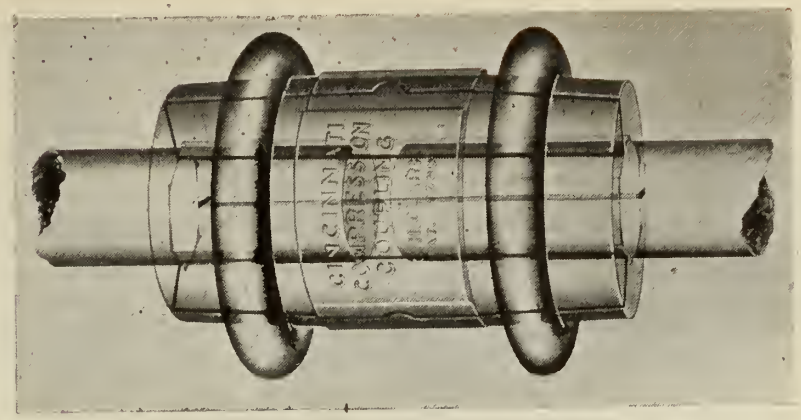
The belt drive from overhead countershaft is rather unique, the driven pulley being carried on the centre line of the swivelling head, as is the cutting face of the emery wheel. This does away with the troubles usually experienced when it is necessary to drive a spindle in several angular positions. There is an idler provided as part of the countershaft, which allows for the vertical adjustment of the head.

One of the valuable features of this machine is the fact that through a very ingenious device, there is a constant and uniform pull that takes up all slack in the spindle indexing and spiral generating mechanisms and permits the grinding wheel to operate on both strokes. Any changes from automatic action to hand action, or vice versa, can be made while the machine is running.

NEW COMPRESSION COUPLING

The Cincinnati Ball Crank Co., Cincinnati, Ohio, have placed on the market a new type of compression coupling for use in connecting line shafting. The illustration herewith gives one a good idea of its appearance and its outstanding feature is simplicity. It can be installed on any kind of shaft in five minutes' time. It is adapted for use in every industry where power is transmitted by means of line shafting.

The construction of this new coupling constitutes a radical departure from the old type flange and bolt connection. It consists of five pieces—three jaws, and two clamping rings. The jaws of the coupling are placed in position about the shaft, and held in place by the longitudinal grooves and notches that lock them together. The forged clamping rings are pushed on over the tapering ends of the jaws, and hammered tight.



VIEW SHOWING CONSTRUCTION OF COUPLING

A hammer is all that is required for installing the coupling—no dismantling or machining of the shafting is required. It is only necessary to have sufficient clearance between the two loose ends of the shaft to allow the passing of the clamping rings.

The coupling grips the joined sections of the shaft, holding them in alignment. The round, machined sections of the tapered end of the coupling jaws form lines of contact for each ring, and once driven into place it is impossible for the coupling to become loose. It is stated that many of these couplings have been in use three years without a single adjustment since they were installed.

The assembled coupling forms a clean, compact shaft joint. There are no projections on its outer surface to catch a workman's clothing. When used as a reducing coupling, the only additional parts needed are three strips of cold rolled steel to fit between the smaller shaft and the inside of the coupling jaws. These couplings are made in sizes from 15/16 to 3 inches.

SMOTHERING THE FIRE

Fires are something which are much to be avoided, and all precautions are generally taken to eliminate them, yet we are well aware that they persist in cropping up in spite of all precautions.

The next best thing is to be prepared for the fire when it does come, and on this assumption the Canadian Firefoam Co., Hamilton, Ont., have placed on the Canadian market what is known as Foamite Firefoam. To illustrate the uses of this product they have issued a very attractive booklet, entitled 60 seconds and out. They show various instances of fires, and how they were extinguished by means of their product. One outstanding example is a huge 55,000 barrel tank fire at its height. In spite of a strong wind this fire was smothered in 48 seconds, or less than one minute after it had reached its worst.

Briefly, the principal of firefoam is as follows: It is based on the well-known fact that carbonic-acid gas is fire's most deadly enemy. Cover any burning surface with this gas and the fire is quickly smothered. Working on this fact, firefoam was so constructed that the gas was kept over the burning surface in the form of millions of minute bubbles.

The illustration herewith depicts what is termed their 40-gallon Foamite Firefoam engine, and its contents expand to 320 gallons of firefoam upon release. The

THIS VIEW ILLUSTRATES THE 320-GALLON CAPACITY ENGINE.

contents can be discharged on any burning surface at a distance of 50 ft. or more. The type of engine shown is one recommended for plants, buildings and other places where hand extinguishers would be of insufficient capacity.

Larger engines of 250, 500, and 800 gallons and upwards are made, all depending upon where they are to be used. Hand extinguishers and fire pails are also handled by this concern, all equipped with the Foamite Firefoam.

One particular advantage, as claimed for this product, is the fact that the foam is comparatively dry compared to water, therefore resulting in less damage. The use of this material is not confined to oil fires, but to fires of any nature in the industrial world.

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Not So Eager To Join

AN attempt by John Fitzpatrick to organize the steel workers in the South Chicago district met with poor success in a meeting which he called recently. A year ago, before the steel strike, Lincoln Hall, Ninety-first Street and Commercial Avenue, South Chicago, was crowded with more than 2,000 enthusiastic workers. All joined the union.

On May 13 only 150 gathered there, although handbills had been distributed among 25,000 workmen. The bills announced that the meeting had been called by the National Organizing Committee of the Iron and Steel Workers of America. It was also stated that a succession of weekly gatherings would be held until the union included every man working in a steel plant in the district.

The steel workers have been tinkered with too much already. If sanity has returned to the point where the appearance of such men as Fitzpatrick and Foster get nothing but an indifferent reception—then so much the better for the steel trade.

Some Common Sense Needed

THE price deflation that has struck many lines in the States has not yet reached the industries of Canada, and as far as many of the lines go, particularly iron, steel, or anything in these classes, the move is not likely to be generally effective.

The market is too empty to permit of much price deflation.

At the same time the trade ought to bear in mind that very serious thought should be given before deciding on more advances.

Unfortunately, there are some lines where the feeling seems to be yet maintained that "we had better get in on this good thing while it lasts."

Reasonable profits should still be the standard of business, rather than maximum exactions.

Firms that are building for the future are well advised if they consider the service they can give to their customers, rather than the money they can wring out of them.

Don't be devoured with over anxiety lest some of the new taxation shall hit you, and that you shall not be able to pass it all along to the next man down in the line toward the ultimate consumer.

If you have an honest case, where your costs and expenses have gone to the point where you must increase, do so openly and honestly.

If you can still do business at present prices, then keep out of the procession leading toward higher costs.

Business is at a point now where a little encouragement and added stability means a great deal. There are projects held in abeyance, because those behind them will not go forward if they think that costs are going to continue upward.

The beating down of all talk of depression and falling-off in trade rests in part with those who are in business themselves.

Increase More Than Exchange

A CANADIAN business man, who comes closely in contact with the machine tool trade, writing to CANADIAN MACHINERY, says:—

Canadian importers of machinery from the United States, it would appear, have been inclined to attach overmuch importance to exchange rates in a raising market. On machinery of a type that is not manufactured in Canada, prices have had practically no stability. In the majority of cases there has been a steady upward trend, yet reports from reliable sources indicate that the exchange has too often been a ruling factor in failures to close. There are cases where the advance in price, since the close of the war, has been insignificant. One case comes to light in which the American manufacturer refuses to consider the absorption of any part of the exchange, claiming that his prices had not advanced, and that his margin of profit therefrom did not permit him to assume any part of the so-called tax, due to the lower buying power of the Canadian dollar.

On the other hand, American manufacturers cite cases where buyers who were in the market months ago for certain necessary equipment and who declined to close, owing to high exchange, are again in the market for the same equipment, now that necessity has become imperative, and have closed at prices which range all the way from 20 to 40 per cent. higher than former quotations—and paying the exchange.

It is true that there has been more stability in the exchange during the past few months and that buyers feel little improvement may be hoped for in the near future, yet the predictions as to advances in machinery prices would seem to have continued good ground for serious consideration of the lower prices then prevailing. The saving on price would have done much more than offset the exchange in a good many cases.

The great surplus of munition machinery seems to have disappeared as if by magic, and prices have responded to steady demand that had to be met in spite of high material and labor.

Why Freight Rates Are High

THE steamer Greleden arrived in London in November, 1919, from Bombay. Ninety-five days were occupied in discharging and loading cargo. In 1917 five vessels were unloaded in 32 days, or an average of about six days for each vessel. The time taken to discharge the same vessels in 1919 was 165 days, or 33 days per vessel.

There is a woeful waste going on here. It looks as though one way of serving the end of a strike was to stay at work and keep putting on the brakes.

Ocean rates are about 60 per cent. below the peak levels of the war, but instead of coming down, they are going up. The average time now spent by a ship in British ports has increased from 6.86 to 15.5 days, due to the longer time taken to handle the same tonnage.

MARKET DEVELOPMENTS

Conditions Are Not Helping Business Now

But There Is a Good Volume of Trade Moving in Spite of Drawbacks—Machine Builders Are Using Trucks to Get Shipments Out to the Roads That Can Handle Them.

BUSINESS conditions in steel, iron and machinery remain sound in spite of conditions, rather than with their assistance. Transportation facilities are not improved, and there are warehouses in Toronto that have not had a shipment come through from the U. S. rollers in the last five weeks. Several Canadian firms that depend largely on supplies of material from these mills have had their own men scouring the country between the mills and the border trying to locate their cars. In several cases they have been successful, but it has done them very little service. It is one thing to locate cars and quite another to get them moving toward the point of destination.

Transportation is also holding up shipments of machinery. Many of the makers are using trucks to get tools to the lines that enter Canada via Montreal, and nearly all of the shipments are now coming in that way. Of course, some buyers will make money by delay as they now get the benefit of the 7½ per cent. war tax coming off, but in a case where material or equipment is badly needed it would pay a firm better to have this amount added and get quick delivery.

Some dealers are not very clear on the interpretation of the one per cent. tax. One side holds that the dealers should absorb it, while others are passing it along. In this way it is possible, in some lines, that the ultimate user might pay the accumulated tax on three or four transfers.

The scrap metal market is dull. The coke situation has made it so that the large melters are not taking on scrap. Even the much-wanted heavy melting steel is not in favor now, and dealers intimate that they would regard it as speculation to take on much of this, although they have to buy as they are committed against certain shipments on contract.

SHORTAGE OF SHIPMENTS KEEPS THE PRICE FROM DROPPING IN MONTREAL

Special to CANADIAN MACHINERY.

MONTREAL, June 3.—"The inability to move material in sufficient quantities to meet the existing demand is the outstanding factor in the steel market. The shortage of cars continues to be a serious problem, particularly in the States, and some of the mills there from which our supplies come have thousands of tons of finished material in the yards awaiting shipment." This statement from a dealer here illustrates quite clearly the general condition as it applies througout the steel districts. The receipt of raw materials at the mills is also below normal, so that operations are frequently limited to the supplies coming in. Ever since the recent outlaw strike on the U. S. railroads the transportation by rail has been very irregular, owing to the slowness of the men in returning to work. As a result the demoralized condition is more or less evident. "It is quite apparent," remarked the dealer, "that with an adequate supply of cars, and the ability of the roads to take care of the shipments, that a weakness would develop in most of the steel lines." Considerable concern is felt in this district over the scarcity of cars, particularly in the way of accommodation for the shipment of coal. Many of the larger manufacturers are beginning to feel that the situation will necessitate the curtailment of activity, if not the closing down of the plants. It has become necessary for strict conservation wherever possible. Dealers here report a good remand for steels but emphasize the pronounced factor of under-supply. While it is difficult to obtain any definite statement as to early improvement, some are of the opinion that a steady betterment may be looked for from now on, but not of sufficient magnitude to alter the present high quotations that prevail in all markets. Warehouse supplies are still impossible, especially on tubes, sheets and plates, of the standard sizes. Chequered floor plates, which have been quoted at 9 cents, are now selling at 8 cents, for the heavy sizes and 8 4-10 for 3-16 inch. Seamless tubes are still in good demand with the supply below the normal. The 2 inch size has advanced $5 per 100 feet, the present quotation being $35 per hundred.

Used Tools Good Sellers

Machine tools activity, especially in new equipment, is becoming more a question of price, and the prospective purchaser of tools is now influenced more than formerly by the price. The case must be very urgent before the user will close for the machine that has shown a recent advance in the price.

Dealers in second hands and rebuilds have reported a good business of late and anticipate a steady trade while high prices dominate the new tool market. Some manufacturers who have tools on order are looking forward to getting the same for considerably less than at the time of order, owing to the cancellation of the 7½ per cent. war tax. The supply trade continues brisk with good business reported in British lines.

Listless Scrap Market

The listless state of the scrap market has been continued throughout the past week and sales have been generally light in character. Dealers here are not anxious to buy, for stock when the disposal of the material is so uncertain. The local demand for scrap has fallen off considerably and foundries are light buyers. Machinery scrap is still holding first place, but in reduced proportion. Prices are quite firm on the basis of last week.

CANADIANS HIT HARD BY STRIKE

Some Places Have Not Had a Shipment Through in Five Weeks

TORONTO. — Those closely in touch with the market agree that inquiries are less brisk than they were a few months ago, and that much of the buying that is taking place is the result of smaller inquiries.

The railroad strike in United States has been blamed for much of the trouble that is befalling Canadian industry and there is nothing better to report this week.

Machine tool dealers claim that many of their principals are making every effort to get shipments out to the Canadian trade and are using motor trucks in order to get their goods to lines that are moving. Most of the shipments reaching here now are coming in by way of Montreal.

The delivery schedule of some makers of machine tools has been spread over a good many weeks in the past, and with the added trouble of getting the goods moving on the rails, there is a greater feeling of uncertainty in the whole situation.

Nothing for a Month

"We have had nothing in our warehouse for a month now," was the statement of one large warehouse interest to CANADIAN MACHINERY. "We know of shipments that have been on the way for five weeks and that is all we know of them. They are some place and we don't know where that some place is, and if we did it would help very little. The superintendent of one Canadian concern has been for some days on the go between the border and several of the mills where they are supposed to have shipped out car lots. This particular firm has 37 cars of material, and they were paid for, so anxious was the firm to get the stuff. In one case several of the cars were located on a siding. They had been brought along some 15 miles from the point where the mills were located on a little road that runs from the mills to the main line. There they stopped, and there they are now. The gentleman who went to try and start them had to give it up as a bad job. He could not get any action. He reports that yards are full of freight cars and that every car loaded means that another car has passed out of the service as far as being available is concerned. He thinks it will take months, even should they settle their strike, to get things moving again. Many cars, to all intents and purposes, are lost.

Another dealer pointed out that the trouble with transportation had a bad effect on trade. A firm might want certain material, but upon hearing of the trouble of other concerns in getting their supplies, conclude that it was no use in going into the market at all until things became better. "That is a serious mistake," commented the dealer, "as one never knows what they can get until they state their case and have a try. Very often there are small lots coming in that could be used to advantage. It is the insistent purchaser that generally gets his case attended to."

About the Taxes

Some of the dealers in small tools are wondering how they get in or out of the new tax of one per cent. on all sales, and have not yet figured out where the passing around of the sale stops. Take a case of $100 worth of drills, for instance, purchased from a Canadian plant. The dealer figures that he has to pay $101, that is $100 plus the tax of one per cent. on sales. The dealer in turn adds his selling profit of ten per cent., which brings the amount to $111.10. The Government will collect one per cent. on his business, so is he to pass it on or pay it? That is where the difference of opinion comes in. Some of the dealers want to pass on the one per cent., making their sales price $112.21, while others hold that the dealer should absorb this. "This thing could go on indefinitely if we all pass it along," was one expression, "and the man who bought the goods in the end might find that he had to pay three or four taxes. I do not think it is the intention of the Government that the trade should keep on passing these things along. It is being absorbed in our concern and will simply reduce our profits by that amount. Here is what might happen: A recognized jobber would buy in the first place, and sell to a store that did retail and wholesale trade. This store might sell again before it ultimately reached the consumer, and by this time there would be five taxes piled on the article on top of the original price." There is quite a difference of opinion among the dealers, and it is likely that some conferences may be held to determine just what course of action will be followed.

Cutting Out the Jobbers

There are stories in the street also that some of the jobbers are receiving notice that they have been cut off by certain of the makers. This refers to small tools, especially, such as drills, taps, dies, reamers and cutters. There seems to have been a general move in this direction, as some jobbers have been cut off by certain factories, while others have been retained.

There is also some talk that there may be a further readjustment in price to meet some of the prices that are being used by the agents of Old Country firms. It is claimed that in several lines of small tools the Old Country prices are about five per cent. under the selling schedule of the Canadian makers, and there is a feeling that something should be done to meet this price.

Scrap Market is Very Dull

There is a very apparent weakness in several lines of scrap metal. Copper is easing up considerably and there is not much demand. Some of the dealers claim that used copper is not worth what is being quoted in this paper, but they are willing to allow the price to stand for the present.

Steel is weaker in the Canadian market as well as in the States. The coal and coke problem in this country is at the bottom of the trouble. The railway strike tied up the big melters that might otherwise have come into the market for replenishment in steel scrap. But as it is they are staying out. In some cases dealers will go as far as to state that they are out of the market for steel scrap. Of course many of the larger dealers have to buy, as they are committed to a certain tonnage under contract and they must take on material against this. But if they are taking on anything for stock, or speculation, they would want it to be at a price under the market. Iron scrap is more in demand and stove plate still finds buyers.

POINTS IN WEEK'S MARKETING NOTES

The railroad strike is blamed for the dullness in the New York machine tool market.

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British firms are buying machine tools in the States as they cannot secure enough of them in their home market.

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Steel piled at the mills and waiting shipment is now estimated at between a million and a half and two million tons.

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Steel Corporation prices to Canada are claimed to be due to the fact that Old Country interests are getting higher prices.

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Pittsburgh reports the iron and steel market as quiet—almost stagnant in spots.

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The scrap metal market continues weak, and dealers are not at all eager to buy except under the market quotataions.

ERRATA

In our April 22nd issue we stated that the Albert Herbert, Ltd., Coventry, England, were Canadian agents for the E. G. Herbert Co., Manchester. This was an error, as Williams & Wilson, Ltd., Montreal, are agents for this concern.

The Galt Industrial Housing Company has been incorporated, with capital of $100,000, to acquire lands in or near the said city of Galt, and to build and make thereon dwelling houses of moderate size, and improvements and conveniences, to be sold at moderate prices or to be rented at moderate rents, etc.

STEEL TRADE IS NOT MUCH BETTER; PITTSBURGH USES THE WORD STAGNANT

Special to CANADIAN MACHINERY.

PITTSBURGH, June 3—A distinct improvement has now occurred in traffic conditions on the railroads. This is admitted by iron and steel producers generally, and as they have been quite cynical in the past as to reports and promises of improvements on the railroads their word can readily be accepted at its full import.

Of course the condition is still very bad, despite the improvement, for there is not much more than a trend in the right direction. There are better car supplies, but by no means adequate supplies. Freight is moving more expeditiously, or rather less slowly, to consignees, but there is almost as much material en route as there was, in other words several times the normal quantity, besides something like a million and a half tons of steel accumulated at mills and not shipped at all.

Production of pig iron and steel has increased only slightly. There is no great desire to increase production, it being much more important to increase shipment. Production of pig iron and steel may be estimated at close to 80 per cent. of capacity, on the assumption that the production rates in March, the highest attained since October, 1918, were 90 per cent. of capacity.

The activities of the Interstate Commerce Commission, which are chiefly responsible for the improvement in railroad conditions, have assumed a broader character. Various orders have been issued which are aimed directly at relieving congestion and improving car supply. In the matter of granting priorities for the movement of particular commodities, the commission has been very conservative. It ordered large numbers of box cars west, for the grain movement, but even after urgent representations as to the need of box cars for moving tin plate about ten days were spent in investigation before an order was issued giving a fortnight's priority to box cars intended for tin plate loading. In the case of coal there are claims and counter claims. At Washington it is claimed that orders for diversion and movement of cars have been issued such as should greatly increase the supplies of cars at coal mines, while on the other hand some Pittsburgh district coal operators express the opinion that the railroads are discriminating against the coal mines and in favor of the manufacturing industries. It is hinted how v r that t may be due not to the lack of orders on the part of Washington, but to the railroads being slow to comply with the orders.

The Pittsburgh & Lake Erie (New York Central system) is doing better. For a long time there were scarcely any operations on what used to be called "The Little Giant," on account of its density of traffic and shortness of line. From the iron and steel viewpoint it runs from Monessen, 25 miles up the Monongahela River, where are located the Pittsburgh Steel Company, Page Steel & Wire Company and National tin plate plant of the American Sheet & Tin Plate Company, through Pittsburgh and out to Youngstown. Now there is a fair amount of single car movement and a good bit of solid trainload movement on the road.

As to the rail strike itself there is not a great deal of change. A few more of the "vacationists" have returned to work, but there are not many of these men left. They are either back on their old jobs or they have secured employment elsewhere. The railroads have been breaking in new men, and on this process is their chief dependence. For a fortnight the Bessemer road has been functioning normally, after having been out a couple of weeks or so.

Canadian Prices Advanced

The Steel Corporation has advanced its Canadian prices $20 a net ton on sheets and tin plates and $2 a ton on bars, shapes and plates. Previously its Canadian prices had been the same as those charged to buyers in the United States, being the Industrial Board schedule of prices which became effective March 21, 1919. It has been the more common practice of the mills in the United States to regard the Canadian market as part of the really domestic market, rather than as part of the export market, which might preferably be called the overseas market. Inasmuch as the independent producers have been charging much higher than Industrial Board prices even to strictly domestic buyers, and of course also to Canadian buyers, the Steel Corporation was extending to Canada its efforts to hold down the steel market, and evidently has concluded that the thing went too far, particularly as British prices have been advancing from time to time. The new Canadian prices of the Steel Corporation are still much below those being obtained in overseas exports, and are as follows: Tin plate, $8 per base box, 100 pounds; black sheets, 28 gauge, 5.35c; galvanized sheets, 28 gauge, 6.70c; blue annealed sheets, 10 gauge, 4.35c; bars 2.45c; shapes, 2.55c; plates, 2.75c, all f.o.b. Pittsburgh, plus freight to destination. It cannot be assumed that the advance in Canadian prices foreshadows any advance by the Steel Corporation in the domestic market.

Stagnant Markets

All branches of the iron and steel market are extremely quiet, practically stagnant. Some of the independent producers state that they are in receipt of a very considerable volume of inquiry, but there is reason to suspect that the inquiry results from the conservative attitude of the mills as to making sales, whereby an inquiry is multiplied in importance by going the rounds. Much of the inquiry, probably, is of tentative character, put out to see whether the independents will recede from the prices they have been maintaining of late, since many consumers are looking for an eventual recession of the independent market to the Steel Corporation level. The independents are quite indisposed to cut prices, and perhaps they are strengthened in their views by the very fact that large quantities of unshipped steel, made on order, have accumulated. As the railroads limber up and this extra steel goes forward, it would be awkward if the customers developed an indisposition to take all the deliveries. Naturally the mills desire to clear off their order books as far as possible before any actual recession occurs in open market prices.

As to prompt deliveries, however, there is clearly a recession in price. Prompt deliveries were bringing so much more than the prices charged by large independents for deliveries in, say, two to five months, that this weakening has no particular effect upon the forward market.

Pig Iron

There is a very involved situation in pig iron. On the surface prices show an advancing rather than a receding tendency, but the only market that exists is the prompt market, and it is one thing for prompt deliveries in small lots to command full prices, or even advanced prices, and quite another thing for consumers to be taking hold for late deliveries, say for the second half of the year. The latter they certainly are not doing. On small sales Bessemer is established at an advance of 50c, at $43, valley, basic remaining at $43.50, valley, and foundry at $45, valley. Freight to Pittsburgh is $1.40.

The coke movement is better. The by-product ovens are getting more coal, and as to the Connellsville region, the Connellsville *Courier* reports coke production in the week ended May 22 at 178,250 tons, an increase of 23,850 tons. Better car supplies since then suggest that the present rate of production is still higher.

NEW YORK BLAMES STRIKE FOR HALT

Quietness is More Marked Than at Any Time Since the Beginning of The Year

Special to CANADIAN MACHINERY.

NEW YORK, June 3.—Conditions are pretty much the same as they have been reported in the past two or three letters, there being very little injury and few orders. The machine tools markets have not been so dull since the early part of last year, following the signing of the armistice. Reports of salesmen who have been callingg upon their custom rs indicate that the trouble is traceable al-

most entirely to the railroad situation. The uncertainty as to when the freight congestion will be cleared up has created a spirit of hesitation. Moreover, buyers who cannot get shipments of machines already on order feel that there is little use in placing further orders at this time.

Aside from the railroad inquiries which are pending, the trade has few prospects for business worthy of special note. The Norfolk & Western and the Chesapeake & Ohio railroad lists are pending, and orders may be placed soon. A new list for about 150 machines from the Atlantic Coast Line was received by the machine tool trade last week. The Southern Pacific Railroad has bought about $200,000 worth of shop equipment, most of this business going to one company. Other railroads are expected to come into the market soon, notably the New York Central, which is preparing a list of its shop requirements.

Export business is only fairly active. England is a good buyer, the inability of British machine tool builders to make early deliveries creating orders for American machine tools. An export inquiry for about 20 machines has been sent out by the West India Sugar Finance Corporation, New York.

ALL REPORT PROSPECTS ARE BRIGHT FOR BRITISH GOODS COMING TO CANADA

A well-attended gathering of the Canadian Association of British Manufacturers was held in the Mossop Hotel, Toronto, the occasion being a special meeting preceded by lunch. There were quite a number of speakers, including Mr. Field, the British Trade Commissioner, and Controller Maguire, who attended in the place of Mayor Church, who was called out of town. Mr. Marshall, the president, was in the chair, and after a short introductory speech, called upon the vice-president, Mr. Harris, who gave a short and interesting talk on the status and achievements of the Association. A proposal had been made to have the Association of British Agencies join hands with the Association of British Manufacturers, which was to be taken up at subsequent meetings of the executive. Mr. Harris spoke of the work of the transportation committe, which had at the present time much important work in connection with proposed re-classifications by the railway companies to engage its attention. Mr. Harris was followed by Mr. Harold Wilson, chairman of the textile section, which is the largest in point of membership of any of the sections of the association. Mr. Wilson urged the necessity of getting a larger number of British manufacturers to join as members, as he felt this would largely enhance the importance of the association. Mr. Wilson also dwelt on the necessity of larger advertising by British firms in the Canadian trade, a point which was emphasized by several of the speakers. Mr. Marshall then called on Mr. Field, the British Trade Commissioner in Toronto, who, after referring to the progress made by the Toronto and Montreal branches of the Canadian Association of British Manufacturers, spoke of the close co-operation between the Association and the Trade Commissioners in Canada. In these days when sentiment is strongly in favor of trading within the British Empire, and there are good business reasons for the development of Empire trade, the Association, he said, has scope for important work and its membership will undoubtedly increase rapidly.

"There are about 1,200 United Kingdom firms represented in Ontario," said Mr. Field. "The opportunity for United Kingdom trade in this market is good in a number of lines, despite the competition of foreign companies. Given aggressive treatment by the British manufacturer this market will undoubtedly yield a substantial volume of business, as it has done in the past."

During the war the outlying parts of the Empire, which had depended to a large extent on the United Kingdom for their supply, were thrown on their own resources and were compelled to develop their own industries and are now able to produce goods in wider range and greater quantity than at any previous period of their history, and it is not always appreciated how completely industries in the United Kingdom were disorganized and the immense effort that had been necessary to re-establish them on a business basis. The demand for goods of all kinds from the Dominions is at present much greater than normal, whereas the output of the United Kingdom is still considerably below its pre-war standard, while the home demand for replacement of the machinery of production and trading stocks is still very large. It is therefore, only possible to supply a small proportion of the requirements of each individual market.

"By the end of this year, however, the United Kingdom will probably have regained its position as the first trading nation of the world.

"The work of the three British Trade Commissioners in Canada has greatly increased and a large number of inquiries for British goods are being received. The value of orders secured directly as a result of early information supplied by my office has, since the establishment of the office two years ago, more than equalled the cost of maintenance of the office for many years to come. In other words, in a commercial sense, the office is on a business basis.

"The British Trade Commissioner's offices in Canada are supplying a large number of reports to the Department of Overseas Trade in London, with regard to the Canadian market for United Kingdom manufacturers, among whom these are being circulated."

Controller Maguire, after apologizing for the absence of His Worship, Mayor Church, expressed his pleasure at being present at such an influential gathering, and spoke of the preference felt by the municipal government of Toronto for British made goods, when they had to purchase outside of the Dominion. This was a preference earned by the high standard of materials which they had always received. He spoke favorably of the initiative shown by agents of British houses, and also spoke of the necessity for more extensive advertising of British goods by British manufacturers. Mr. Bunney, of the steel section, which represents the most influential section of the association in point of value of importations, mentioned the fact that while the proportion of expense of U. S. firms in advertising was 25 per cent. of the selling cost, the proportion of expense of the British firms in this direction was only a little over 1 per cent. The publicity activities of the association were explained by Mr. Beale, who told the members that a series of booklets dealing with the various sections were in course of publication, which would be of interest and value to all the members. The general tone of the speakers was very optimistic towards the prospects of British trade in Canada, and the meeting closed with a feeling of general satisfaction for the work done so far, and the good results to be attained in the future.

OLD LAKE CAPTAIN HAS PASSED AWAY

Was Ready to Shoot Up All Concerned When Ordered to Pull Down Union Jack

Kingston.—The death occurred in the General Hospital of Capt. William Simmons, aged 78. He had sailed on the lakes for over fifty years, retiring some years ago. He was born in Ireland and had lived in Canada 70 years. He is survived by several sons, who are proprietors of a hardware store here. He was much in the limelight in 1906, when he entered Charlotte harbor with the schooner Acacia, of which he was owner. It was the 4th of July, and the Union Jack flew from the Acacia's masthead. The customs officer at Charlotte ordered him to lower the flag or float the Stars and Stripes with it. The old captain refused, and when the customs officer and others attempted to board the vessel to carry out the former's order, Capt. Simmons held them up with a revolver and threatened to shoot if they made a move The incident was reported to Washington, but was soon smoothed over.

Unfair and Unwise Proposal for Increase of 300 to 500% to Meet Increased Costs of Less Than 100%

A DRASTIC increase in postal rates, amounting to 300% the first year, and 500% the second year, is proposed in the resolution of Hon. Martin Burrell to increase postal rates on second-class matter from ¼ cent per lb. to 1 cent per lb. in 1921, and 1½ cents per lb. in 1922.

The reason given for this terrific increase of 300 to 500 per cent., is that the railroads have been awarded a higher rate for carrying mail matter. *This increase, however, is less than* 100%. Salaries of postal officials have been increased. *These increases have been less than* 100%.

The Government may need increased revenue, but why inflict a 300 *to* 500% *increase* on second-class matter, when increased costs of salaries and transportation are less than 100%?

A similar percentage increase in first-class mail would increase the cost of minimum rate for letters from 3 cents to 12 cents in 1921 and 18 cents in 1922.

When the Government reduced the rate of postage some 20 years ago on second-class matter from ½ cent per lb. to ¼ cent per lb., and at the same time reduced the letter rate from 3 cents to 2 cents, the result was not a deficit, but a surplus, and the first surplus the Post Office Department had shown for years. These reductions in rate of postage were accompanied by increases in salaries to postal officials, and also by regulations which eliminated much unnecessary waste.

A low postal rate was granted on second-class matter to encourage establishment of Canadian newspapers and periodicals. Is it fair when publishers have invested large sums of money to suddenly reverse the policy and make a drastic increase in rates which will ruin many worthy publications, and cripple the service given by the majority which survive?

Every dollar added to the price of a magazine narrows the circle of readers, and the men who would fail to subscribe are the ones who need information most.

This drastic increase would place a crippling tax on the periodical press, which, next to the schools themselves, is the greatest educational power in the country.

It would seriously retard our development in agriculture, in trade, in manufacturing, in medicine, science and en-

gineering by restricting the spread of information essential to development in these lines. This retardation would result in a tremendous annual loss to the country — a loss far greater than the revenue which the proponents of this measure (erroneously, we believe) expect.

The Canadian publishers of magazines, religious and educational papers, farm papers, trade and technical papers are already working under handicaps not experienced in other lines of business. They are subject to what is equivalent to "dumping" on the part of American publishers of magazines. The very large production by American magazine publishers takes care of the overhead expenses so that each can quite easily provide for an additional 5,000 or 10,000 copies for the Canadian market at relatively small additional expense. This extra run for the Canadian market is dumped into Canada by freight or express absolutely duty free.

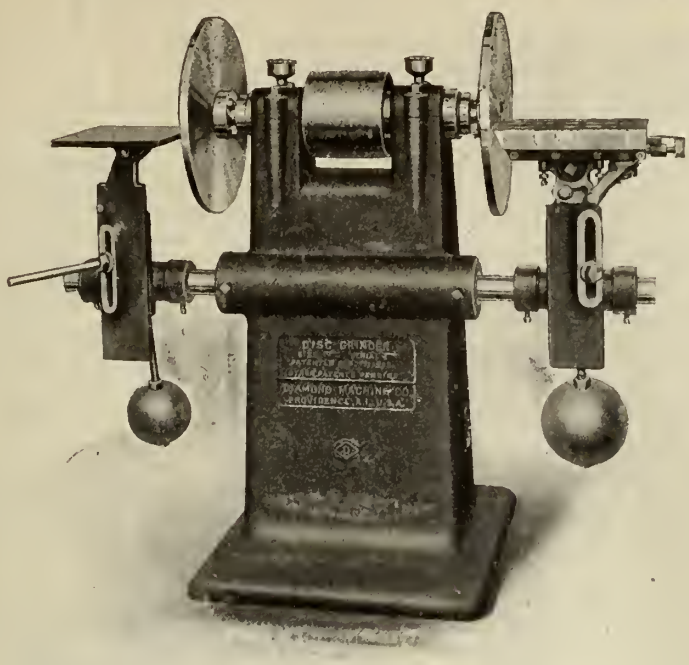
The Canadian publisher must provide for his overhead with a much smaller circulation and is subject to additional expense amounting to over 40% represented by the Customs Tariff on equipment and supplies used in the production of his magazine.

Canadian National Magazines circulate to a total of approximately 5,000,000 copies annually. As against this we have a total circulation in Canada of American weekly and monthly magazines of approximately 20,000,000 copies annually. Would it not be in the public interest instead of further penalizing Canadian magazine publishers to provide even greater encouragement such as would tend to promote a much larger circulation of distinctively Canadian periodicals?

Seven years ago Canadian publishers asked for an investigation of cost of carrying various classes of mail matter, but this has not taken place. We believe such an investigation would bring out many ways in which economies could be effected.

The public has always been keenly interested in educational matters. We believe they would object strenuously to any further percentage of increase than is justified by increased expenses. In no case is this higher than 100%.

The work of magazines, business and religious papers should not be crippled to make up deficits in other departments. They should not be penalized to the extent of 300 to 500%. The increase in postal rates on Canadian publications should not be more than 100% at this time, and it would be obviously unfair and demoralizing to enforce the proposed increase of 300 to 500%.



DIAMOND
DISC GRINDERS

Good grinding in fast time has made the Diamond popular in a host of shops. The right design and build eliminate vibration and give the operator a perfect surface every time. There is a suitable size and equipment for every surface grinding job you have. Workmanship and material of "Diamond" quality throughout.

May we send you catalogue?

The A. R. Williams Machinery Company, Limited

ST. JOHN, N.B
WINNIPEG, VANCOUVER

If It's Machinery Write "Williams"

64 Front Street West
TORONTO

"Firth quality means First quality"

FIRTH'S

SPEEDICUT High Speed Steel
EXTRA Cast Steel
BEST Cast Sheet Steel
NICKEL-CHROME Steel

Superior steels of the highest quality, each a leader in its class.

Immediate shipments from stock.

Thos. Firth & Sons Limited

Montreal
449 St. Paul St. W.

Toronto
79 W. Adelaide St.

John J. Coleman - *Canadian Manager*

Railway Scrap Sorting Finds 98 Varieties

Great Saving Has Been Made Since Attention Has Been Given to Specializing in This Business—Sheet Used by the Railway Storekeepers' Association

THE care that is taken by large firms, especially transportation companies, in the grading and classifying of scrap material, would be a revelation to the layman. The average man's idea of the scrap metal business is too apt to be based on the sight of a peddler's wagon plodding along with a few pieces of scrap rattling around in the bottom of the cart.

Some of the large railway companies, since paying strict attention to sorting scrap, have reported savings of hundreds of thousands of dollars per year.

A very good idea of what classifying scrap means in a railway company's business can be gathered from a perusal of the report sheet on scrap used by the Railway Storekeepers' Association. The description of the classes follow:

1. Arch bars and transoms, iron.

2. Arch bars and transoms, steel.

3. Axles, iron. Driving and other axles, 6 in. diameter and over.

4. Axles, steel. Driving and other axles, 6 in. diameter and over.

5. Axles, iron. Car, tender, engine truck and other axles, car and locomotive, under 6 in. diameter.

6. Axles, steel. Car, tender, engine truck and other axles, car and locomotive, under 6 in. diameter.

7. Angle bars, splices and fish plates, iron. For patented oints see No. 36.

8. Angle bars, splices and fish plates, steel. For patented joints see No. 36.

9. Brake beams, uncut. All metal brake beams.

10. Bolsters, uncut (except cast steel). To include all metal built up type body and truck bolsters.

11. Boilers, uncut. Locomotive and stationary boilers, locomotive tanks, other heavy oil tanks, fire boxes without flues or trimmings, but including mud rings.

12. Boilers, cut up. Locomotive and stationary boilers, locomotive tanks, other heavy oil tanks, fire boxes without flues or trimmings, but including mud rings, cut in sheets and rings.

13. No. 1 busheling. Iron and soft steel pipes and flues (free from scales); tank and bands No. 12 and heavier, boiler plate punchings and clippings, and soft steel and iron drop forgings and trimmings; nothing to be over 8 in. long or wide, free from galvanized or tin stock.

14. No. 2 busheling. Cut hoops, sheet, cotton ties and similar light material; nothing to be over 8 in. long or wide; bundled wire and bundled sheet suitable for busheling without further preparation; bundles not to weigh over 40 lbs. and not to be over 15 in. in height, width or length; all free from hard steel, cast and malleable and galvanized or tinned stock.

15. No. 1 railroad cast. Pieces weighing 150 lbs. or less, includes new grates, new stove plate; clean cast iron culvert, soil and water pipe; free from burnt grates, burnt stove plate and brake shoes.

16. No. 1-A railroad cast. Cylinders and wheel centres.

17. No. 2 railroad cast. Pieces weighing over 150 lbs.; can include new grates and new stove plate; free from burnt grates, burnt stove plate; also exclusive of cylinders and wheel centres.

18. No. 3 railroad cast. All kinds of burnt, centres, including grate bars, grate frames, stove plate, hand car and truck wheels with wrot iron spokes.

19. Cast iron borings. Clean and free from other metals, dirt and lumps.

20. Chain, iron. All sizes regardless of length. (May be included in No. 1 Railroad Wrot).

21. Chain, steel. All sizes, regardless of length.

22. Channels, iron. Car truck, cut apart.

23. Channels, iron. Car truck, uncut.

24. Channels, steel. Car truck, cut apart.

25. Channels, steel. Car truck, uncut.

26. Steel couplers and knuckles. Cast steel couplers, knuckles and coupler heads.

28. Frogs and switch points, uncut. 50 lbs. section and over.

28. Drillings and oily chips. Wrot iron and soft steel.

29. Flues and pipes. Flues and pipes, boiler flues, wrot iron and steel pipe, regardless of lengths, without removing scrap fittings, such as couplings, elbows, tees, etc.

30. Limited iron and steel. All kinds (except flues) from the interior of boilers, which are incrusted with lime or corroded by the action of water, such as Crown Bars, Crown Bar Bolts, Staybolts, etc.

31. *No. 1 structural and shaped iron, cut up. Channels (except car truck channels, see item 22), angles, tees, "I" beams, girders and columns, except cast.

32. *No. 2 structural and shaped iron, uncut. Channels (except car truck channels, see item 23), angles, tees, "I" beams, girders and columns, except cast.

33. *No. 1 Structural and shaped steel, cut up. Channels (except car truck channels, see item 24) angles, tees, "I" beams, girders and columns, except cast.

34. *No. 2 structural and shaped steel, uncut. Channels (except car truck channels, see item 25) angles, tees, "I" beams, girders and columns, except cast.

35. *Structural and shaped iron and steel, mixed, uncut. Channels (except car trucks), angles, tees, "I" beams, girders and columns, except cast.

36. Rail joints. All patented joints.

37. Malleable. All malleable castings.

38. No. 1 iron rail. 5 ft. and over 50 lbs. and over standard "T" section, free from frog, switch and guard rails and bent and crooked rails.

39. No. 2 iron rail. Cropped rail ends, 3 ft. and under.

40. No. 3 iron rail. 3 ft. long and under 5 ft., 50 lbs. and over standard "T" section; also bent and crooked rails.

41. No. 4 iron rail. Frog, switch and guard rails.

42. No. 1 steel rail. 5 ft. long and over, 50 lbs. and over standard section, free from frog, switch, guard, bent, curved and circle rails.

43. No. 2 steel rail. Cropped rail ends under 3 ft. long, 50 lbs. and over standard section.

44. No. 3 steel rail. 3 ft. long and over and under 5 ft., 50 lbs. and over; split heads and worn flanges, curved and bent rails, free from frog; switch and guard rails.

45. No. 4 steel rail. All sections of rail not coming under specifications of No. 1, 2 or 3 rail, including frogs, cut apart, guard rails and switch points. Does not include frog fillers or plates.

46. No. 1 light steel. Under ¼ inch, consisting of cut smoke stacks, netting, wire rope (not galvanized) hoops, band iron and steel, pressed steel hand car wheels, scoops, shovels, iron, wire, free from galvanized iron and tin. Exclusive of material coming under classification of "Busheling."

47. No. 2 light sheet. Galvanized iron and tin, galvanized rope, roofing, tinware, etc.

48. Heavy sheet. ¼ inch and over, including tank, boiler and fire box steel and iron, cut up, bridge plates, frog and crossing plates. Exclusive of material coming under the classification of "Busheling."

49. No. 1 brake shoes. Plain gray iron.

50. No. 2 brake shoes. Miscellaneous, including all shoes with steel back or with steel or wrot iron insert, both driving and car.

51. No. spring steel. Flat; includes all pieces of flat spring steel, old or broken leaf or elliptic springs, from which the bands and bolts have been removed.

52. No. 2 spring steel. All coil springs made from steel 3-16 inch and over in diameter.

Continued on Page 100.

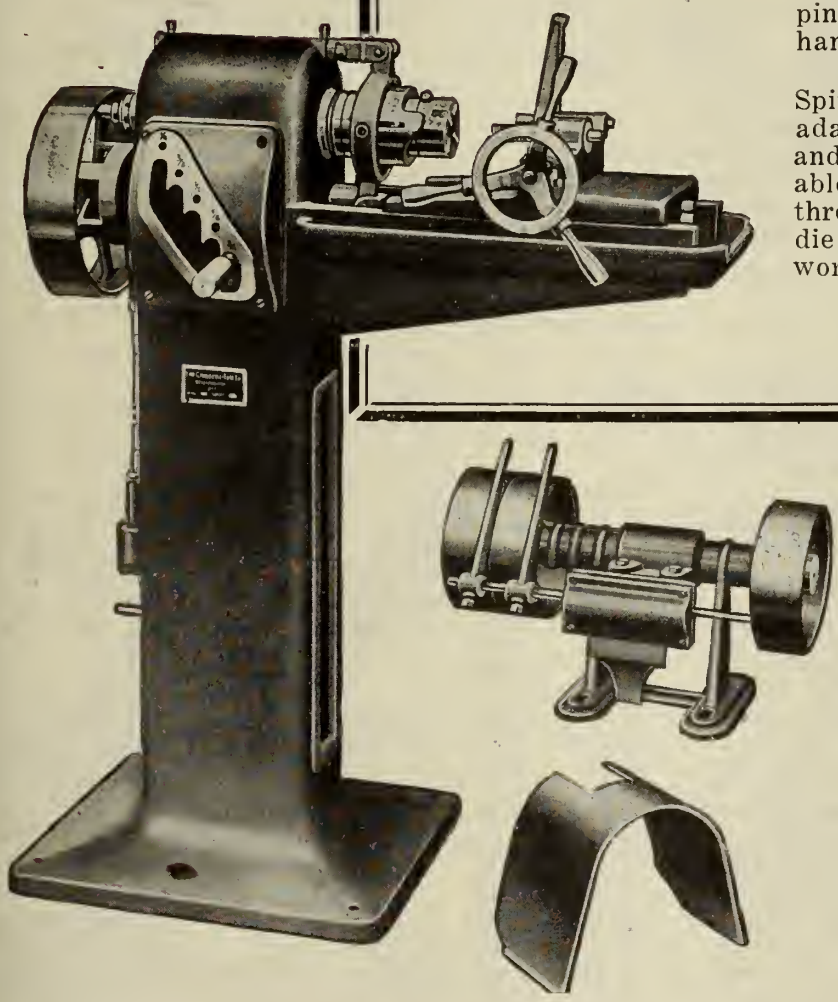
THE GEOMETRIC WAY

Where quantity and exactness have to be considered, the Geometric Threading Machine is just the way that suits. These machines have been tested and proved over and over again on speed, accuracy and endurance.

Geometric Threading Machines are employed on a large class of small threaded parts that cannot be produced economically on the ordinary screw machine.

Made in three sizes—to cut 1/8 to 1/2 inch, 1/4 to 3/4 inch, and 3/4 to 1 1/2 inch diameter threads. The carriage is mounted on slides and on the largest size machine is moved back and forth by rack and pinion, and in the smaller sizes by hand.

Spindle speed changes readily made, adapting the machine to the diameter and material of the work. An adjustable stop assures accurate length of thread, and automatically opens the die head, permitting of drawing the work straight back.



A line from you brings ful details regarding this machine. Tell us your threading requirements—let us recommend the proper Geometric Collapsing Tap or Self-opening Die.

THE GEOMETRIC TOOL COMPANY
NEW HAVEN CONNECTICUT

Canadian Agents:

Williams & Wilson, Ltd., Montreal. The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg, St. John, N.B.
Canadian Fairbanks-Morse Co., Ltd., Manitoba, Saskatchewan, Alberta.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$42 40
Lake Superior, charcoal, Chicago	57 00
Standard low phos., Philadelphia	50 00
Bessemer, Pittsburgh	43 00
Basic, Valley furnace	42 90
Toronto price:—	
Silicon, 2.25% to 2.75%	52 00
No. 2 Foundry, 1.75 to 2.25%	50 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 50
Steel bars, base, Toronto	5 50
Iron bars, base, Montreal	5 50
Steel bars, base, Montreal	5 50
Reinforcing bars, base	5 00
Steel hoops	7 00
Norway iron	11 00
Tire steel	5 75
Spring steel	10 00
Band steel, No. 10 gauge and 3-16 in. base	6 00
Chequered floor plate, 3-16 in.	8 40
Chequered floor plate, ¼ in.	8 00
Staybolt iron	9 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	4 00
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 67 to 5 50
Small shapes under 3"	3 62

FREIGHT RATES

Pittsburgh to Following Points	C.L. per 100 Pounds.	L.C.L. per 100 Pounds.
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

	Montreal (Gross.)	Toronto (Gross.)
Lake copper	$25 00	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	72 00	65 00
Spelter	12 00	12 00
Lead	11 50	11 00
Antimony	14 50	14 00
Aluminum	34 00	36 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$ 7 25	$ 7 25
Plates, ¼ up	6 50	6 50

PIPE—WROUGHT

Price List No. 44—April, 1920.

STANDARD BUTTWELD S/C

	Steel Black	Steel Galv.	Gen. Wrot. Iron Black	Gen. Wrot. Iron Galv.
⅛ in.	$6 50	$ 8 50	....	....
¼ in.	5 13	7 26	$ 5 43	$ 7 56
⅜ in.	5 13	7 26	5 43	7 56
½ in.	6 84	8 42	7 27	8 84
¾ in.	8 45	10 58	9 03	11 16
1 in.	12 50	15 64	13 35	16 49
1¼ in.	16 91	21 16	18 06	22 31
1½ in.	20 21	25 30	21 59	26 68
2 in.	27 20	34 04	29 05	35 89
2½ in.	43 00	53 82	....	....
3 in.	56 23	70 38	....	....
3½ in.	71 30	88 32	....	....
4 in.	84 48	104 64	....	....

STANDARD LAPWELD S/C

	Steel Black	Steel Galv.	Gen. Wrot. Iron Black	Gen. Wrot. Iron Galv.
2 in.	$30 90	$37 74	$34 60	$41 44
2½ in.	45 34	56 16	51 19	62 01
3 in.	59 29	73 44	66 94	81 09
3½ in.	73 14	90 16	82 34	99 36
4 in.	86 66	106 82	97 56	117 72
4½ in.	0 98	1 23	1 24	1 49
5 in.	1 15	1 44	1 44	1 73
6½ in.	1 49	1 86	1 87	2 25
7 in.	1 94	2 43	2 42	2 90
8-L in.	2 04	2 55	2 54	3 05
8 in.	2 35	2 94	2 92	3 51
9 in.	2 81	3 52	3 50	4 21
10-L in.	2 61	3 26	3 25	3 90
10 in.	3 36	4 20	4 18	5 03

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

1" and under, 60%.

1½" and larger 50%.

4" and under, running thread, 30%.

Standard couplings, 4-in. and under, 30%

Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds. Montreal	Toronto
Copper, light	$15 00	$14 00
Copper, crucible	18 00	18 00
Copper, heavy	18 00	18 00
Copper wire	18 00	18 00
No. 1 machine composition	16 00	17 00
New brass cuttings	11 00	11 75
Red brass cuttings	14 00	15 75
Yellow brass turnings	8 50	9 50
Light brass	6 50	7 00
Medium brass	8 00	7 75
Scrap zinc	6 50	6 00
Heavy lead	7 00	7 75
Tea lead	4 50	5 00
Aluminum	19 00	20 00

	Per Ton	Gross
Heavy melting steel	18 00	18 00
Boiler plate	15 50	15 00
Axles (wrought iron)	22 00	20 00
Rails (scrap)	18 00	18 00
Malleable scrap	25 00	25 00
No. 1 machine east iron	32 00	33 00
Pipe, wrought	12 00	12 00
Car wheel	26 00	26 00
Steel axles	22 00	20 00
Mach. shop turnings	11 00	11 00
Stove plate	26 50	25 00
Cast boring	12 00	12 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜-in. and less	10
Carriage bolts, 7-16 and up	Net
Coach and lag screws	25
Stove bolts	55
Wrought washers	45
Elevator bolts	Net
Machine bolts, 7/16 and over	Net
Machine bolts, ⅜-in. and less	15
Blank bolts	Net
Bolt ends	Net
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square, blank	add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 50
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	25 and 5
Sq. and hex. hd. cap screws	22½
Rd. and fil. hd. cap screws	plus 17½
Flat but. hd. cap screws	plus 30
Fin. and semi-fin. nuts up to 1-in.	20
Fin. and Semi-fin. nuts, over 1 in., up to 1½-in.	10
Fin. and Semi-fin. nuts over 1½ in., up to 2-in.	Net
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$60 00
Open-hearth billets	60 00
O.H. sheet bars	76 00
Forging billets	56 00-75 00
Wire rods	52 00-70 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 70
Cut nails	5 85
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 35½
British Manila rope	0 28
New Zealand hemp	0 28
Transmission rope, Manila	0 47
Cotton rope, ¼-in. and up	0 88

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net

Canada's Leading Tool House

Aikenhead's

Quality Tools for All Purposes

Johansson Adjustable Limit Snap Gages

In manufacturing plants where economy and efficiency is keenly studied, there you will find Johansson Adjustable Snap Gages. Their remarkable success is due to two great factors —they make short cuts to production and cut manufacturing costs. In these days, when production costs are extremely high, every minute wasted by the mechanic eats up the profit and Johansson tools become an important essential of shop equipment. Johansson Adjustable Limit Snap Gages eliminate the cost of making and maintaining solid snaps. They eliminate the tendency of the operator to work to "absolute dimension" and get results, even in the hands of unskilled operators.

The Johansson book tells all about them. Write for your's to-day.

Aikenhead Hardware Limited
17, 19, 21 Temperance Street
Toronto, Canada

Johansson Gages are emblematic of Aikenhead quality in tools. Buy your tools at Aikenhead's.

Aikenhead's

Try Aikenhead's tools. You'll find the service, quality, and price right. Write or Wire. Immediate shipments on all orders.

Wahlstrom Automatic Tapping Attachment

Why stick to the old slow and expensive practice of Hand tapping when you can do the same work in one-tenth the time with a Wahlstrom Automatic Tapping Attachment? It imitates the simple to-and-fro motion of hand tapping and will tap holes as squarely as they could be drilled.

The Wahlstrom is constructed of hardened and ground parts and has nothing whatever that can get out of order. Attached to any type of drill press this Wahlstrom device will pay its cost in short order. It is made in two sizes. No. 1 takes taps of all sizes from 5.40 to ½ inch standard. No. 2 takes taps from ¼ inch to ¾ inch.

You can get the Wahlstrom at Aikenheads. Send for our free trial offer.

AIKENHEAD HARDWARE LIMITED
17, 19, 21 TEMPERANCE STREET, TORONTO

If interested tear out this page and place with with letters to be answered.

MISCELLANEOUS

Solder, strictly	$ 0 40
Solder, guaranteed	0 43
Babbitt metals	18 to 70
Soldering coppers, lb.	0 62
Lead wool, per lb	0 16
Putty, 100-lb. drums	8 30
White lead, pure, cwt.	20 00
Red dry lead, 100-lb. kegs, per cwt.	16 50
Glue, English	0 40
Tarred slater's paper, roll	1 30
Gasoline, per gal., bulk	0 35
Benzine, per gal., bulk	0 35
Pure turp., single bbls., gal.	3 60
Linseed oil, raw, single bbls.	3 00
Linseed oil, boiled, single bbls.	3 03
Sandpaper, B. & A.	List plus 43
Emery cloth	List plus 37½
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin, "D," per lb.	0 14
Borax crystal and granular	0 14
Wood alcohol, per gal.	2 70
Whiting, plain, per 100 lbs.	2 75

CARBON DRILLS AND REAMERS

S.S. drills, wire sizes	32½
Can. carbon cutters, plus	20
Standard drills, all sizes	32½
3-fluted drills, plus	10
Jobbers' and letter sizes	32½
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	net
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	20 to 40
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At warehouse]

Rounds and squares	$7 base
Hexagons and flats	$7.75 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	60	75
Class B	27	37
Class C	18	27

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 8 50	$ 9 50
Sheets, black, No. 10	8 50	9 00
Canada plates, dull, 52 sheets	8 50	10 00
Can. plates, all bright	8 60	9 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	11 00	....
Fleur-de-Lis, 28 B.W.G.	10 50	....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28.	....	....
Premier, No. 28, U.S.	11 50	10 50
Premier, 10¾-oz.	11 50	10 90
Zinc sheets	16 50	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	29 50
1¾ in.	31 50	30 00
2 in.	35 00	30 00
2¼ in.	35 00	29 00
2½ in.	42 00	37 00
3 in.	50 00	48 00
3¼ in.	.. ..	48 50
3½ in.	63 00	51 50
4 in.	85 00	65 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	24½
Palacine	27½
Machine oil, per gal.	43½
Black oil, per gal.	18½
Cylinder oil, Capital	82
Cylinder oil, Acme	70
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	$2 60
Union thread cutting oil, antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil, bbls., net	13½

BELTING—No 1 OAK TANNED

Extra heavy, single and double	10%
Standard	10%
Cut leather lacing, No. 1	2 75
Leather in side	2 40

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 60
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	09
Pumice, ground	06
Emery glue	30
Tripoli composition	09
Crocus composition	12
Emery composition	10
Rouge, silver	60
Rouge, powder, nickel	45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finef	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE

XXX Extra	.24	Atlas	.20
Peerless	.22½	X Empire	.19½
Grand	.22½	Ideal	.19
Superior	.22½	X Press	.17½
X L C R	.21		

Colored

Lion	.17	Popular	.13
Standard	.15	Keen	.11
No. 1	.15		

Wool Packing

Arrow	.35	Anvil	.22
Axle	.28	Anchor	.17

Washed Wipers

Select White	.20	Dark colored	.09
Mixed colored	.10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades... 15%

ANODES

Nickel	.58 to .65
Copper	.38 to .45
Tin	.70 to .70
Zinc	.18 to .18

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10.		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6 x 4 base	45 00	44 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 75	$14 50
Sheets, 3½ lbs. sq. ft.	10 50	14 00
Sheets, 4 to 6 lbs. sq. ft.	10 25	13 50

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .23
Acid, hydrochloric	.03¼
Acid, nitric	.10
Acid, sulphuric	.03¼
Ammonia, aqua	.15
Ammonium, carbonate	.20
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.14
Copper, carbonate, anhy.	.41
Copper, sulphate	.16
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.08
Nickel carbonate	.32
Nickel sulphate	.19
Potassium sulphide (substitute)	.42
Silver chloride (per oz.)	1.25
Silver nitrate (per oz.)	1.20
Sodium bisulphate	.11
Sodium carbonate crystals	.06
Sodium cyanide, 127-130%	.38
Sodium hyposulphite per 100 lbs	8.00
Sodium phosphate	.18
Tin chloride	1.00
Zinc chloride, C.P.	.30
Xinc sulphate	.08

Prices per lb. unless otherwise stated

Quality

CONFIDENCE

THE GREATNESS OF BRITAIN IS FOUNDED ON HER INTEGRITY.

HER STRENGTH SHE DERIVES FROM WORLD COMMERCE—HER ENDURANCE FROM CONFIDENCE.

THE WAR TEMPORARILY RETARDED HER CONSTRUCTIVE EFFORTS, BUT THE POWER OF THE CONFIDENCE OF THE PEOPLES OF THE WORLD WILL RESTORE TO HER IN MORE BRILLIANT FORM THE LEADERSHIP SHE HAS JUSTLY EARNED AND PROUDLY HELD.

CONFIDENCE IS THE FOUNDATION OF OUR POSITION IN THE WORLD OF IRON AND STEEL—OUR PROGRESS DEPENDS ON IT.

WE HAVE BEEN SUCCESSFUL IN THE PAST—THE FUTURE IS BEFORE US. TO ADVANCE, WE MUST CONTINUE TO MERIT THE CONFIDENCE OF THE BUYERS OF STEEL AND IRON PRODUCTS OF EVERY DESCRIPTION IN CANADA. AND WE ARE DETERMINED TO ADVANCE.

THE
STEEL COMPANY
OF
CANADA
LIMITED
HAMILTON MONTREAL

Service

If interested, tear out this page and keep with letters to be answered.

INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS PERSONAL AND TRADE NOTES

TRADE GOSSIP

Want to Buy Crane.—Fried Bros., Glace Bay, N.S., are in the market for a second-hand locomotive crane, capacity 15 to 20 tons, standard gauge.

Incorporation has been granted to the Easy Washing Machine Co., Ltd., of Toronto, capitalized at $400,000, to manufacture and deal in machinery and parts and accessories.

More Buying.—This year the Canadian National Railways rolling stock will be increased by the building of 5,750 freight cars, 80 locomotives, and 70 passenger coaches. The additions to the rolling stock, contracted for in 1919, are now almost completed.

For Ship Steel.—The Davie Shipbuilding Corporation of Levis, Que., a subsidiary of the great British Empire Steel and Iron Corporation, has taken options on lands situated in Lauzon with the intention of building in a year a huge establishment destined to prepare steel and iron for the construction of ships.

Better Shipments.—Freight conditions at Buffalo have improved in the last few days. The Pennsylvania Railroad are undertaking to relieve the congestion of cars in its yards at Buffalo to provide a freer movement of coal. About 150 trainmen were brought into Buffalo from other points and are working in the yards. Coal shipments were reported to be coming into Ontario in fairly regular quantities by the Grand Trunk. On one day 159 cars of soft coal and 108 cars of hard coal were brought into Toronto..

The first of the two blast furnaces which have been under construction at the River Rouge plant of the Ford Motor Co. was put in operation Monday, May 17, when Henry Ford, holding in his arms Edsel B. Ford's three-year-old son, Henry Ford III, helped the child light a match and fire oil-soaked excelsior, which touched off the charged stack. The 500 tons of pig iron which henceforth will be produced daily, will be increased to 1,000 tons daily when the second furnace is put in operation.

Short of Coal.—The soft coal situation in Guelph is becoming more serious every day, and if coal does not come in more freely during the next few days some of the local factories may have to close down until they can secure a supply. There are one or two factories that have a fairly good supply on hand, but they are conserving it in every possible way in order to make it last. The city waterworks department has only a very small supply, and it has already used up three cars of wood. The gas department has sufficient for several weeks.

Coming Back to Canada.—Building trades mechanics who crossed to England following the armistice, in considerable numbers, are coming back to Canada, according to John Cottam, secretary of the Toronto union of carpenters. "Each steamship arrival brings old members back along with a number of new faces. They all tell the same story," said Mr. Cottam. "They say that work is plentiful in the skilled trades, but that living is very high and that the housing problem is very serious."

Returning to Work.—Men at the Keating's foundry, Toronto, who have been on strike for several weeks, have returned to work. They have been granted a five cent increase upon the wages they were receiving a few weeks ago, the increase to be retroactive to May 1, and a further increase of five cents to be granted on August 1. Agreements have also been signed with the brass workers at the Monarch and Standard Sanitary Foundries. Other firms are still negotiating with the Machinists' Union respecting increases.

Motor a Failure.—Sequel to the remarkable furore over stock of the P. Lyall & Sons' Construction Company because of the remarkable motor engine said to have been tested out by them some months ago. comes in the annual statement of the company, which says: "The automobile engine with which your company experimented was tested by experts, whose reports do not offer sufficient encouragement to undertake its

DISPOSAL OF ROSS RIFLE PLANT SPOKEN OF IN OTTAWA HOUSE

QUOTATIONS asked and answered in the Dominion House a few days ago, have a peculiar interest for the Canadian machine tool trade and manufacturing interests generally. Mr. Bureau was the questioner, and the replies were supplied by the Hon. Hugh Guthrie:

Q. What was the inventory value of the machinery in the Ross rifle factory at Quebec when taken over by the Government?

A. The Canadian Appraisal Company made inventory values as follows:

Reproductive value $875,000
Sales value $500,000

Q. What amount has been received from the sale of this machinery up to the end of the last fiscal year?

A. Approximately $400,000.

Q. Was said machinery and other physical assets of the plant disposed of by public tender, through commission agents or by private sale?

A. The means adopted for the sale of the machinery and other assets of the plant were intended to meet conditions as they occurred, and are as follows:

(a) By the circulation of printed lists;
(b) By advertising;
(c) By assistance from machinery firms;
(d) By personal calls and correspondence.

Q. What method is being adopted at present in regard to the disposal of machinery on hand?

A. Machinery now being sold as in "3" above, and in accordance with a price list.

Q. Who is the officer in charge, where and on whose recommendation was he appointed?

A. Mr. W. S. Fisher is the commissioner in charge, and was appointed by Order-in-Council in April, 1917.

Q. What prior experience has he had in regard to the valuation and disposal of machinery?

A. He has wide business experience in foundry and hardware business.

Q. Has the Government a special auditor at the plant to check up prices, methods of sale and amounts received from the assets disposed of?

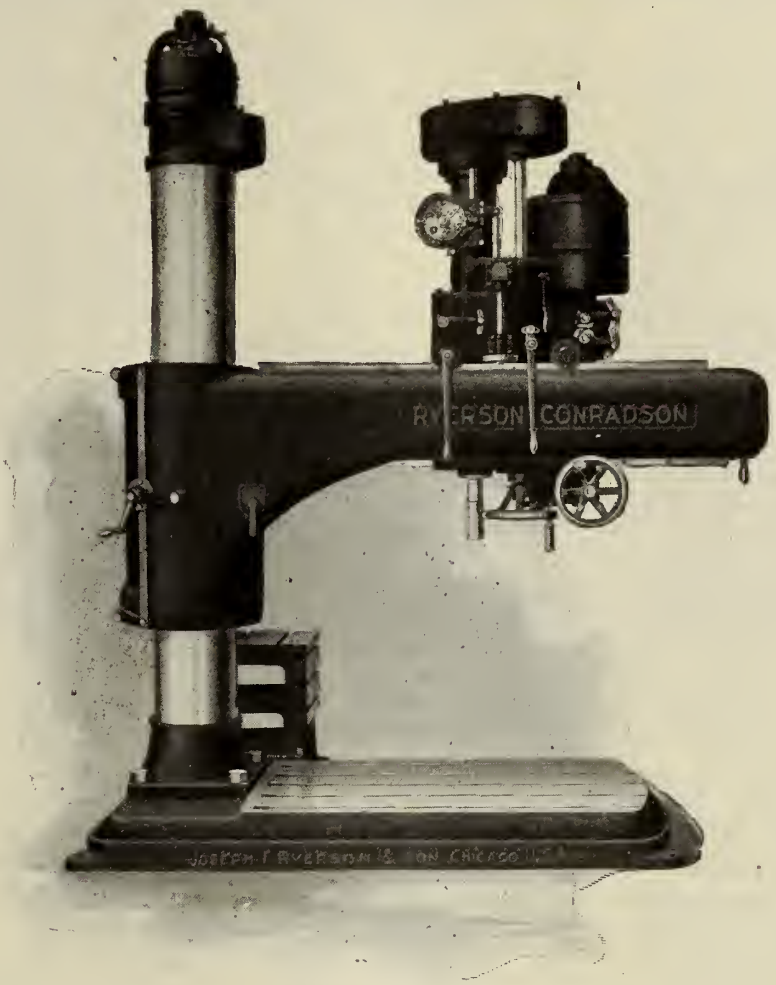
A. No. Systematic auditing is carried out by departmental auditors, and a special audit on the premises is made periodically.

Q. Is it true that some of the machinery in the plant has been broken up and sold as scrap metal instead of being sold intact at present market value?

A. Yes. A few special machines have been broken up and sold as scrap. However, these were of special design for the manufacture of Ross rifles, and, being absolutely useless for any other purpose, were unsaleable.

Announcing the New

Ryerson-Conradson Twin Motor Driven High Power Plain Radial Drilling Machine



Special Features in the Design, Construction and Operation

Twin Motor Drive. One motor on head driving spindle and the elevating motor on column.

Drilling, tapping, boring and reaming operations can be performed.

Concentration of all shafts in head. Only four shafts and sixteen gears furnish sixteen spindle speeds.

Elimination of all bevel gears and friction clutches for tapping.

Arm of box section design. No overhanging of head as on other types of radials.

Splash Oiling System.

Exceptional Feed Range. Sixteen feeds from .005" to .370".

Only radial drill which can be operated on a true radial line with column.

The long bearing surface and double acting clamping device of the arm on the column reduces all springing and sagging to a minimum.

Power consumption practically 40 per cent less than that of other radial drills.

The new Bulletin 4001-D gives complete information.

ESTABLISHED 1842 INCORPORATED 1888

JOSEPH T. RYERSON & SON

CHICAGO, ILL., U.S.A.

Canadian Representatives:

MACHINERY

GARLOCK-WALKER MACHINERY CO., 32-34 Front Street, TORONTO

MONTREAL WINNIPEG

If interested tear out this page and place with with letters to be answered.

manufacture." There has been a large decrease in earnings during the first year of reconstruction, but President William Lyall says: "Your company has been fortunate in securing several large contracts, in addition to those already in hand, and your directors look forward with confidence to the future."

Sues for Commission.—J. Wesley Allison, of Morrisburg, Ont., who figured in the famous fuse inquiry at Ottawa in 1916, is now appearing as plaintiff in a suit in New York that is also based on munition contracts. Suit for $300,000 based upon a British munitions contract was filed in the United States District Court here this afternoon by Colonel Allison against H. M. Dodge, of Madison, N.J., director of the Remington Arms-Metallic Cartridge Company. Allison claims the amount as commission due him on a contract for more than 2,000,000 shells. He alleges that he obtained plans and specifications for the cases, furnished them to Dodge, and gained from Sir Sam Hughes, Minister of Militia and Defence of Canada, "directions to proceed with the manufacture of the tools."

PERSONAL

Official announcement was made that P. Merril has been appointed general manager of the Dominion Iron and Steel Company, and the Dominion Coal Company. Mr. Merril will reside in Sydney and will be in charge of all the operations of the two corporations and their subsidiaries.

EXPANSION CANADIAN BUSINESS MAY FOLLOW HALL-WILLIAMS MERGER

Some time ago CANADIAN MACHINERY presented an article to their readers on the plant of the John H. Hall & Sons, Ltd., Brantford, Canada. At the conclusion of this article we stated that business expansion was only a matter of time as far as we could see, and while we take no credit as to being prophets, our prognostication has come true nevertheless. This concern has now formed a merger with a well-known American pipe machine manufacturer, namely, the Williams Tool Corporation of Erie, Pa.

The John Hall Co. is too well known to require further introduction, but to those who are not familiar with the Williams Tool Corporation, we might state that they are one of the oldest and perhaps the largest manufacturers of pipe machines in the United States.

The Hall Co. have been so busy lately that a night shift has been necessary, and it was felt that something had to be done to meet the increasing demand for their machines and for prospective export orders, hence the merger. It is expected that in the very near future a new modern factory will be necessary.

The announcement of this merger will no doubt be of particular interest to the machinery houses in Canada, and the users of pipe threading machines in general. Both these concerns specialize on pipe machinery, and the new corporation will have a capitalization of close to one million dollars. The entire activities of the new company will be to produce the latest and best in their line. This will ensure that the present high standard of Hall products will not only be maintained but improved if possible. Machines will be manufactured in larger quantities, and it is hoped in the near future that the company will be able to ship from stock from their own warehouse. All standard stock parts and dies will be available for immediate shipment.

A special department of the new corporation will be the publicity or educational department. Attractive literature covering the various uses of pipe machines, as seen from the users' standpoint, will be covered. Charts will be shown and devices in actual practice. The cost of threading pipe and how to overcome lost production will be gone into. A service of instructive and educational circulars will be issued for the man on the machine, and the advice and experience of twenty years will be placed in these books and booklets.

The local plant of the concern will be known as the Hall plant of the Williams Tool Corporation, and several special high powered machines will be installed to speed up their present production.

Speaking to Mr. Leslie S. Hall, the president and general manager of the old company, regarding changes in positions, he stated that the personnel of the new concern would be as follows:

Mr. Brill, who will be president, is a consulting and manufacturing engineer of wide experience. Mr. Davis, senior member of Davis & Co., New York, will be chairman of the board of directors, while Leslie S. Hall himself will take over an executive position between the two factories and becomes vice-president. Mr. A. R. Hall will be manager of the local plant and Mr. E. L. Williams, will have charge of the local office. Mr. E. W. Hall is retiring as secretary and treasurer of the company, and Mr. E. L. Hall, who is now in England, will no doubt continue with the new corporation on his return.

This places the local branch in an enviable position as nearly all their present officers retain executive positions. "Still better machines and better education as to the use of our machines will be our motto," finished Mr. Hall.

Screw Pitch Gauge

The Greenfield Tap and Die Corporation of Greenfield, Mass., have made an improvement on the old-fashioned screw pitch gauge, in making the same into a limit gauge, which will increase the accuracy and enable the user to determine in which direction any error lies. One side of the gauge is cut to conform to the normal pitch of the thread, while the opposite side is divided into two sections, one of which is cut with a thread 0.002 inch long, and the other section 0.002 inch short per inch, thus giving a tolerance above and below the normal size.

ON THE TRAIL OF THE PROFITEER

—Reynolds' in Tacoma "Register."

Dumore Grinders in the Delco Tool Room

BUSY, EFFICIENT, ADAPTABLE TOOLS

THE Dumore Grinders at the Dayton Electric Laboratory Company (Dayton, Ohio) are continually busy and the Delco tool makers surely like them. The job you see chucked in the heavy lathe is one of a lot of fine counterbores used in the production of distributor cams on Delco ignition sets. Fine limits are fixed on this job and the Dumore as an internal grinding machine has amply proven its dependability for the accurate grinding of duplicate diameters.

This is only one of the many uses made of Dumore Grinders. For all work where speed and production costs are to be considered—where accuracy is of prime importance—and also for the multitude of odd jobs that arise every day — Dumore Grinders are indispensable

Dynamically balanced, no end play, no vibration. Equipped with S. K. F. and Norma ball bearings. Well built, adaptable, efficient—Dumore Grinders cut costs throughout the shop.

WISCONSIN ELECTRIC COMPANY

2924 Sixteenth Street **RACINE, WISCONSIN**

DUMORE HIGH SPEED GRINDERS

If interested, tear out this page and keep with letters to be answered.

RAILWAY SCRAP SHORTAGE

Continued from page 90

53. No. 3 spring steel. Coil springs made from steel under 3-16 inch in any diameter.

54. No. 1 cast steel. Charging box size, 5 ft. and under, under 18 in. wide; no piece weighing less than 10 lbs. to be included.

55. No. 2 cast steel. Over 5 ft. long and 18 in. wide.

56. No. 1 heavy melting steel. Charging box size, 5 ft. and under 18 in. wide; no piece weighing less than 10 lbs., including all steel scrap not otherwise specified.

57. No. 2 heavy melting steel. Over 5 ft. long and 18 in. wide; including all steel scrap not otherwise specified.

58. Tools and tool steel. Files and worn-out steel tools, including old claw bars, pinch bars, spike mauls, track wrenches, picks, adzes, axes, chisels, drills, hammers, knuckle pins, punches, tool steel, finger pins, bits, draft keys, bar steel, weighing 10 lbs. per piece.

59. No. 1 tires. All locomotive driving, engine truck and coach tires 36 in. and over inside diameter, smooth inside; not grooved for retaining rings.

60. No. 2 tires. All tires not included in No. 1.

61. No. 1 turnings and drillings. Wrot iron and soft steel, clean and free from cast borings, brass, hard steel, other metals, dirt and lumps.

62. No. 2 turnings and drillings. From tires and other similar steel, including hard steel; clean, free from other metal, dirt and lumps.

63. No. 1 turnings, drillings and borings. Wrot, cast and steel mixed; free from other metals, dirt and lumps.

64. No. 2 turnings, drillings and borings. Wrot, cast and steel, mixed with brass and other metals; free from dirt and lumps.

65. Wrot, No. 1 extra railroad. Rods and bars, 1½ in. in diameter and larger; 6 ft. and over.

66. No. 1 railroad wrot. Clean wrot iron, from railroad equipment, pieces measuring 4 in. long and over (exclusive of threads), may include rods and bolts ⅜ in. in diameter and over (except track bolts), also drawbar yokes, bridge iron in bars or rods, switch rods, heavy iron chains, links and pins; free from riveted material.

67. No. 2 railroad wrot. All wrot iron under 6 in. long not specified under No. 1; to include track spikes, bolts and nuts, rivets and lag screws.

Miscellaneous

68. Babbitt. Clean.

69. Barrels, oil. Standard classification.

70. Barrels, paint. Standard classification.

71. Bags and burlap. Bagging, sacking and waste covering.

72. Brick. Arch and fire brick.

73. Belting, leather. Including punchings and trimmings (specify width).

74. No. 1 brass. Locomotive brass, including rod brass.

75. No. 2 brass. Steam metal brass, including valve fittings.

76. No. 3 brass. Car journal bearings free from babbitt.

77. No. 4 brass. Brass borings, drillings and turnings.

78. No. 5 brass. Yellow brass castings, including hose couplings, etc.

79. No. 6 brass. Coach trimmings and light brass.

80. No. 1 copper. Wire, flue ferrules, pipe, hammer heads.

81. No. 2 copper. Sheet copper.

82. No. 3 copper. Roofing copper with paint and nails.

83. No. 4 copper. Battery copper, dross and oxide. Report separately.

84. Carpet, linoleum and plush. (Specify kind).

85. Crucibles, old.

86. No. 1 hose. Air brakes and signal hose free from wire and fittings, also rubber boots and shoes without leather soles.

87. No. 2 hose. Steam and water hose, free from wire end fittings.

88. No. 3 hose. Engine tank, washout, fire and rubber lined fire hose, free from wire and fittings.

89. No. 4 hose, wire wound hose and wire inserted. To also include oil and paint hose.

90. Rope. Manila fibre, not including tar rope.

91. Tarred rope and marlin.

92. No. 1 rubber. Rubber packing, gaskets, diaphragms, matting and step treads.

93. No. 2 rubber. Rubber valves of all kinds.

94. No. 3 rubber. Rubber belting of all kinds.

95. No. 1 wheels. Cast iron, including car, tender and engine truck; no allowance for grease and dirt.

96. No. 2 wheels. Steel tired; specify kind.

97. Wire, telegraph in rolls.

98. Zinc, sheet and battery.

*Structural covers building and bridge iron and steel. Shaped covers cars and pile driver iron and steel.

INDUSTRIES THAT ARE EXTENDING

Going Ahead With New Building in Order to Handle the Increasing Trade

The Draper Mfg. Co., Port Huron, will re-open and enlarge its plant at Petrolia, Ont., which was closed some time ago. It manufactures valve facing tools, ball check valves, ball globe valves, balanced brass balls, etc. Operations are expected to begin in about two months.

Beatty Brothers, Fergus, Ont., manufacturers of stable equipment, pumps, washers, etc., have increased their capital stock from $750,000 to $2,000,000 to provide additional capital to take care of increased business. It is the intention of the company to spend this year about $150,000 on additions and machinery. About 70,000 sq. ft. of floor space is being added to the Fergus plants and improvements are under way at the plants at London, Ont.

The Sherbrooke Machinery Co., Randrell Street, Sherbrooke, Que., has awarded the general contract to the Loomis Construction Co., 7 Belvidere Street, for an addition to its machine shop to cost $26,000.

Bert Marsh, Auburn, Ont., will rebuild his sawmill recently destroyed by fire and is asking for prices on equipment.

The Berliner Gramophone Co., St. Antoine Street, Montreal, has awarded contracts for the erection of a factory costing $400,000. The Atlas Construction Co., 37 Belmont Street, has the contract.

The Atlas Mfg. Co., Port Arthur, Ont., manufacturer of electrical supplies and equipment, automobiles, etc., has recently purchased property on Ambrose Street and is remodelling a building on the site. It also intends to erect a four-storey brick structure for which machinery will be purchased. W. L. McGregor is president; A. G. Day, vice-president, and A. C. Latoski, secretary and general manager.

Montreal Notes

G. J. Desbarats, Deputy Minister of Naval Service; Thos. Robb, of the Shipping Federation, and C. J. Gauthier, sailed from New York last week on the Cretic to attend the Seamen's International Conference, which is being held at Genoa this month.

The St. Lawrence Welding Company, of 138 Inspector Street, Montreal, has secured the manufacturing and selling rights for the Simplex collapsible rims for automobiles. In addition to the making of the new rims they will manufacture the attachments for the converting of old rims.

The new addition to the plant of the St. Lawrence Welding Company has been completed and new machinery has been installed. A set of 8 ft. bending rolls, capable of handling 1-inch plate, has been added to the equipment. Several new machines have also been provided in the machine shop.

At the annual meeting of the Montreal branch of the Engineering Institute of Canada held last week, Arthur Surveyor was elected chairman for the ensuing year. In addition to the election of officers, a corporation of professional engineers was formed, and the council for the present year of this new section will be A. R. Decary, president; W. J. Francis, vice-president, and F. R. Brown, honorary secretary-treasurer.

The man who has a well defined ideal, who hews to the line, who eliminates all deterrent influences, who concentrates his energy on his ideal, who bends his efforts towards the one thing is pretty sure to accomplish his purpose.

MORROW HIGH SPEED FORGED DRILLS

WILL SOLVE YOUR HOLE PROBLEMS

Try Your Jobber First

Order by the Name *"Morrow"* and Make Assurance Doubly Sure

JOHN MORROW SCREW & NUT CO., LTD.

INGERSOLL, CANADA

7 Hop Exchange, Southwark St., London, England

MONTREAL
St. Paul St.

WINNIPEG
Confederation Life Building

VANCOUVER
1290 Homer St.

Largest makers of Set and Cap Screws, Semi-Finished Nuts, S. A. E. Plain and Castle Nuts, S. A. E. Cap Screws.

If interested tear out this page and place with with letters to be answered.

Upon the Health of your employees depend your profit and production

Don't be contented with half-way goodness or makeshift drinking arrangements.

Throw out the germ-laden Drinking Cup !

Give your men a clean drink

PURO **SANITARY DRINKING FOUNTAIN**

(MADE IN CANADA)

Allows just the proper amount of cool, clean, fresh water to come through the bubbler. No spurting, overflowing, no loss. "Puro" regulates itself. "Puro" saves 35% on water bills, too. You can attach it in a few minutes. Tell us how many men, how many departments and we'll tell you how much the cost will be.

Puro Sanitary Drinking Fountain Co.

Canadian Agents:

McKENZIE BROS.

18 St. Alexis St. Montreal, P.Q.

When Writing to Advertisers say you saw it in Canadian Machinery

REGARDING MOLYBDENUM

(Continued from page 531)

of the other ingredients alloyed. The rolling mill yield is also higher and the cost of grinding less.

"Most marked results are obtained in the forming of the steel. To illustrate, the forging temperature can be carried considerably higher than is ordinary without fear of destroying properties hitherto unreclaimably lost if the temperature exceeded the allowable narrow limits. In other words, the forging can be done at a higher temperature without burning or over-crystallizing the steel, and this results in cutting down the forging operations because the metal is more plastic, and it also eliminates the losses heretofore frequently occurring for the reason that the allowable limits of forging temperature were exceeded during the forging, because of inability to maintain uniform temperature regulation, particularly where articles are being produced in large quantities. An additional saving is effected by virtue of the fact that with such wider range of forging temperature, the use of the expensive regulating equipment and operators is obviated, because the furnace men can readily approximate the temperature within much less than 200 deg., merely by the color of the metal.

"Again, the range of temperature for heat treatment is greatly increased, and instead of being confined within 10 deg. to 20 deg. Fahr. as is the case with present commercial alloy steel, the temperature range is increased to about 200 deg. Stated in other words, the molybdenum prevents detrimental structural changes, such as crystallization, and secondary chemical reactions from taking place until the temperature goes several hundred degrees above the point of recalscence. This is an advantage of the greatest importance, not only because of the saving effected in the cost by the elimination of furnace regulating equipment, but also because the metal will run uniformly under wide variations in temperature, which means that the losses in manufacture and in service, ordinarily attributable to exceeding the narrow range of heat treatment, are reduced to a minimum, if not entirely eliminated. In other words, it is possible to manufacture machine parts, for example, on a large scale and obtain uniform results notwithstanding the impossibility of maintaining uniform temperature conditions.

"Furthermore, it appears that the qualities of the steel after forging are far superior than is ordinarily found to be the case, so that it is possible, if desired, to eliminate the normalizing heat preceding the quenching heat. In so far as the drawing heat is concerned, the use of the molybdenum makes it possible to draw at a much higher temperature, which effects a saving because it is much easier to regulate a furnace at high temperatures than it is at low temperatures.

"As to workability after heat treatment, I find that alloy steels made in accordance with my invention have excellent machining characteristics, having the ease of workability of vanadium steel combined with the superior non-crystallizing characteristics of the nickel steels.

"The physical properties of the steel, in contra distinction to ordinary commercial alloy steels, very closely approximate the super-excellent properties of the special steels. Thus, the tensile strength and the elastic limit are greatly increased, while a maximum elongation is obtained. The cost to obtain like results with the nickel and the vanadium steels, even assuming that no result detrimental to other properties would follow, would be prohibitive. The steel also has a very high resistance to impact and shock, and to alternating stresses without crystallization, the reduction in area is excellent, and the steel can be cold bent double or twisted a number of times without developing flaws. It appears that by the use of molybdenum in small quantities the increase in the physical properties is obmolybdenum materially increases the depth of hardening, so that the above properties will be found even where considerable reductions in cross-sectional areas are made during manufacture. Certain of these properties flow from the fact that the increased temperature range permits of forging, quenching and drawing at a higher temperature; and others from the direct chemical effect and the indirect chemical effect of the molybdenum."

TRADE GOSSIP

Trouble at Peterboro.—The Canadian General Electric machinists' at Peterboro offer to the company to abide by the recommendations of the Board of Conciliation authorized by Senator Robertson, Minister of Labor, brought the following reply from Senator Nicholls to Mayor McIntyre: "The company declines to be represented on a Board of Conciliation in connection with the strike in Peterboro, and must also decline to accept any award of such board if appointed. We are still willing to grant the increases which were offered to the men before going on strike. We have advised the Minister of our decision." It was followed by another telegram, which simply reiterated Senator Nicholls' determination not to yield to the demands of the men.

Get-Together Meeting.—Friday evening the management and the employees of the P. B. Yates Machine Company, Limited, Hamilton, held their first annual "get-together" social and entertainment in the Sons of England hall, Hughson street north, when about three hundred of the employees and their friends attended. The entertainment commenced about 7.15, in the form of a euchre and whist drive, concert, supper and dance. The company had also prepared a fine softball diamond, and the team of the Yates company will be glad to arrange a game with any of the other factories. There is also a fine soccer and quoits field for the employees. For some time past there has been a steady growth of the community spirit in the firm.

WORKING TO MAKE USE OF LIGNITE

U. S. Department of Marines Has New Scheme Under Way to Use Large Deposits

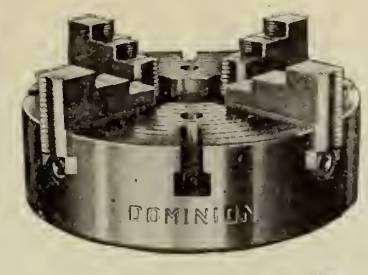
Washington.—Efforts to make the lignite or brown coals of Texas, North Dakota, and other Western States so serviceable to that part of the country that it will be unnecessary in the future to ship in other coals at great expense are to be inaugurated immediately by the Bureau of Mines, Department of the Interior, at New Salem, North Dakota, in co-operation with a company there.

Immense quantities of these lignites, constituting one-third of the fuel resources of the nation, are available in these states, but have been little used because of the great amount of moisture in them, their tendency to disintegrate when dry and their liability to spontaneous combustion. In fact, the difficulties have been so great in burning the lignite that the people have preferred to buy their coal in Illinois, Indiana, West Virginia, Kentucky, and Pennsylvania, bringing into their localities several million tons of coal that had been hauled an average of 1,000 miles and at a cost of nearly $5,000,000 in freights. The Bureau of Mines proposes to carbonize and briquet this raw lignite and develop a smokeless domestic fuel that will do away with the importation of domestic coal into this section of the country. By heating the lignite sufficiently to drive off the moisture and a part of the gases a char is obtained, which, in heating value closely approximates anthracite coal. The briquetting of this makes a very satisfactory household fuel.

An appropriation of $100,000 was made by Congress a year ago for this purpose and the Bureau of Mines has, after a careful survey of the entire field in which a number of the cities in these states have offered their facilities, selected New Salem as the place best fitted for the investigations, which will begin at once.

It is claimed in this process of carbonizing the lignite and making briquets out of it that not only is a superior domestic fuel created, but that valuable by-products are made, such as enormous quantities of gas to be used for fuel or power purposes, and a great amount of oils and tars.

Sliding Wage Scale.—Judge McLellan, chairman of the conciliation board sitting on the Ottawa Electric Railway dispute, suggested a novel way of coming to an agreement regarding wages, which may be recommended in the board's findings. His idea is that an agreement should be made covering a long term. The rates of wages should be increased in proportion to the increase in the cost of living. Every six months there should be a revision, and if living costs increase or decrease wages will increase or decrease in the same proportion. The figures taken as a basis would be those published in "The Labor Gazette."



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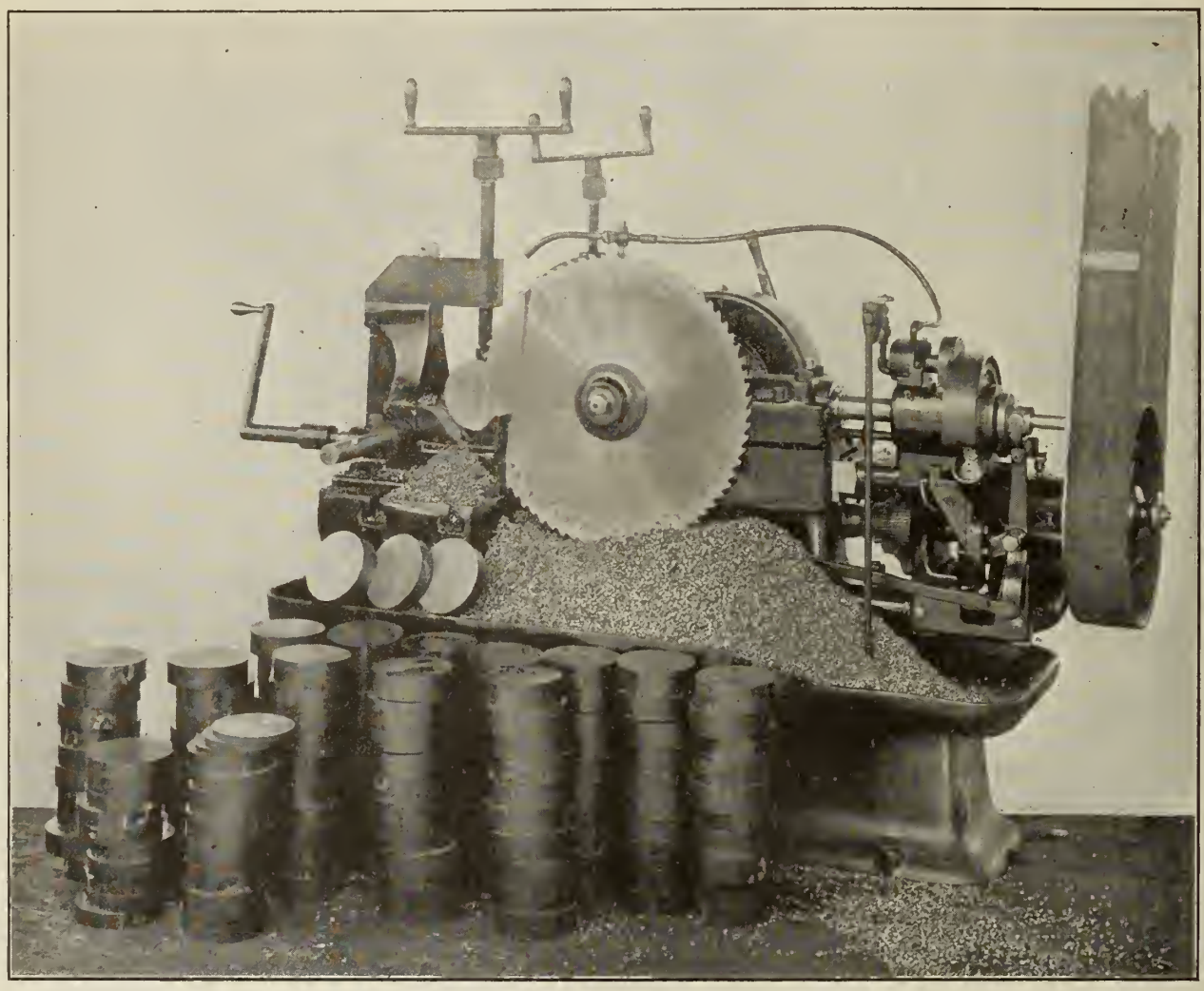

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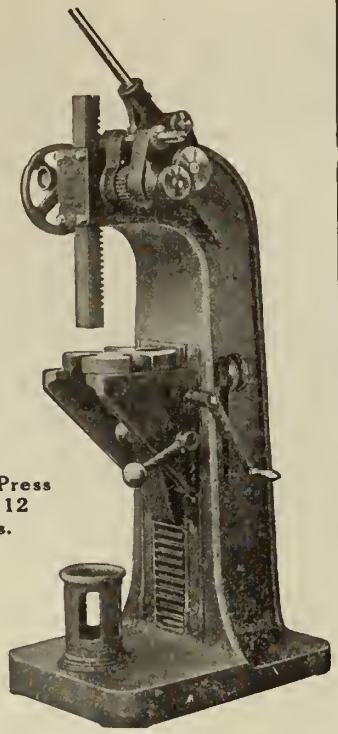
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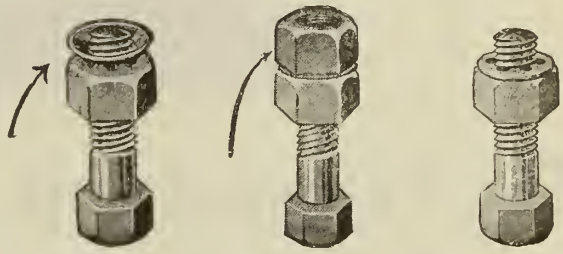

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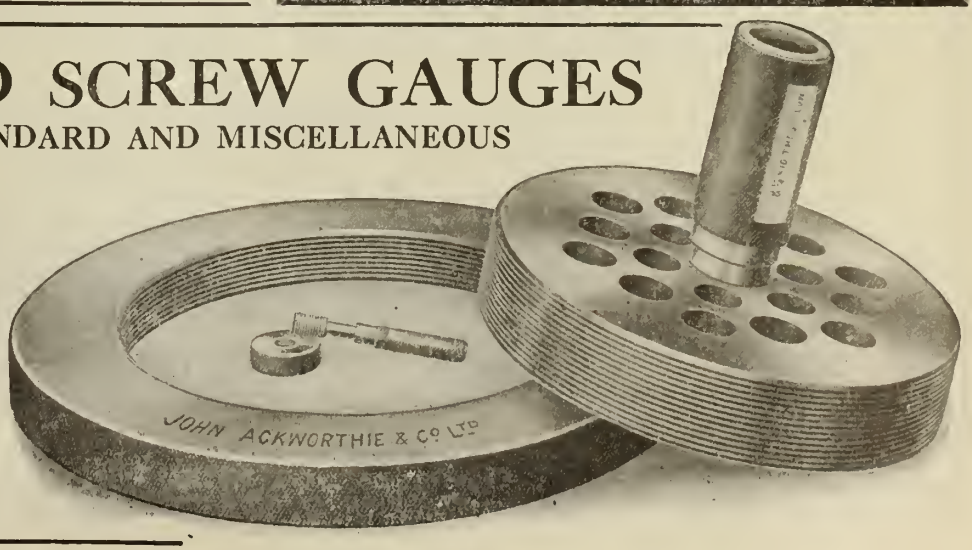

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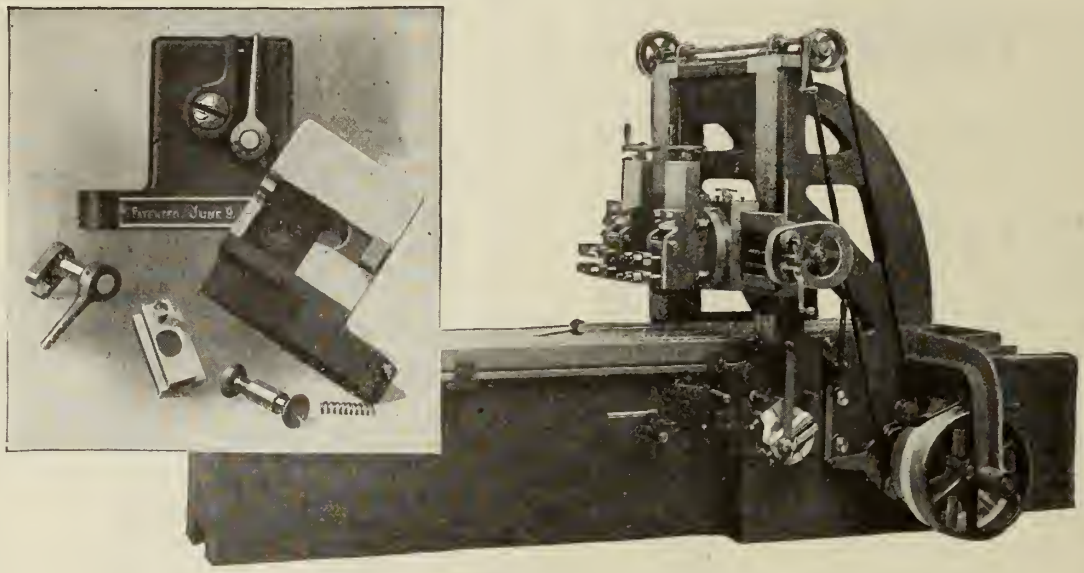

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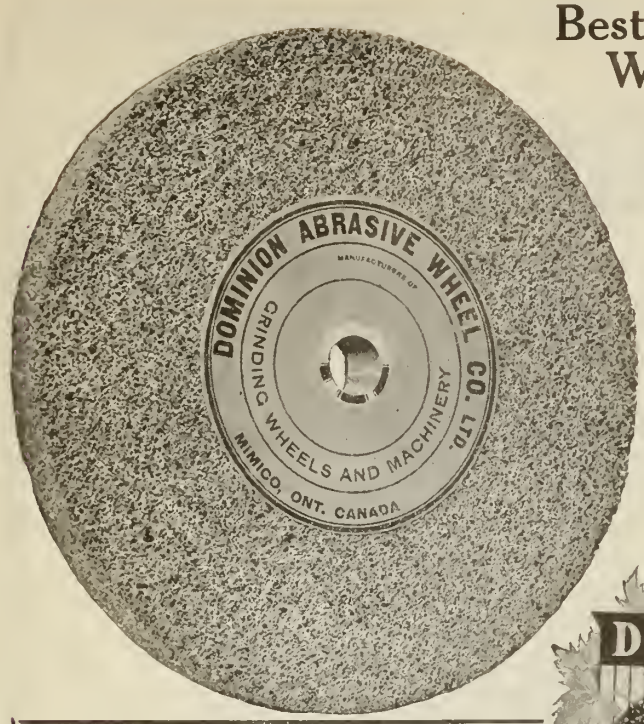

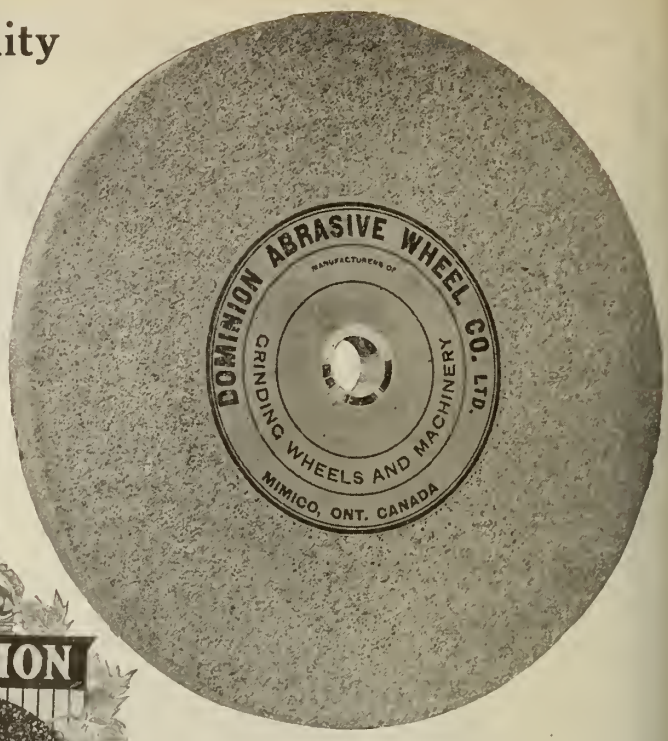

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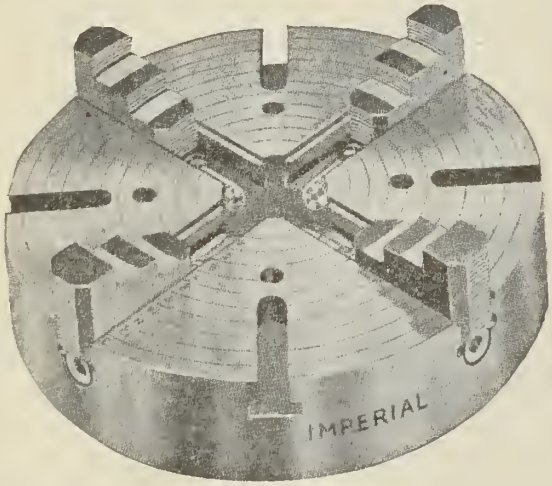

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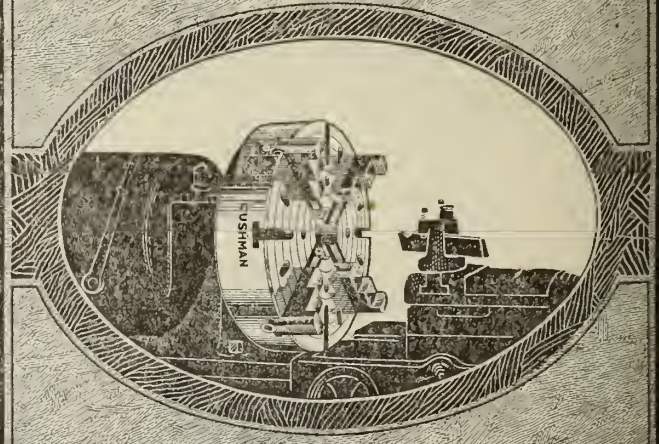

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New Truths and Old Fallacies

Fusibility of Alloys—*Continued*

Alloys are solutions of one metal into another and the degree of solubility varies.

The term, "fusible metals' 'is usually applied to alloys whose melting point is below that of tin. The lowest freezing point in a series of alloys was first designated by Doctor Guthrie as an Eutectic. The eutectic structure is defined as being composed of the different constituents in juxtaposition. There is a natural limit of saturation in a solid compound, just as there is in a liquid compound, and when that limit is reached the undissolved portion separates and falls out, as it were, into the matrix or eutectic and at that point occurs the lowest freezing point or eutectic, which is also the lowest melting point.

In an alloy composed of lead and antimony, 13 per cent. of antimony is the natural limit of saturation, and any antimony in alloy in excess of 13 per cent. can be easily seen in the eutectic compound under moderate magnification in the form of crystals, but the antimony dissolved in the eutectic compound is so intimately mixed and finely divided that the highest magnification is required for its resolution. As the undissolved antimony crystals multiply and become attached to one another, forming bridges, the alloy becomes increasingly brittle to the extent of the antimony used in excess of 13 per cent.

The fusing point of an alloy is always less than the mean of its constitutent metals and the fusing point of trinary or quarternary alloys containing, respectively, three and four elements, are lower than a binary alloy. The molecules of different elements combined are supposed to be in constant motion in effort to adjust their crystalline structures, which likely accounts for alloys having lower fusibility than the single metals of which they are composed.

(Continued next month)

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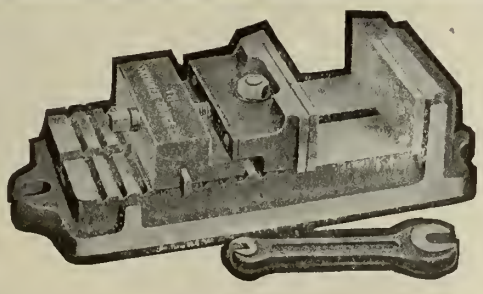

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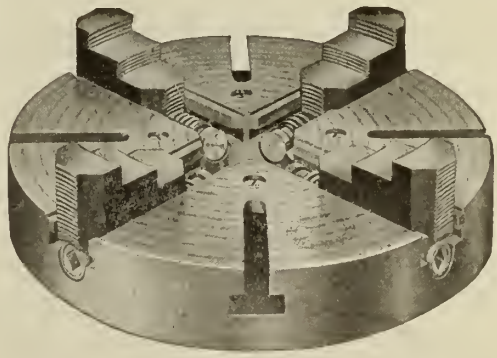
INDEPENDENT CHUCKS

are not an experiment—they have come to stay. They are a necessity with the modern machinery and high-speed steel cutting tools.



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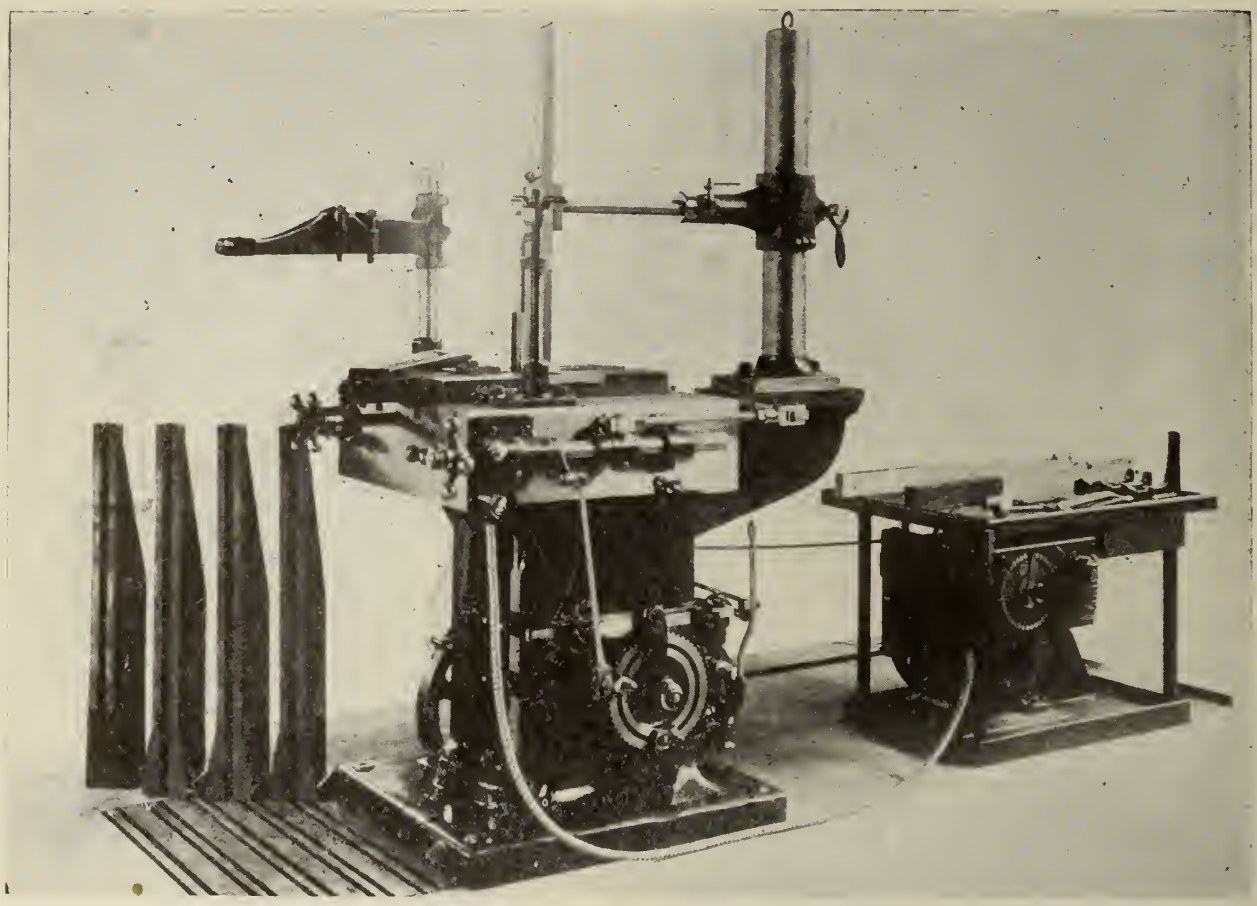
Fully Equipped for General Work



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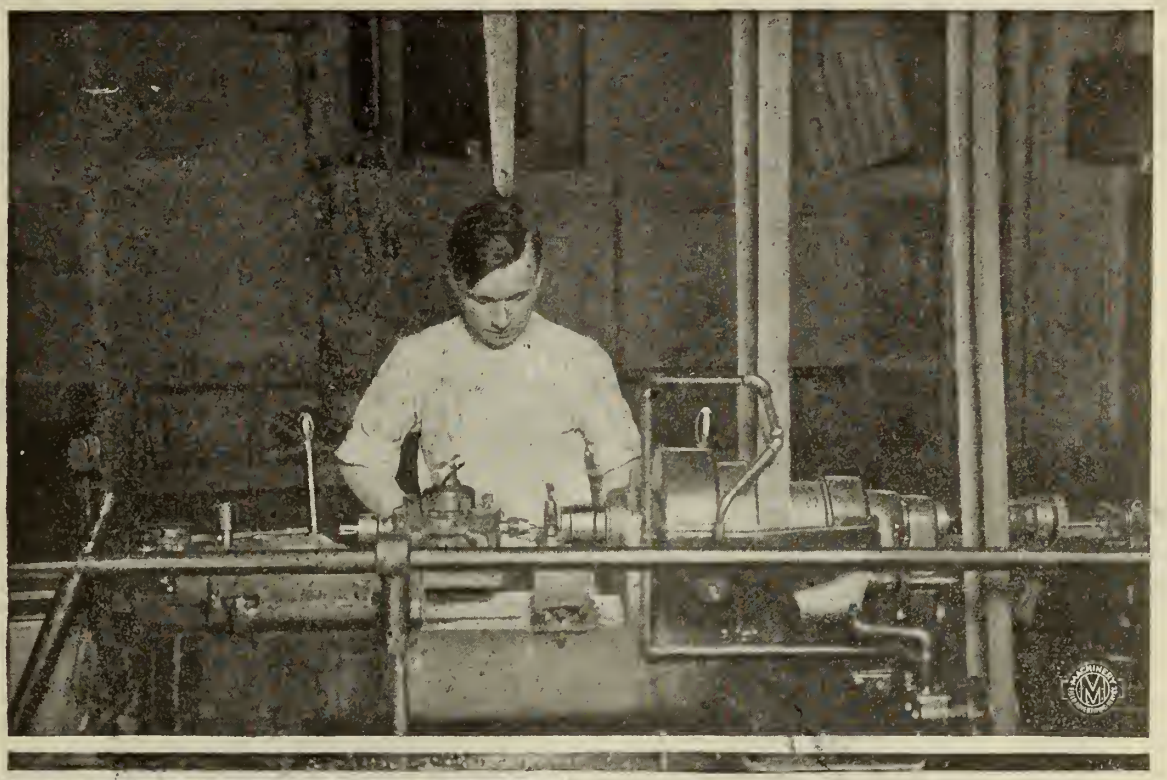
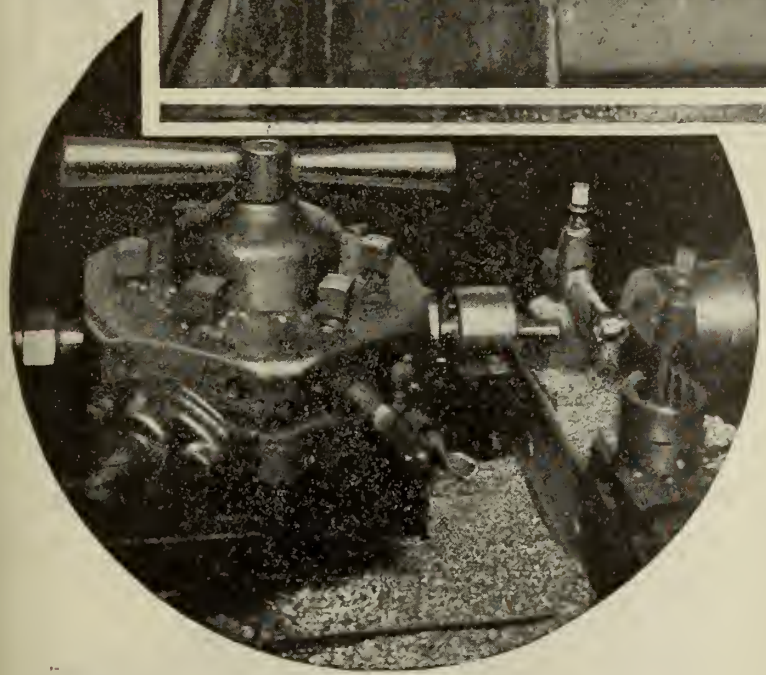
GARVIN MACHINE TOOLS

SCREW MACHINES





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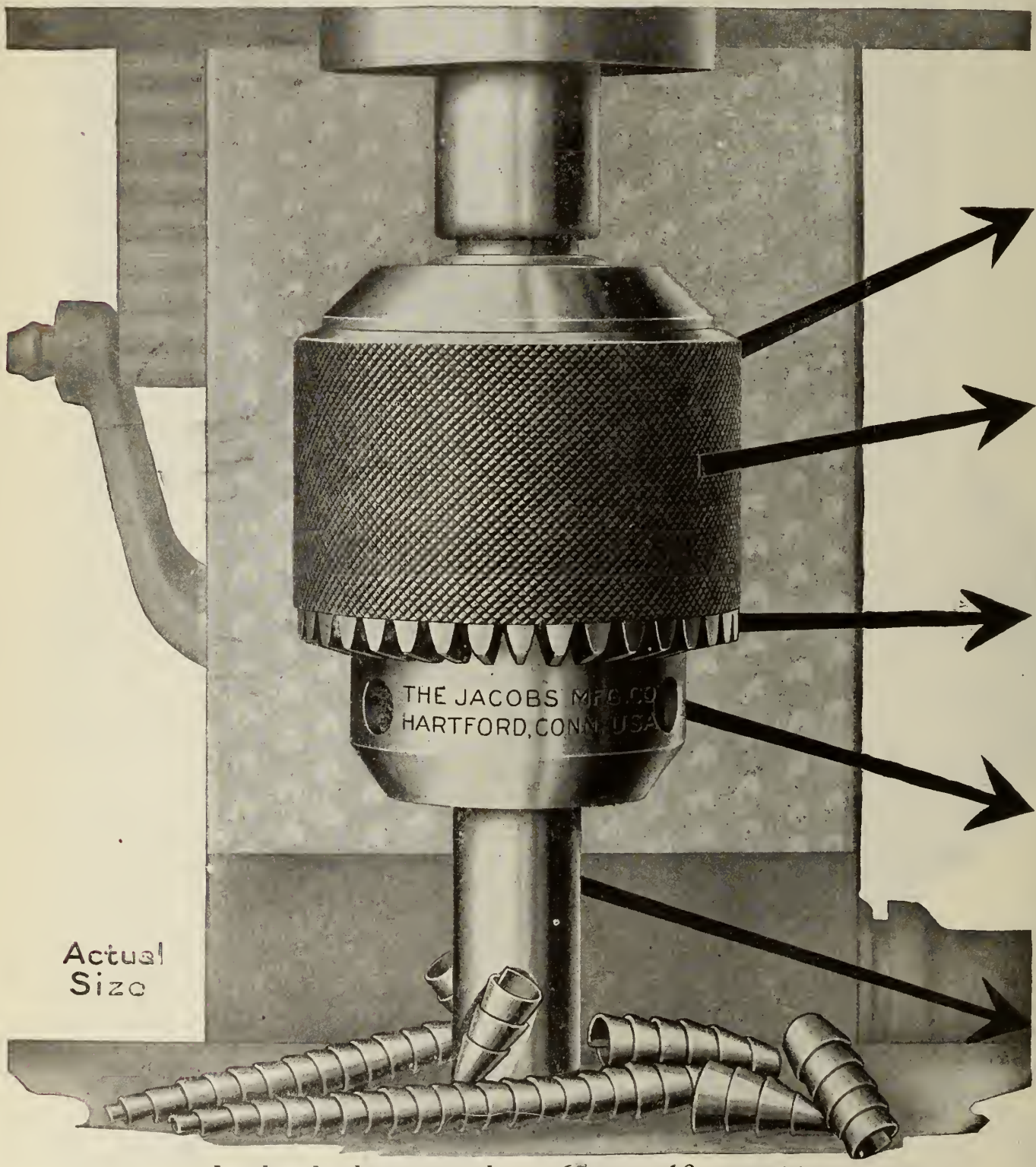
G-12

The JACOBS "Big Five"



Jacobs chucks are made in 6 sizes--13 capacities

The JACOBS "Big Five"

Reason 1

Balance of weight is in the back of the chuck near the bearings of drilling machine, and being evenly distributed from center of chuck eliminates vibration on these bearings.

Reason 2

The shape and construction of the chuck permit the operator to see at all times exactly how and where he is drilling, and allow unusual ease of operation within narrow confines.

Reason 3

Regardless of size of drill used, the chuck is perfectly symmetrical. *This means safety in handling.* The three jaws grip the drill the full length of the jaws, giving a positive grip to prevent slippage of drills.

Reason 4

A simple and easy turn of the key which may be inserted in any of the three holes in the body, one of which is always in position, quickly changes the capacity, and tightens or loosens the grip on the drill.

Reason 5

Guaranteed to run true within 0.003", two inches distant from end of jaws when operated at maximum capacity. This means greater accuracy, in addition to the unusual ease of operation.

Distinctive Points of Superiority and Five Reasons Why

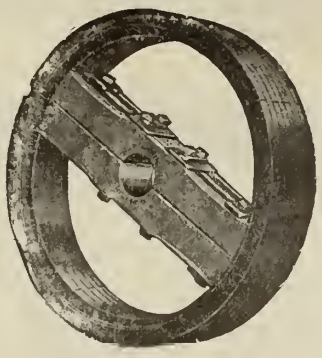
UP to one-half inch capacity, drills have been developed to run at great speed. Drill manufacturers have found it essential to adopt Jacobs Chucks on these high speed drills because of the absolute accuracy and balance required.

While the need of an accurate and well balanced chuck on drills of greater capacity is not so apparent, it is nevertheless just as important. Its use prevents vibration, with its constant wear and tear and breakage of drills.

The Jacobs Manufacturing Co.

Hartford, Conn., U. S. A.

BERNARD
Wood Split Pulleys

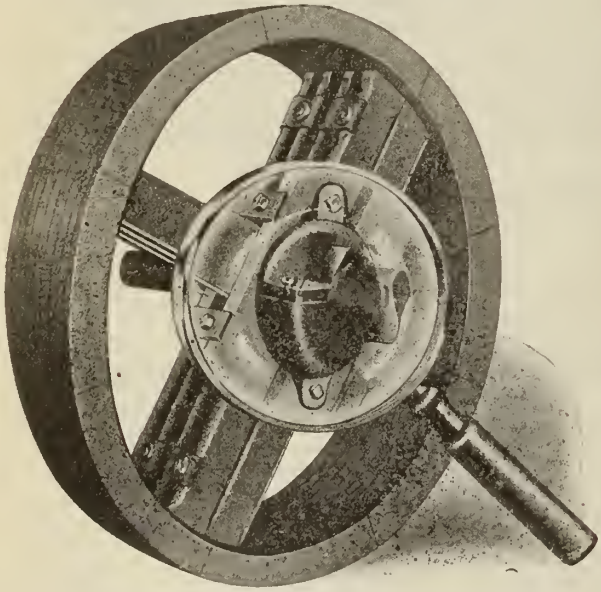


Save Power

Wood Split Pulleys are lighter and they have an efficient Belt Gripping Surface

With the installation of Bernard Wood Split Pulleys you start on the road to lower overhead. Their cost is low.

Safety **Satisfaction**



BERNARD SAFETY COLLAR

Put them to the test

The A. Bernard Industrial Co.

Manufacturers of High-Grade Power Transmission Appliance

Office and Works: Fortierville, Que., Can.

MacKINNON STEEL CO., LTD.

Engineers, Manufacturers and Erectors of Steel Structures

Industrial Bridges, Buildings, Towers, Smoke Flues and Stacks, Chutes, Coal Bins, Ore Bins, Tanks, Cranes, Engine Houses, Grain Elevators, Derricks.

Structural Steel and Steel Plate Work, and a combination of the two lines.

Prompt Deliveries Assured

MacKINNON STEEL CO., LIMITED

Sherbrooke, Quebec

Montreal Office: 404 New Birks Building

MATTHEWS OF PITTSBURGH

Durably Made Steel Letters and Figures

For Marking on all Kinds of Metal

MATTHEWS Steel Letters and Figures are hand-made from high quality Pittsburgh steel, properly tempered to assure hardness. They give long service under hard conditions.

Matthews line of steel stamps includes a wide range of letters, figures and symbols—for concave, convex or flat surfaces.

MARK YOUR NEXT ORDER "MATTHEWS" MADE.

JAS. H. MATTHEWS & CO.

3946 FORBES STREET - PITTSBURGH, PA., U.S.A.

Steel Lettering Dies and Stamps

That's all the introduction I need- if you sell

CLEVELAND

THE CLEVELAND TWIST DRILL CO., Cleveland, New York, Chicago

Agents for Europe, CLEVELAND TWIST DRILL CO. (GREAT BRITAIN), Ltd., 36-37 Upper Thames St., London E.C.4.

MALLEABLE AND CAST IRON PIPE FITTINGS

The Brand That Has The Quality

"Quality" and "Reliability" are two essentials demanded of *Cast Iron* and *Malleable Fittings*, by all sanitary and heating engineers.

Time and money are lost by improperly made fittings. All our cast iron and malleable fittings are properly recessed and every fitting bears the above trade-mark of quality.

We make a complete and full line of both flanged and threaded fittings from ⅛-inch up, and can make deliveries from stock, both standard and extra heavy.

When ordering from your jobber be sure you buy---"the brand that has the quality." They are different. A trial order will convince.

International
Malleable Iron Company, Limited
Guelph, Ontario, Canada

PETRIE

Canada's Dependable Machinery and Supply House

ASIDE from being in a position to supply the trade with everything in Machine tools and supplies we make a specialty of rendering valuable service in treating problems that arise in the shop. Fifty years' experience gives us an intimate knowledge of Canadian manufacturing conditions. Our engineering staff has given advice on hundreds of perplexing problems. If we can at any time be of help to you, Mr. Reader, get in touch with us. Our services are gratis. Always remember that **Petrie** signifies MACHINERY and SUPPLIES, QUALITY and SERVICE.

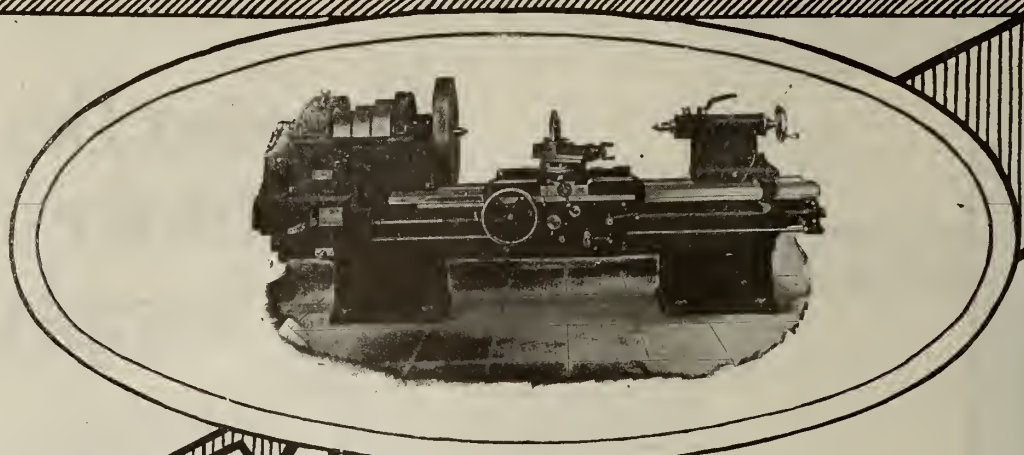
H.W. PETRIE
TORONTO. HAMILTON.

H.W. PETRIE LIMITED
ENGINES
LATHES PLANERS MACHINE TOOLS
SHAPERS DRILLS AND HAMMERS
BOILERS
TORONTO

TRADE MARK

MACHINERY AND SUPPLIES

Heavy Duty Lathes



SIDNEY For Service

Easy Masters of Big Jobs

Dependence put upon Sydney Lathes is never misplaced. Very heavy work can be done without apprehension.

The 25-inch Heavy Duty Quick Change Sydney here shown is the last word in lathe construction. Every possible improvement will be found in this model. Bed lengths of 10, 12, 14, 16, 18 and 20 feet are available. Build also with 27 inch swing.

Write for full particulars of the more suitable machine to-day.

Canadian Agents:
THE YEATES MACHINERY & SUPPLY CO.
Montreal, Quebec
H. W. PETRIE, LIMITED, Toronto, Ontario

The Sidney Tool Co.
Sidney, Ohio, U.S.A.

Open a Bank Account in Canada

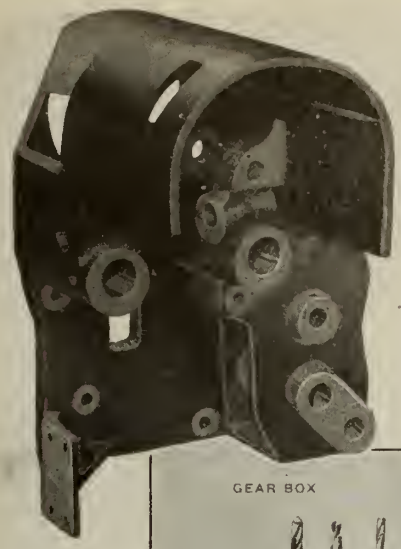
The present abnormal exchange situation between Canada and the United States is affecting trade relations between the two countries. Exporters in the United States can meet this by opening Bank Accounts in Canada.

This Bank has 681 Branches, of which 590 are located in Canada from the Atlantic to the Pacific Coast. Write for a complete list of Branches and for terms respecting a Canadian account.

THE ROYAL BANK OF CANADA

Capital and Reserves $35,000,000 **Total Resources $560,000,000**

Head Office : **MONTREAL**

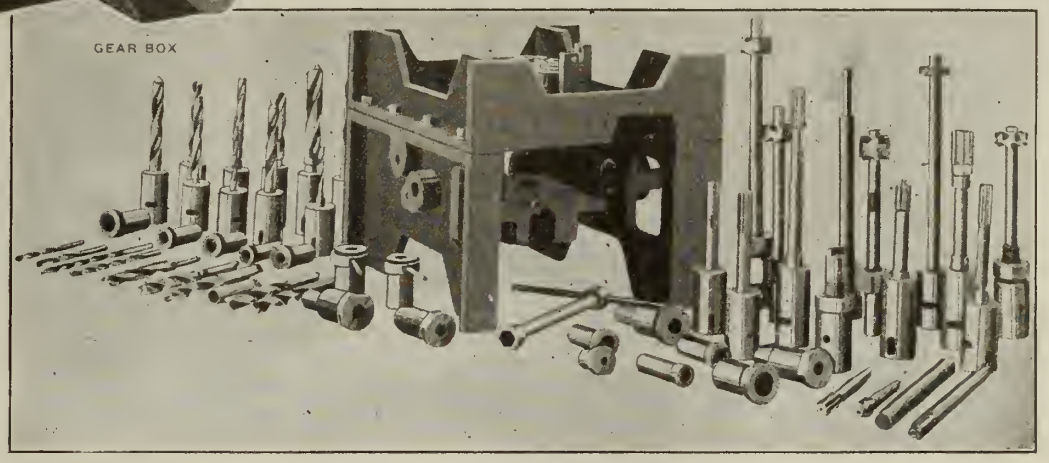


MODERN "Magic" Chucks

As Used By

Foster Machine Co.

Of Elkhart, Ind.



The illustration above does not show the "Magic" chuck—only the collet equipment and tools used therein. This cut was used by the Foster Machine Company in its bulletin "Foster Quality," and also in its trade magazine advertising.

As the text in both the bulletin and the advertising is designed to impress readers with the quality work done in building the Foster turret lathes, the array of tools presents a very fine tribute to the quality, efficiency, and usefulness of Modern "Magic" Chucks.

In our own advertising we have confined most of our argument to the "Quick Change" feature. In view, however, of the Foster experience we should, perhaps, make "Quality of Work Performed" our chief appeal. But remember, tools changed instantly without stopping or slowing machine.

Send for complete technical bulletin of this wonderfully adaptable tool.

MODERN TOOL CO., ERIE, PA.

Main Office and Works: State and Peach Sts.

Branch Offices:

New York, N.Y., 2 Rector St.
Detroit, Mich., 40 Larned St. E.
Cleveland, Ohio, 335 Guardian Bldg.
Chicago, Ill., 32 N. Clinton St.
Philadelphia, Pa., The Bourse.
Buffalo, N.Y., Associated Service Bldg.

Export Dept., Bishop Bldg., New York, N.Y.

CANADIAN AGENTS: Rudel-Belnap Machinery Co., Ltd., Toronto and Montreal.

CALIFORNIA REPRESENTATIVES: Herberts Machinery & Supply Co., San Francisco and Los Angeles.

If interested, tear out this page and keep with letters to be answered.

More Pounds Per Dollar and Per Hour

THAT heading tells the advantages of **Waltham Carbowalt** Wheels for snagging your gray iron castings. Give us your wheel sizes with descriptions of the approximate shape and weight of pieces you snag and that will be a start toward greater economy in your grinding room.

Tell us your peculiar conditions or special problems, if you have any. Then let us send you, at **our expense,** a **Carbowalt** wheel for you to test. It is your gain in wheel economy if we make good. Do it now. We are as anxious to serve you as you are for real proof of the possibility of

More Pounds Per Dollar and Per Hour

Waltham Grinding Wheel Co., Waltham, Mass.

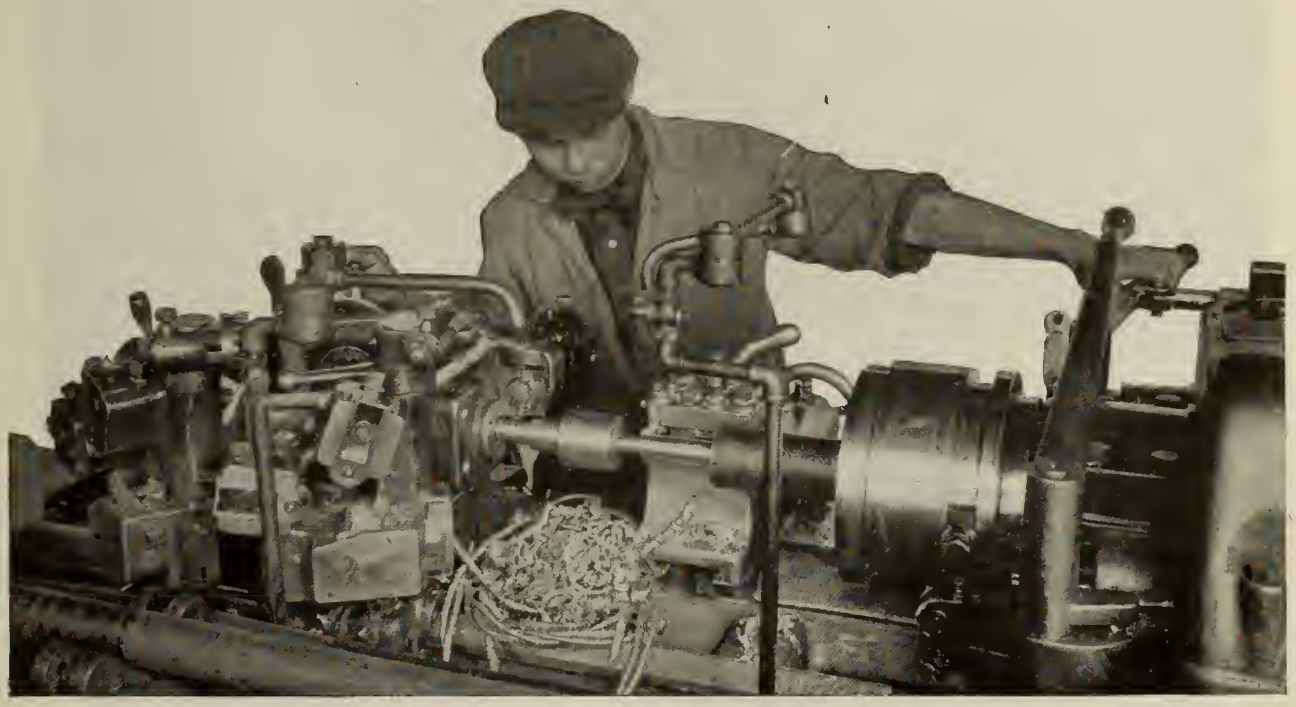
Agents: Standard Machinery & Supplies, Limited, Montreal

W & S Turret Lathes in operation

at the Master Mechanics and Master Car Builders Convention

Young's Million Dollar Pier Atlantic City, N.J.

June 9th to 16th Spaces 145 to 147



Here's an opportunity to compare what a W & S turret lathe can do with what is being done in your own shop.

We're showing three turret lathes in operation at the M. M. & M. C. B. Convention this year—

A No. 2A on a bar job (picture above)
A No. 3A finishing a gear blank
A No. 6 machining a clutch cone
and Stellite cutting tools on two of the machines.

You can get up close to the turret lathes and see them work—You can examine the work itself as closely as you like—You can ask questions about your own work—We send men to these conventions who know W & S turret lathes and they like to be quizzed—so bring a list of questions if you like—The more the merrier.

If you're not going to be in Atlantic City during that time, write for our new booklet "Turret Lathes in Railroad Shops."

The Warner & Swasey Company

CLEVELAND, OHIO, U.S.A.

NEW YORK OFFICE: Singer Building.
BOSTON OFFICE: Oliver Building.
BUFFALO OFFICE: Iroquois Building.
DETROIT OFFICE: Ford Building.
CHICAGO OFFICE AND SHOW ROOMS: 618-622 Washington Blvd.

DOMESTIC AGENTS:
Fulton Supply Company, Atlanta, Ga.
Young & Vann Supply Company, Birmingham, Ala.
Woodward, Wight & company, New Orleans, La.
Salt Lake Hardware Company, Salt Lake City, Utah.
Smith-Booth-Usher Company, Los Angeles, Calif.
Fred Ward & Son, San Francisco, Calif.
Portland Machinery Company, Portland, Oregon.
Hallidie Machinery Company, Seattle, Wash.
Hendrie & Bolthoff Mfg. & Supply Company, Denver, Col.
Peden Iron & Steel Company, Houston, Texas.

CANADIAN AGENTS:
A. R. Williams Machinery Company, Ltd., Toronto, Winnipeg, Vancouver, St. John's.
Williams & Wilson, Ltd., Montreal.

FOREIGN AGENTS:
Charles Churchill & Company, Ltd., London, Birmingham, Manchester, Bristol, Newcastle-on-Tyne, Glasgow.
Allied Machinery Company, Paris, Turin, Zurich, Barcelona, Brussels
Wilhelm Sonesson Company, Malmo, Copenhagen, Stockholm, Gothenburg.
R. S. Stockvis en Zonen, Rotterdam.
Benson Brothers, Sydney, Melbourne, Adelaide.
Yamatake & Company, Tokyo.
McLeod & Company, Calcutta.
Anderson, Meyer & Company, Ltd, Shanghai., Tientsin, Pekin, Hankow, Canton, Yumanfu, Changhau, Kalgan.
Brossard-Mopin & Company, Saigon, Singapore, Haiphong.

If interested, tear out this page and keep with letters to be answered.

MORE ACME FORGINGS

FORGINGS of all shapes and sizes ars made from scrap material on Acme Heading and Forging Machines.

These machines are so readily and quickly changed from one job to another that lost time between jobs in negligible.

Acme Heading and Forging Machines in construction are made extremely simple—power and effectiveness they are known for—constant use and greatest output at the lowest cost for general operation you will find in the "Acme."

Put your difficult forging problems up to us.

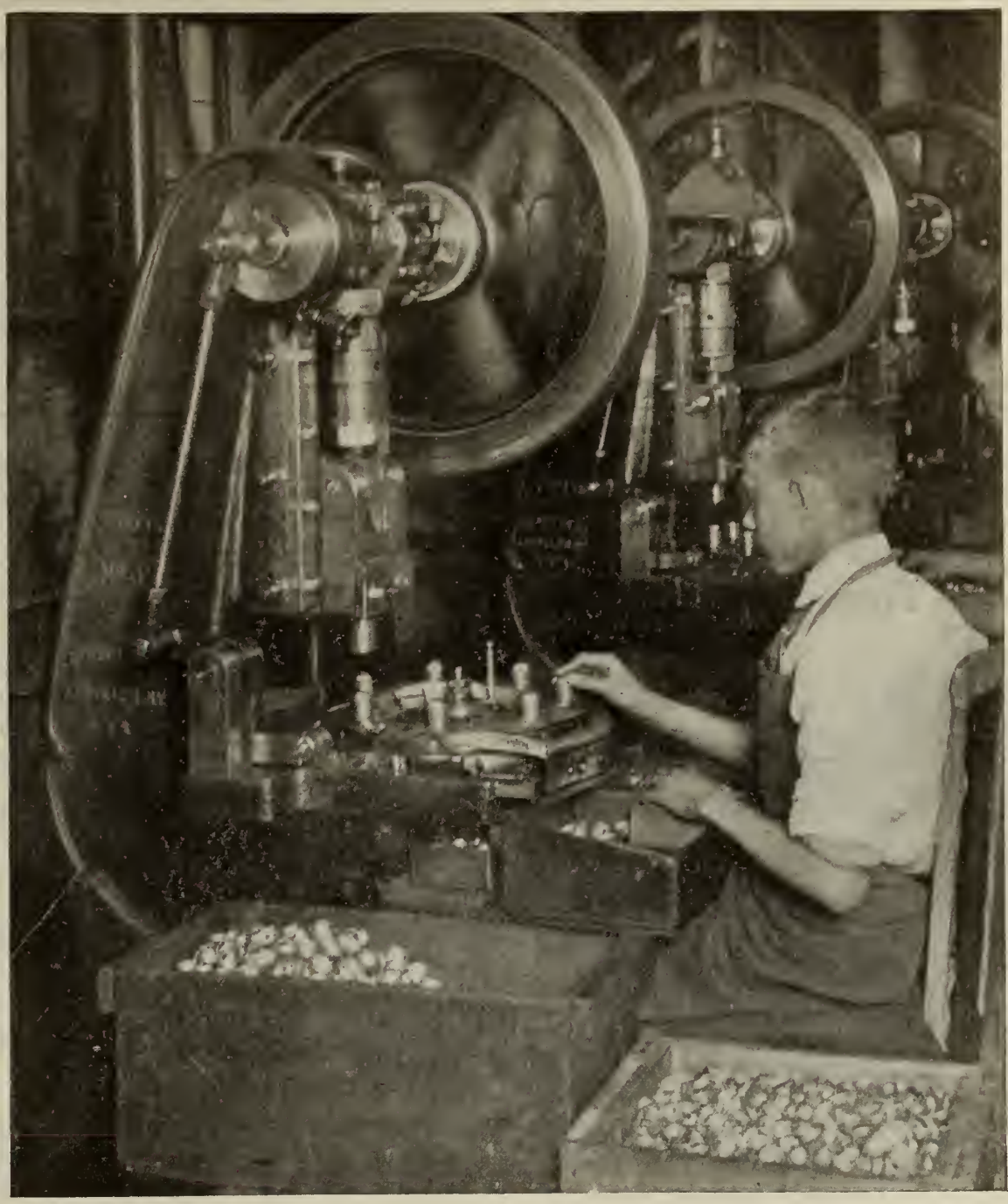
The Acme will take care of you. Write to-day.

The Acme Machinery Company

4530 St. Clair Ave. **Cleveland, Ohio**

Representatives for Canada :

The John Bertram & Sons Company, Limited, Dundas, Ontario



A BOY, operating this "BLISS" No. 19 Inclinable Press for THE KIRBY MANUFACTURING CO., "TOYS WITH BELLS," MIDDLETOWN, CONNECTICUT, is able, regularly, to close 15,000 two-piece, cold-rolled steel sleigh bells per 10-hour day.

The dial feed arrangement makes practicable this extremely rapid production. This press has been operating 10 hours per day since 1906 without replacement of any part.

BLISS 1857

E. W. BLISS COMPANY

Main Offices : BROOKLYN, N.Y., U. S. A.
American Factories : BROOKLYN, N.Y. *and* HASTINGS, MICH.

BLISS 1920

SALES OFFICES

CHICAGO, People's Gas Bldg.
CINCINNATI, Union Trust Bldg.
DETROIT, Dime Bank Bldg.
BUFFALO, Marine Bank Bldg.
CLEVELAND, Union Bank Bldg.
ST. LOUIS, Boatmen's Bank Bldg.

FOREIGN SALES OFFICES AND FACTORIES

LONDON, ENGLAND, Pocock Street, Blackfriars Road, S. E.
PARIS, FRANCE, 100 Boulevard Victor-Hugo, St. Ouen.

87

If interested, tear out this page and keep with letters to be answered.

Industrial Furnaces of Maximum Efficiency

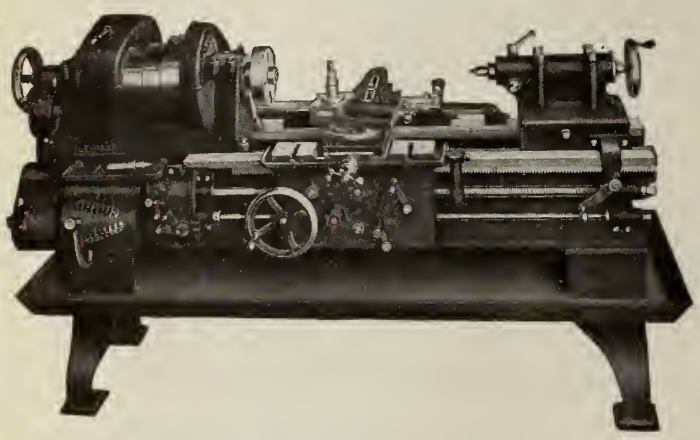
OILGAS

"The only distinct advance in furnace practice since Siemens' time."
Whatever the process, if it requires **HEAT,** we can supply an **OILGAS** furnace to handle the work with the highest efficiency, safety and reliability of operation.
Bulletin Fifty-Four is now ready.

General Combustion Company of Canada, Limited
619-623 New Birks Bldg., Montreal

"LEHMANN LATHES"

Will Put the Same Degree of Efficiency Into *Your* Shops as They Have in Many Others



TWO SIZES—16", Swing 18¼" and 18", Swing 20¼"

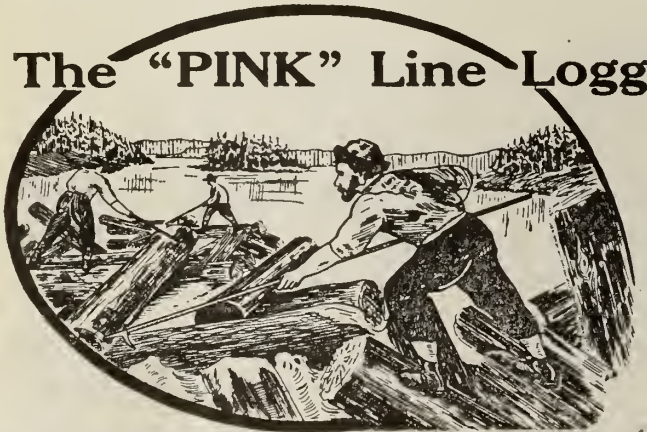
Because they are constructed "right" of the best material, workmanship and design, and therefore are adaptable to all conditions, whether it be work requiring accuracy to the highest standards or for the heavy duty where power, strength and rigidity are required.

Convince yourself of these facts! Let us send you complete specifications of this superior lathe and the names of some of the larger concerns who are using "LEHMANN LATHES" for better results.

We know you are interested, so don't put off writing us. Do it to-day. Now!

LEHMANN MACHINE COMPANY, 612 S. BROADWAY, ST. LOUIS, U. S. A.

The "PINK" Line Logging Tools and Handles



MADE-IN-CANADA Products---Headquarters for British Empire for all Lumbering Tools

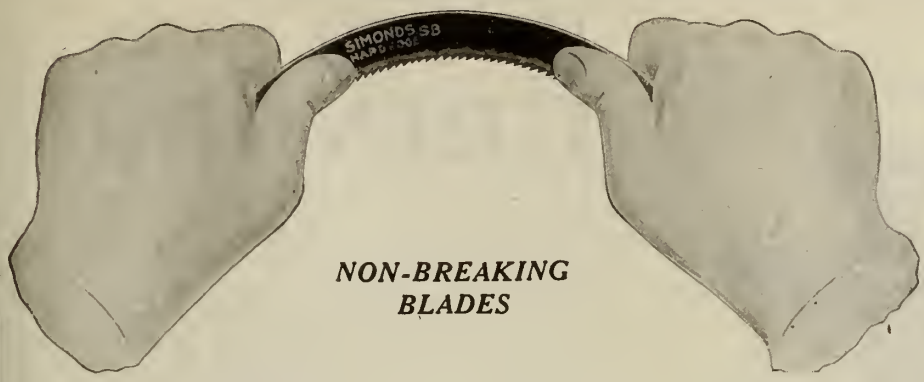
In every lumber camp in Canada you'll find PINK'S famous lumbering tools. They are the favorites there and have won the esteem of all woodsmen through their superior merit. They are world-renowned and are extensively used in Australia, New Zealand and other countries where the lumbering industry thrives.

EXPORTERS TO EUROPE

We export the same good quality of lumbering tools that have made PINK'S TOOLS a by-word in the matter of good tools in all Canadian lumber camps. Enquiries cordially solicited.

Thomas Pink Co., Limited
PEMBROKE, ONT., CAN

SIMONDS HACK SAWS



NON-BREAKING BLADES

CUT CUTTING COST

For Machine or Hand Use
Any Size or Length

Simonds Canada Saw Co. LIMITED

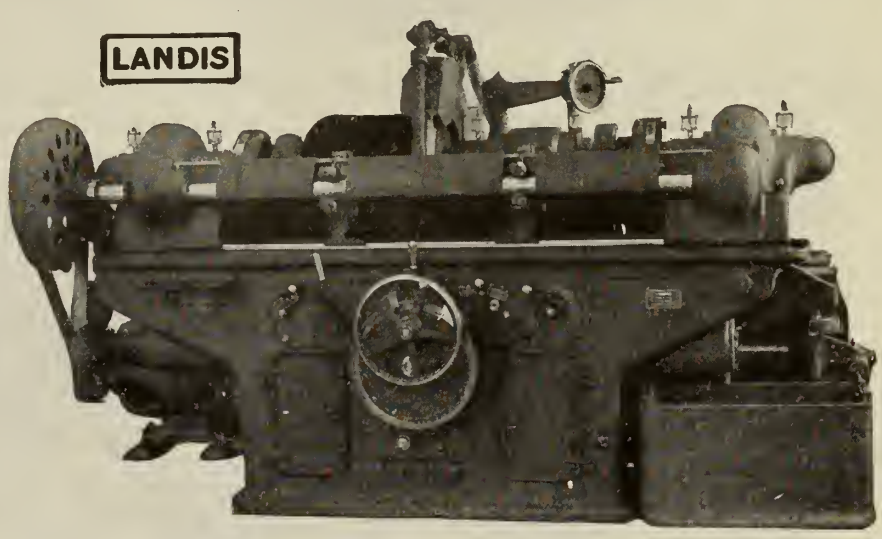
MONTREAL

St. John Vancouver

Rough Grinding Crank Pins on the Landis—

125—Four cylinder automobile shafts in 9 hours.
Removing .040 in. to .050 in. stock. Pins 1¾ in. diam.

This production speaks for itself, and is possible only because the Landis crank grinding machine is correctly designed, and because it is substantially and carefully built.



LANDIS TOOL COMPANY
Waynesboro, Pa.

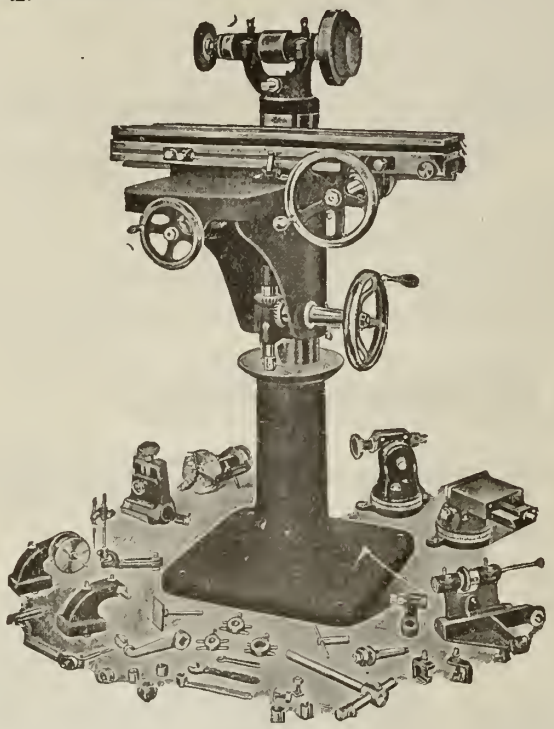
CANADIAN AGENTS:
A. R. Williams Machinery Co., Toronto, Winnipeg and Vancouver
William & Wilson, Montreal

A new and large assortment of the finest diamonds for dressing emery wheels has been added to our stock. Canadian manufacturers will do well to let us know their requirements.

Canadian Desmond-Stephan Mfg. Co., Limited
Hamilton, Ontario, Canada

Greenfield

UNIVERSAL AND TOOL GRINDER



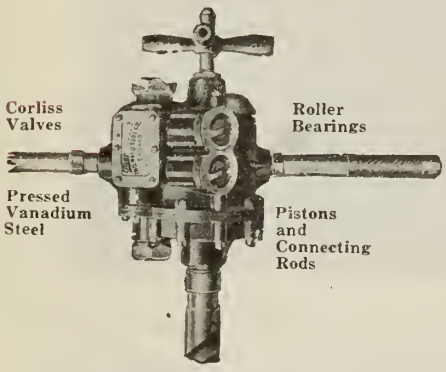
May we send you a complete description?

The Greenfield is equipped with all attachments for the grinding of milling cutters, reamers, taps, lathe centres, etc., and capable of handling all this work with the accuracy and convenience essential in the modern tool room.

The Greenfield is a simple necessity in the tool room for routine grinding work, but has a versatility outside this line that is astonishing. It is truly universal and handles all varieties of cylindrical, internal and surface grinding within its capacity with a consistent accuracy and finish that adapts it to the making of intricate jigs and gauges.

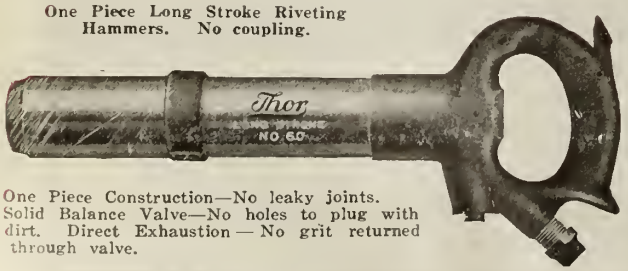
Greenfield Machine Co.
GREENFIELD, MASS., U. S. A.

Thor Air Drills



Four cylinder type, two on each side, Semi-Corliss valve close to each pair of cylinders gives greater efficiency and power, saves clearance losses and allows air to enter cylinder at full pressure of the pipe line.

One Piece Long Stroke Riveting Hammers. No coupling.



One Piece Construction—No leaky joints. Solid Balance Valve—No holes to plug with dirt. Direct Exhaustion — No grit returned through valve.

Thor PNEUMATIC TOOLS

The Tools that Reduce High Cost of Labor

Manual labor was never so costly as it is to-day. You are running into needless expense if you continue work with hand tools when ONE man with one **T h o r** pneumatic tool will do FIVE TIMES the work.
The demand for **Thor** pneumatic drills, hammers, grinders, rammers, electric drills and grinders increases daily. Their economy, efficiency and superiority in practical service is widely recognized. You should adopt them without delay.

Our Catalog contains valuable information— Yours on request

Independent Pneumatic Tool Company
334 St. James Street, MONTREAL
32 Front St. W., Toronto; 123 Bannatyne Ave. E., Winnipeg;
1142 Homer St., Vancouver

Fine Precision Tools Slightly Used in Excellent Condition

2—14″ x 6′ Hendey, Quick Change Gear, Tool Room Lathes.
1—No. 1 Cincinnati Universal Milling Machine.
2—No. 2 Cincinnati Plain Milling Machines.
1—No. 2 Brown & Sharpe Plain Surface Grinder.
2—No. 12 Pratt & Whitney Milling Machines.
1—Henry & Wright Sensitive Drill Press.
1—Leland & Gifford Two-Spindle Sensitive Drill Press.
New and Refitted Heavy Duty Machine Tools for Quick Delivery.

LATHES

32″ x 54″ x 26′ McCabe Double Spindle Lathe.
26″ x 20′ F. E. Reed Engine Lathe.
26″ x 14′ Greaves Klusman Engine Lathe.
Bertram Double End Axle Lathes.
36″ x 18′ London Triple Geared Engine Lathe.
24″ x 16′ American Tool Works Engine Lathe.

RADIAL DRILLS

5′ Ridgeway Heavy Duty Radial Drill.
4′ Fosdick Radial Drill.

WOOD WORKING MACHINERY

Chain and Chisel Mortisers.
Tenoners.
Door and Sash Clamps.
Moulders.
Buzz Planers.
Planers and Matchers.

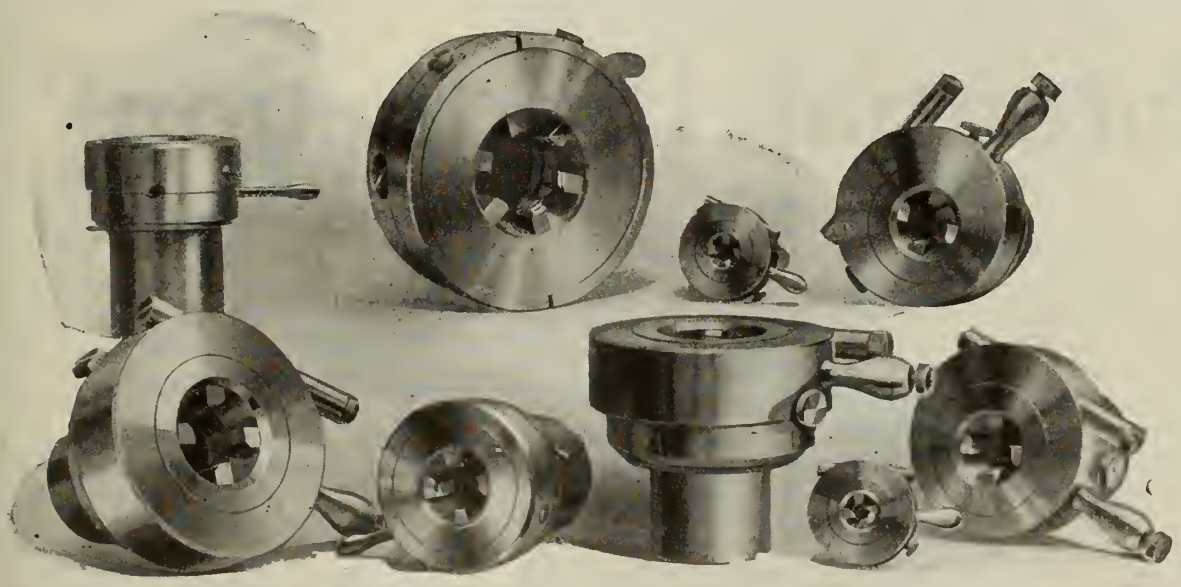
CRANK SHAPERS

20″ Gould and Eberhardt Crank Shaper.
24″ Ohio Crank Shaper.
15″ McKenzie Crank Shaper.
24″ Gould and Eberhardt Crank Shaper.
16″ C.M.C. Crank Shaper.
Bertram Car Wheel Boring Machine.
34″ Colburn Boring Mill.
No. 26″ Williams White Bulldozer.
No. 2 Mitts and Merrill Keyseater.
No. 4B Cochrane Bly Cold Saw.
12″ Betts Slotter.
No. 2 Cochrane Bly Filing Machine.
600 lb. Steam Hammer.

A. R. Williams Machinery and Supply Co. Limited

320-28 St. James Street

Main 5200 MONTREAL



Wide Range, Few Dies, Small Ex-pense

The No. 1 Hartness die will thread from 3/32 inch to 9/16 inch diameter, all pitches.
The entire range from ¼ inch to 2¾ inch for standard threads, and to 3 inches for 8 pitch or finer, is covered by three sizes of dies, whose ranges overlap.
And any of these dies, even the large No. 9 will thread pitches as fine as 32 per inch on its largest diameter without danger of stripping.

Jones & Lamson Machine Company

(AUTOMATIC DIE DEPARTMENT)
SPRINGFIELD, VERMONT

American Agents for Dies and Chasers:

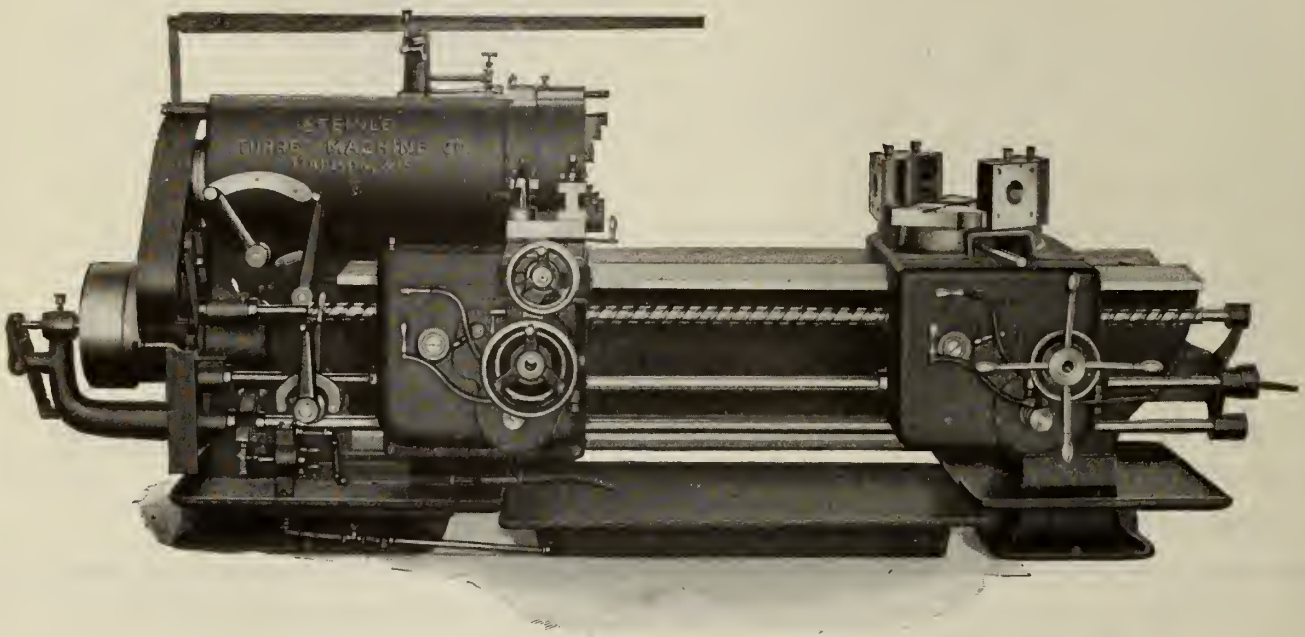
Boyer, Campbell Company, Detroit.
E. L. Essley Machy. Co., Chicago, Milwaukee and Moline.
Robinson, Cary & Sands Co., St. Paul and Duluth.

Foreign Agents:

France, Spain, Belgium—F. Auberty & Company, 91 Rue de Maubeuge, Paris, France.
Holland—Spliethoff, Beewukes & Company, Rotterdam, Holland.
Australia—McPherson's Pty., Ltd., Melbourne, Australia.
Japan, Manchuria, Korea, Formosa—Mitsui Bussan Kaisha, Ltd., Tokyo, Japan.

STEINLE

Full Swing Side Carriage Turret Lathe



"Potential Production"

"Potential Production—production which is possible, but not actual."

This would be Webster's explanation of the phrase, but applied to your own particular case it means: Are you obtaining the greatest production possible from your present machines? Are you using equipment which permits you to reach that actual peak of output which is so necessary for profitable operation?

The Steinle Heavy Duty Full Swing Side Carriage Turret Lathe is essentially a manufacturing machine especially designed for the rapid, accurate, and economical duplication of machine parts.

The STEINLE lathes are widely and satisfactorily used by many leading manufacturers where rapid production, accurate work and economical operation are leading factors in their original selection and subsequent additions to equipment.

Why not send us your blue prints and let our engineering department determine what can be done on your own work?

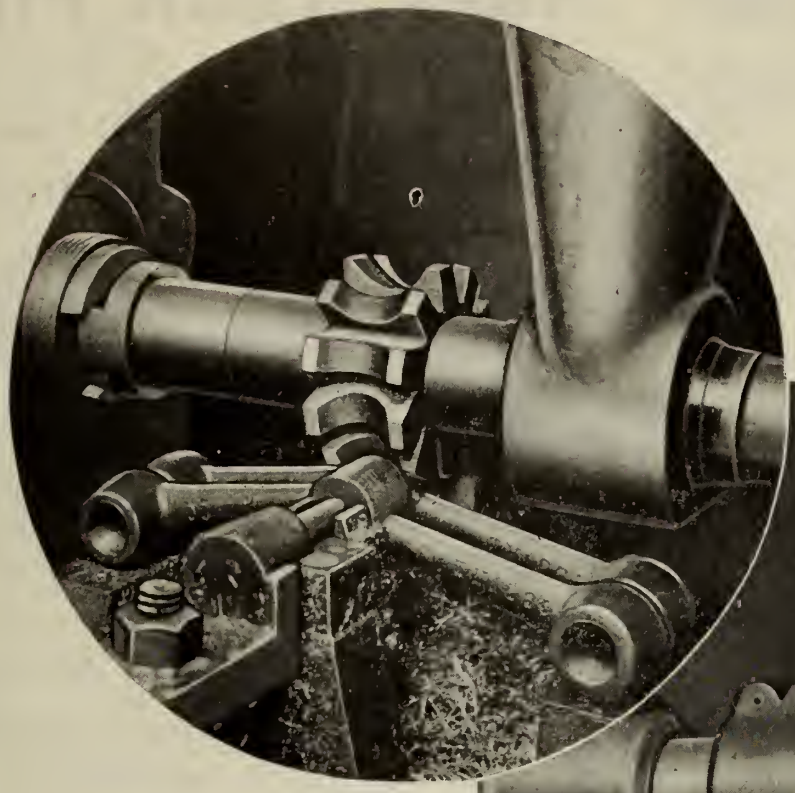
Steinle Turret Machine Company

Madison, Wis., U. S. A.

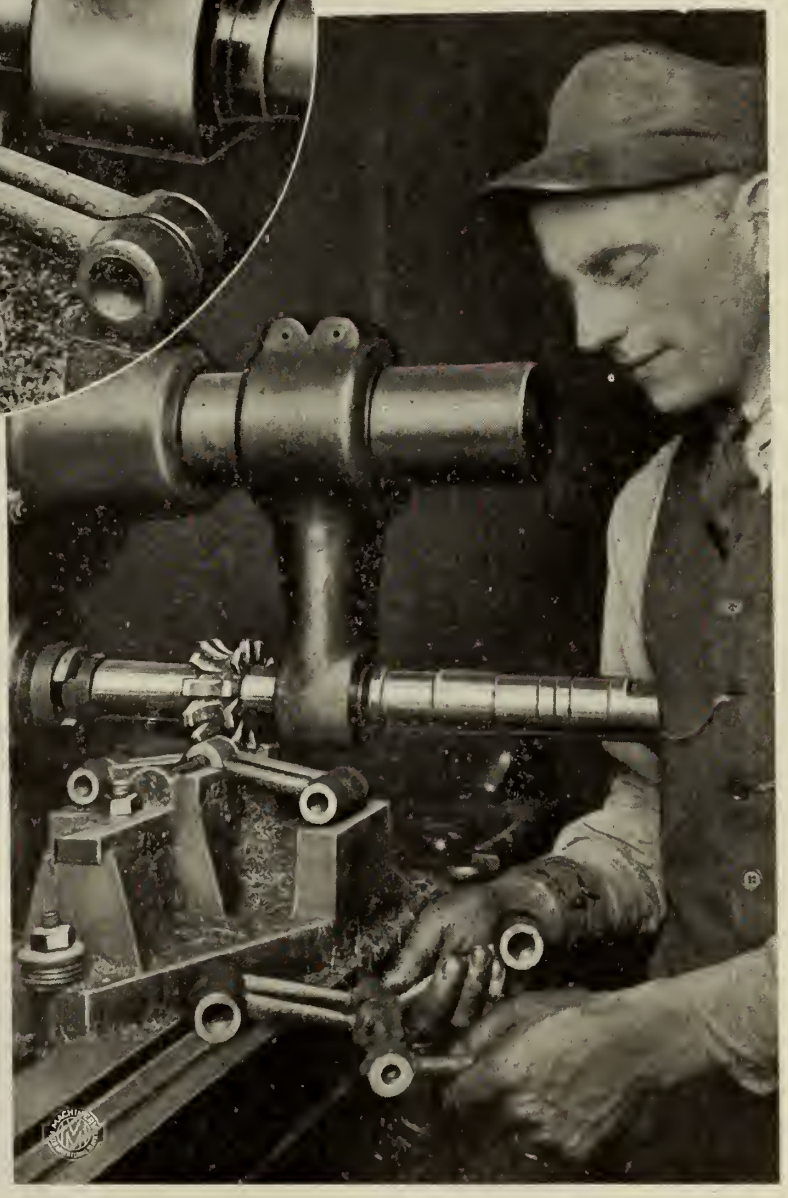
AGENTS: Machine Tool Engineering, Singer Building, New York; Cadillac Tool Company, Dodge Power Building, Detroit, Michigan; L. G. Henes, 75 Fremont Street, San Francisco, California; and Title Insurance Building, Los Angeles, California. FOREIGN: Leo. C. Steinle, 53 Victoria Street, London, England.

If interested, tear out this page and keep with letters to be answered.

ROCKFORD MILLING MACHINES



Handy to Operate



Every Movement Controlled from the Operating Position

All feed control levers on the Rockford No. 2 Plain, Heavy Duty Milling Machine are located in front, within easy reach of the operator. The fourteen feeds are controlled by but two levers. **Operating convenience** has made the Rockford foremost in the manufacturing plant.

Rigid, Strong, Speedy

Built with a view of obtaining the maximum speed from a heavy machine, handy to operate, the Rockford Milling Machines will be found satisfactory in every way.
Literature on Rockford Millers shows how they will help your plant attain a rate and quality of production far above the average. Send for it.

ROCKFORD MILLING MACHINE CO., ROCKFORD, ILL.

Canada: Rudel-Belnap Machinery Co., Toronto, Ont.

FOREIGN REPRESENTATIVES: Great Britain, A. A. Jones & Shipman, Ltd., Leicester, England. France and Belgium, Louis Beese, Paris, France. Italy and Colonies, Societa Anonima Adler & Co., Milano.
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More Accurate Work

There is a certain class of work that demands the greatest accuracy. It must be absolutely true to gauge—free from blemishes—and finely finished. If the work turned out by your plant must conform to these standards you will do well to look into the record of

MYSTIC
CUTTING COMPOUND

This remarkable free-flowing coolant permits the greatest accuracy on high carbon steels, forgings, manganese bronze, Monel metal, etc. Adapted equally well for use on drill presses, turret lathes, saws and all types of automatics.

Does not grow rancid, separate in solution or cause rust. Contains nothing to injure operators' hands.

Let us give you a free demonstration.

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Labor Costs More Than Files

And it costs more to-day than it ever did before.

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Throw them away as soon as the edge begins to go, and buy new ones.

Famous Five Files keep their edge longest. They are made of highly specialized steel, accurately cut and thoroughly hardened.

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Diamond Fibre is a super-material that combines great strength with light weight (lighter than aluminum). It is dense, tough and hard; high in dielectric, compression, shearing and tensile strength—does not splinter, split, crack or break.

Diamond Fibre is absolutely free from grit and all foreign matter and therefore takes extreme machining with but little wear on edge tools. It can be sawed, bored, drilled, stamped, turned, tapped, threaded, milled, punched, bent or worked into almost any conceivable form.

Superior to metal, rubber, porcelain, wood and leather for a great variety of purposes. Made in sheets, rods, tubes and special parts machined to your specifications.

Prices, samples and complete information upon request.

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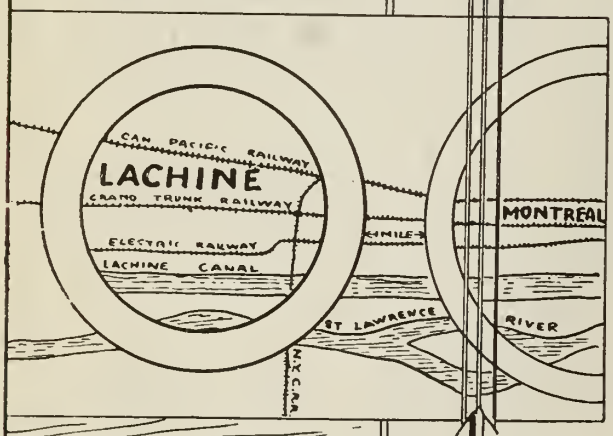
FROM an industrial view point Lachine is the logical location for your new factory. Its commanding position at the head of the Lachine Canal—the gateway to the great inland water system of Canada; the St. Lawrence and the Great Lakes and on the trunk lines of the C.P.R. and G.T.R. ensures low freight rates and a first-class transportation service. Its close proximity to the docks at Montreal, provides fine opportunities for ocean trade with any part of the world.

The manufacturer wishing to locate a factory in or about the City of Montreal, should investigate Lachine. It possesses every accommodation that Montreal can offer in the way of shipping facilities, banking accommodations, home market for products and cheap electric power while he reaps the advantages of cheap sites with both rail and water facilities and a satisfactory solution to his labour problems .

Lachine enjoys every modern convenience in the way of adequate fire protection, waterworks, electric car service, postal delivery and plenty of play houses and clubs for the entertainment of yourself and your employees.

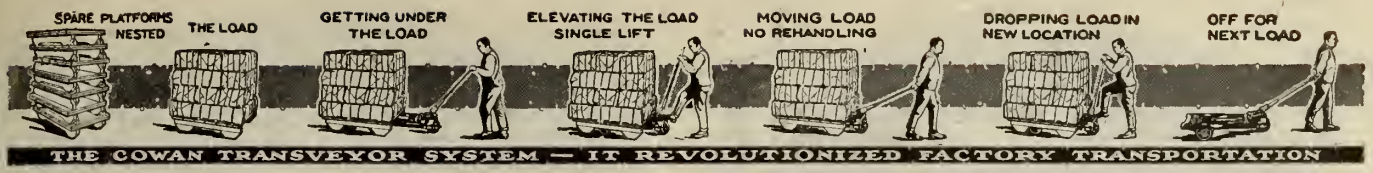
Some of the most important engineering establishments in Canada have chosen Lachine as the most suitable location in the Dominion. They have demonstrated that they can assemble raw products cheaper and distribute their output quicker from Lachine than any other point. There are certain to be advantages in Lachine peculiarly adapted in your industry. A line will bring full details. Investigate to-day.



For more detailed information write :

Mr. E. Leduc

Sec. Treasurer of the City of Lachine


SPARE PLATFORMS NESTED
THE LOAD
GETTING UNDER THE LOAD
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MOVING LOAD NO REHANDLING
DROPPING LOAD IN NEW LOCATION
OFF FOR NEXT LOAD
THE COWAN TRANSVEYOR SYSTEM — IT REVOLUTIONIZED FACTORY TRANSPORTATION

INSIDE ITEMS

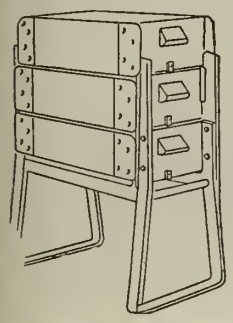
Little notes of interest to users and prospective users of lift trucking and "skid" erection or storage.

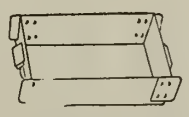
A PLATFORM KINK

IF your full size platforms are 66 x 30, make up some 33 x 30. Two of the small skids may be transveyed at one time, bearing one load; or different loads on the two platforms, may be delivered to different destinations.

EASY TO HANDLE

CONGESTED storage space and car loading often makes it difficult to use a truck handle in an extended position. It is worth remembering that the Transveyor can be backed with the handle upright, and perfect control of the load still maintained.





METAL TOTE BOX RACKS

THERE is no difficulty in handling piles of heavily loaded tote boxes on ordinary Transveyor platforms. Sometimes, however, it is necessary to leave boxes and contents in a blueing, baking or annealing oven. In such cases, a special metal base is used, along the lines of the small illustration shown herewith.

SOMETHING IN A NAME

KODAKS are cameras, but all snap-shotters are not Kodaks. Vaseline is petroleum jelly, but all petroleum jelly is not Vaseline. The list might be prolonged, but it would only lead to this, Transveyors are lift trucks, but only Cowan lift trucks are Transveyors.

SOWING THE SEED

IT is decidedly interesting to watch the rapid development of the Transveyor idea in unusual places. A seed and plant company informs us that the Transveyor is saving them $200 per month by reducing the number of men necessary for moving heavy bags of seed and feed.

THE WEAKEST POINT

LIKE the oft-mentioned chain, an elevating truck can be no stronger than its weakest point. During the many years which the Cowan Transveyor has been in constant use, anything likely to prove a weak "link" has had the most careful attention, and the weak points eliminated. The Transveyor now has the wear and strain so well distributed over the entire machine that there doesn't seem to be any wear-out left in it.

TRUCKING TRACTORS

A WESTERN maker of farm trucks and tractors says that they have saved, at the very lowest, 30% of the cost of transferring materials around their works, by using the Cowan Transveyor. They believe it is the best truck for the purpose made.

Transveyor Lift Trucks Used to "Run The Hoover Over"

WHERE quality products are produced by up-to-date methods the TRANSVEYOR is sure to be found at work. Its superior all-steel construction, 5-year guarantee and long record of faithful performance, make it the undisputed leader in the factory trucking field.

The TRANSVEYOR System forms the basis of endless short cuts and savings in forwarding, erecting, storing and shipping. Notice in the above picture how cores are transveyed to and from the bake ovens at the Hoover plant. Let us send you an illustrated booklet, showing how the Cowan TRANSVEYOR System operates in **your** business.

Clip and Mail

THE COWAN TRANSVEYOR
TRADE MARK REG. U. S. PAT. OFFICE

Representatives in Principal Cities—refer to Dannelley's Red Book for Local Addresses

Clip and Mail Coupon

COWAN TRUCK CO., 118 Glenholme Ave., Toronto, Ont.

I am interested in reducing the cost and increasing the efficiency of hand trucking. Send a copy of "HOW TO APPLY THE TRANSVEYOR TO YOUR BUSINESS."

NAME .....

ADDRESS .....

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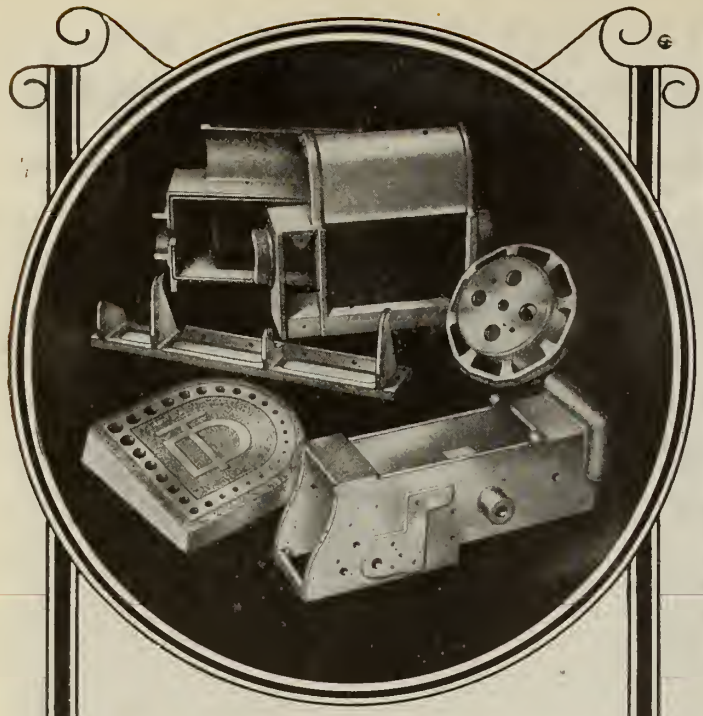

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They Simplify Production and Reduce Costs

For nearly thirty years Franklin Die-Castings have aided the development of many fields of industry by reducing costs and simplifying production.

Wherever Franklin Die-Castings are adaptable they lower the cost of p o-duction through the saving of tim e, labor, equipment and material otherwise spent in machining.

Franklin Die-Casting methods often make it possible to produce a device in fewer parts. It is through such advantages, derived from the use of Franklin Die-Castings, that many products have been made commercially practical.

In 1892 we originated the die-casting industry. From our long experience, we can advise you whether the die-casting principle can be applied correctly and profitably to your special needs.

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We cast in Aluminum, Tin, Lead and Zinc base alloys. Estimates made from samples, drawings or blueprint .

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Circulating Pumps

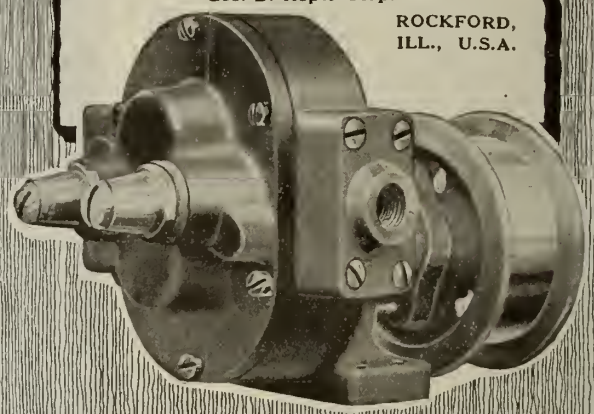
Indiv dual Pump or Central Station

The individual pump has proven its superiority over the central station method for supplying coolant to machine tools

Central stations permit only slight fall in the return pipes, allowing sediment to accumulate and clog the line. This pipe stoppage necessitates a suspension of operation on all machines in the battery. A Trahern individual pump eliminates this risk.

The individual pump permits the use of different cutting compounds on each machine. This is impossible with the central station.

TRAHERN PUMP DIVISION
Geo. D. Roper Corp.
ROCKFORD, ILL., U.S.A.



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Series B6

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Seventy-two years' experience making flat and spiral springs of every description enables us to furnish you with springs of the highest quality, that can be depended upon under all conditions.

Send blue prints for estimates

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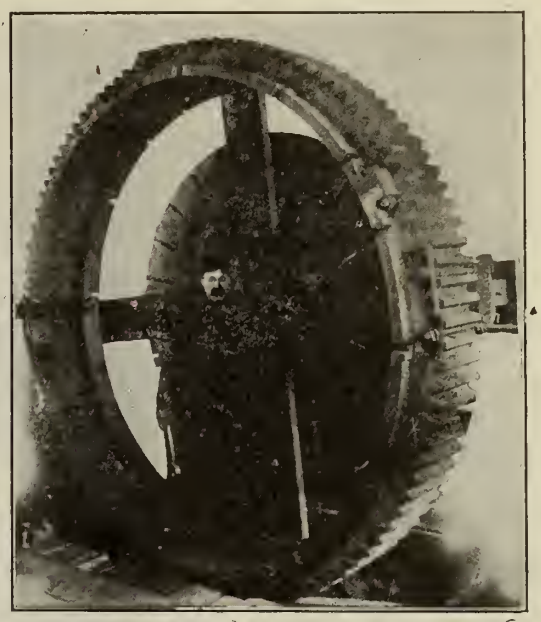
HULL, QUEBEC



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"HISCO" machine-moulded gears, while requiring no pattern, insure accuracy, dependability, quality, and the price is minus the cost of patterns—which in these days of high prices of lumber and labor is something to be considered.

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Easy Gauging A Big Feature of BRYANT Hole Grinders

Note the Freedom Allowed for Gauging

If gauging is difficult or dangerous the men are not inclined to gauge the work properly.

No firm can afford to turn out indifferently gauged work.

One poor article and it may be that a good customer is irretrievably lost.

With a Bryant Hole Grinder the work can be gauged with ease.

One turn of the handle brakes the work spindle, withdraws the grinding wheel and swings it out, leaving the work clear. (See illustration).

A turn of the wheel in the opposite direction, sets the wheel back on the job.

SIMPLE—EASY—SAFE

This is but one of the many distinctive features of the Bryant Hole Grinder. Let us tell you the remainder.

THE BRYANT CHUCKING GRINDER CO.

Springfield, Vermont, U.S.A.

Detroit, Direct Representative, B. J. Riordan, 263 St. Paul Ave., Detroit. Chicago, Direct Representative, L. C. Gilchrist, 1262 Columbia Ave., Chicago. Motch & Merryweather, Mchy. Co., Agents in Cleveland, Cincinnati and Pittsburgh. Henry Prentiss & Company, Agents in New York City, Boston, Rochester, Syracuse, Buffalo and Scranton. Berger & Carter Company, Agents in San Francisco, and Los Angeles.

THE MASTER METAL □ THE MASTER METAL

STELLITE

Not Steel—but its master

The hotter it gets the better it cuts. This is true of one cutting metal only—Stellite.

Stellite works continuously at red heat at temperatures up to 2000 deg. F. Heat which would break down the finest steel but serves to make Stellite tougher, truer, more lasting.

It is readily seen how such properties speed up production. The capacity of the lathes now set the limit, instead of the speed the cutting tools will stand.

Have us demonstrate Stellite on *your* work in *your* plant.

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THE MASTER METAL □ THE MASTER METAL

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THERE is as much difference in the various makes of High Speed Steel as there is in men—

The practice and methods of manufacturers differ widely in every mill and anyone who is at all familiar with the manufacture of High Speed Steel thoroughly understands this

"Red Cut Superior"

The Nationally Known—First Quality

HIGH SPEED STEEL

is the best for all Machine Work

ARE YOUR TOOLS MADE OF "Red Cut"?

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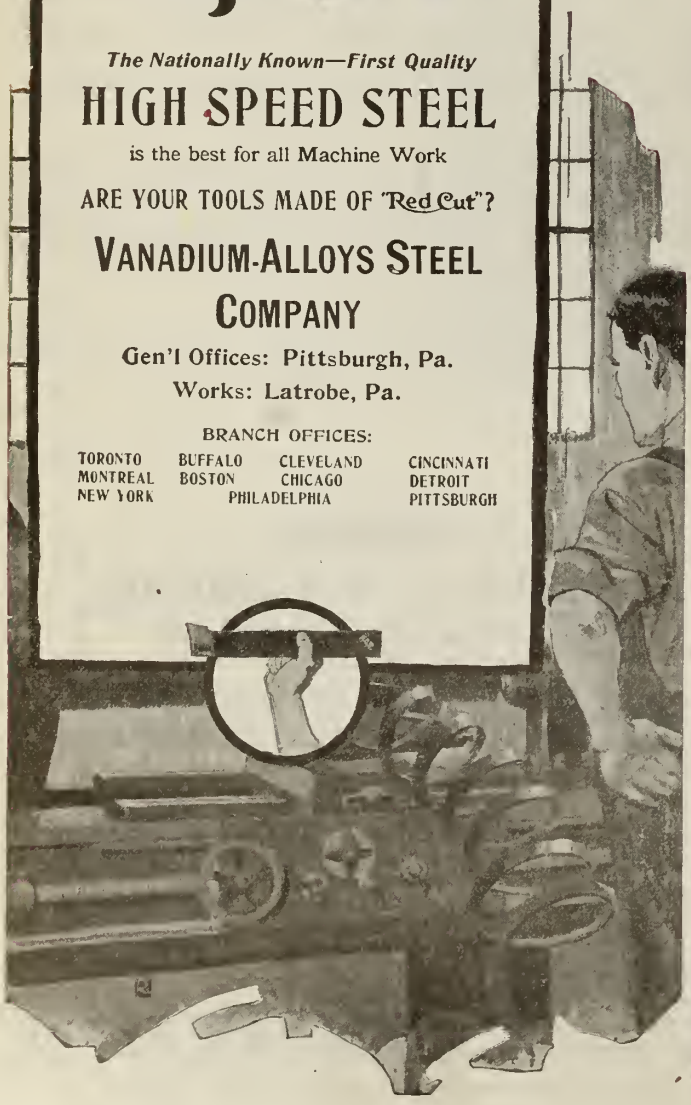

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When you buy Elk Fire Brick we sell you a brand with the qualifications equal to the duty for which it is intended. We do not recommend the best quality brick for a certain job if a lower-priced brand will stand up just as well. Each brand of

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has some particular qualification which fits it to give better results in certain places than other brands we produce.

OUR BRANDS:

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Try us on your next fire brick needs. You'll find both our quality and service right.

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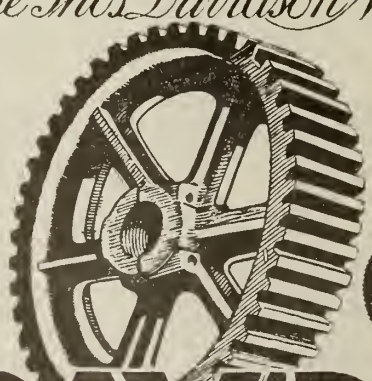
Castings supplied for shipbuilding, cars, locomotives, all classes of machinery, etc.

The Thos. Davidson Mfg. Co. Limited



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Branches: Toronto and Winnipeg

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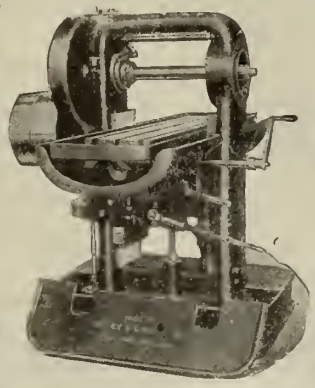
DAVIDSON

BRIGGS MILLERS

Production Tools

Machine tools to-day are judged by their ability to do efficient work, save time, labor and expense. These have ever been the measures by which Briggs Millers have been designed and constructed. That our engineers have succeeded in meeting these requirements is evidenced by the increasing popularity of Briggs Millers.



No matter what the nature of the work or how severe the service the Briggs Miller will stand up to it. Its unusual rigidity, great strength and ability to take wide deep cuts when running at a high rate of speed, has established a wide reputation that is unexcelled. We would like to show how "B r i g g s" adaptability and convenience can increase output and lower costs for you. A letter will bring full details by return mail.

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QUICK DELIVERIES

High Carbon Steel
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QUALITY GUARANTEED

Sizes—½ lb. to 5,000 lbs. each

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OWEN SOUND, ONTARIO
ESTABLISHED 1860

Your Money's Worth

Never again will t h e Canadian Nation and People be the same careless improvident spenders of "ante bellum" days. "EFFICIENCY" and "GET Y O U R MONEY'S WORTH" will be the popular motto and the successful machine shop manager must be able to see the advantage of making one pound of High Speed Tool Steel do the same work as ten pounds in forged tools; in other words he must and will

USE ARMSTRONG TOOL HOLDERS

No heavy "stub-ends" to throw away. No time lost with men at the grinder while lathes stand idle. No stock of heavy sizes of steel to carry, and the blacksmith as a tool-dresser is eliminated entirely.

Armstrong Tools are great favorites with the men— a good thing to consider from a production standpoint.

Our Catalogue is of handy pocket size and will be mailed to you upon request

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"THE TOOL HOLDER PEOPLE"
306 N. FRANCISCO AVE. CHICAGO, U.S.A.
STRONG STRONG

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Works

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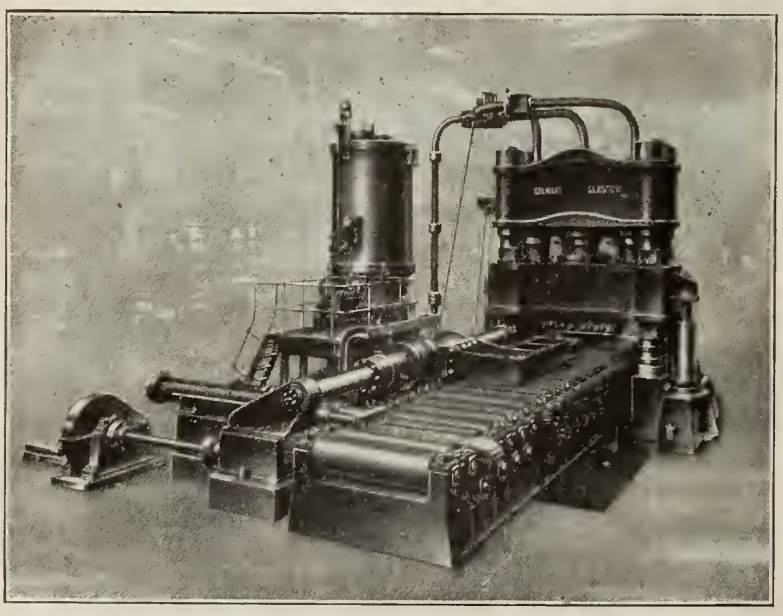

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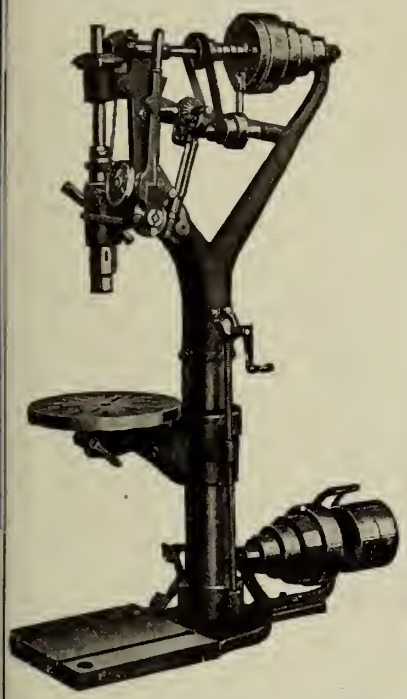

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—and these factors are essential in a drill intended for economical work, for the speedy production of high grade parts where accuracy and finish are important. Silver Drills rigidly retain their accuracy under the heaviest and fastest work. The result is fewer rejects and broken tools.

—20-in. drills in four styles—plain lever feed, lever and wheel feed, power feed, automatic stop, back gearing. Singly, or in gangs of 2, 3 or 4.

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—Compact, Efficient, Economical.

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The Silver Mfg. Co.
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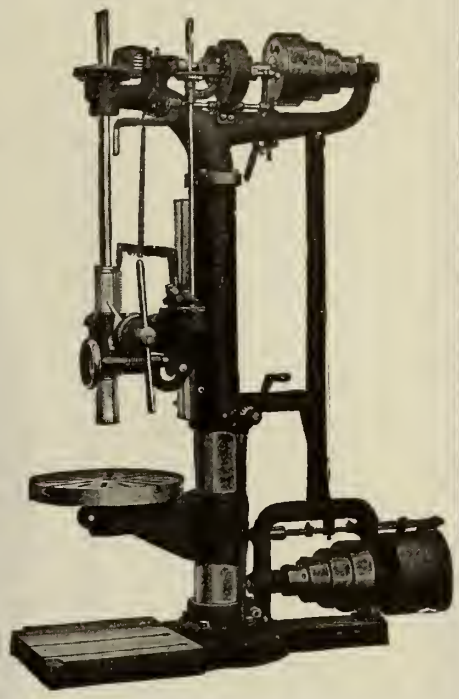
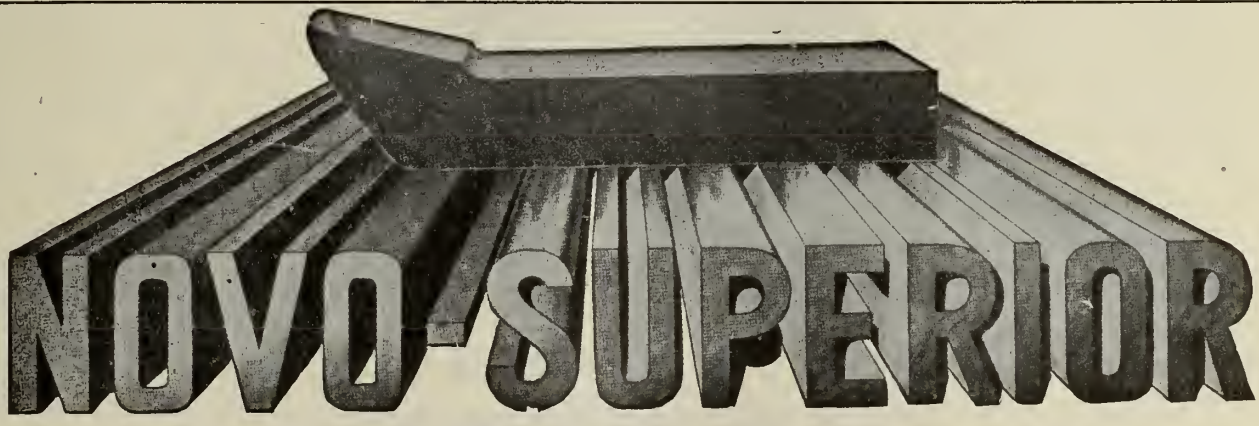
Manufacturers also of the Silver Radials





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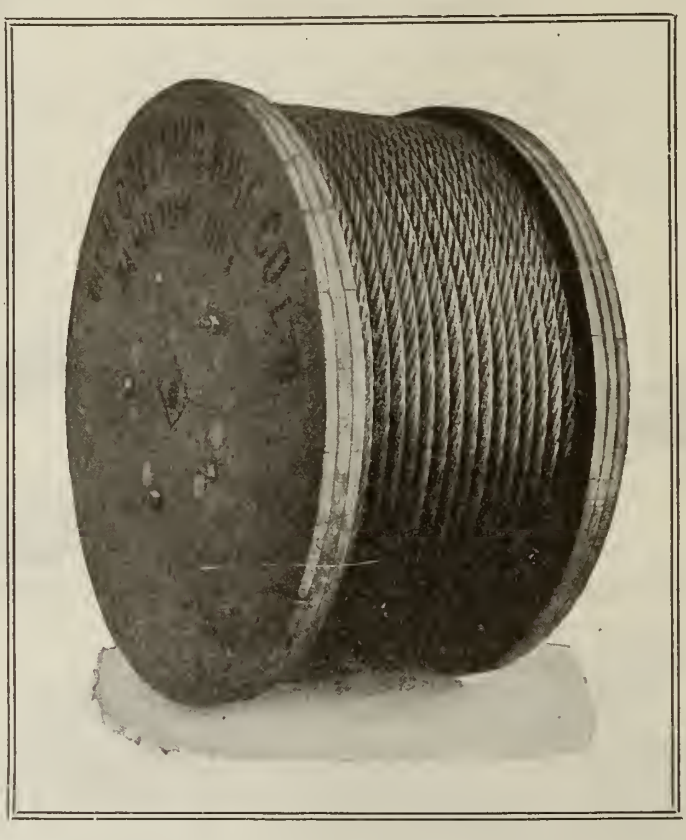
WIRE ROPES



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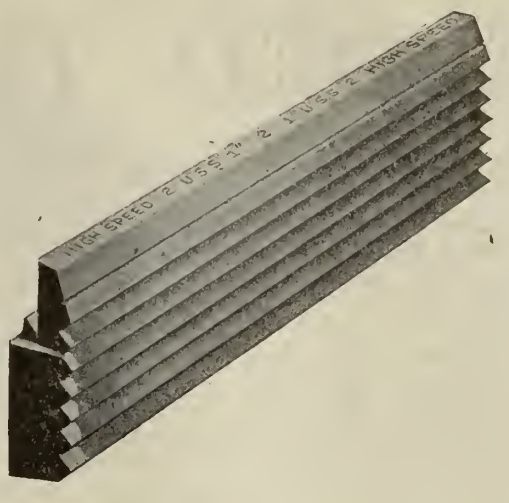

You are cordially invited to visit
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to be held on Young's Million Dollar Pier,

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Spaces 123-125-127, Machinery Hall.

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Electric and Oxy-Acetylene
WELDED TUBING
Also BUTT SEAM TUBING

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Straight, Accurate and Plentiful

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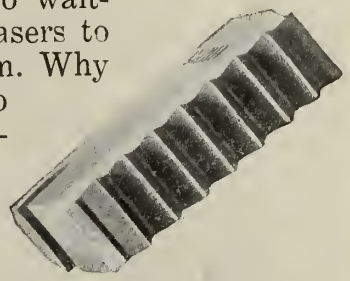

Murchey Tools will cut your tapping and threading costs. **They will boost production 50%.** Another important feature is Murchey's **Quick Deliveries on Chasers.** This is a Murchey specialty. No waiting! We get your chasers to you when you want them. Why not use Murchey Tools to speed up your threading production?

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This Morse Chain is delivering power to an 80" boring mill from a 15 H.P. G-E Motor running at 1200 R.P.M. The chain is exposed to all the grit and dust of the shop. It is 4" wide and connects a 17 tooth pinion with a 120 tooth wheel directly below - a distance of only 33" between centers.

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Shouldn't you bear these facts in mind when you plan your next important drive?

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We mention Cutters as descriptive of our whole line but our biggest seller is the Eclipse Interchangeable Counterbore which has won its favor through remarkable service. Hard jobs become easy jobs because the tool itself stands up continuously for many operations, and where sharpening is necessary another cutter is inserted in the twinkling of an eye and the dull cutter may be sharpened without loss of time. Then, too, you may sharpen and sharpen and sharpen down to the last fraction of an inch—and you have in no way disturbed the holder. You will find all Eclipse Tools a big help in making that hard job an easy job. Our representative will call at your convenience. When shall we send him?

Our Catalog will be mailed on request

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Eclipse Interchangeable Counterbores, Core Drills, Connecting Rod Cutters, Countersinks, Inverted Counterbores, Spot Facers, Adjustable Length Holders, And many other Special Tools

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A rearrangement of your patterns might cut their cost 25%; a different method of molding them might double your production at no increase in molding cost. *We can advise you* and we have expert metal and wood patternmakers who are able to make any changes that may commend themselves to you.

If you need some new Patterns send us a sample, blueprint or sketch, and ask for our advice. It won't cost you anything. If our advice is good and commends itself to you, it is only fair to assume that our work will be equally satisfactory, and we need the work as badly as you need the patterns.

We are in a position to do turning, boring, drilling or other semi-finishing operations on castings supplied by us.

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CANADIAN MADE CANADIAN MADE

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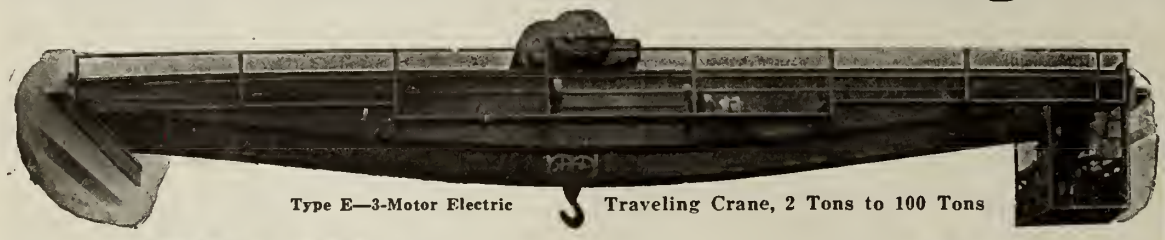
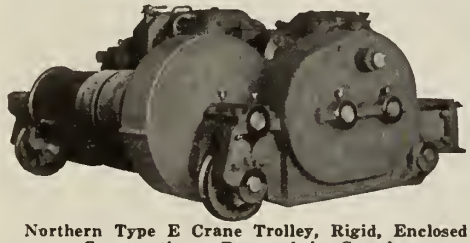
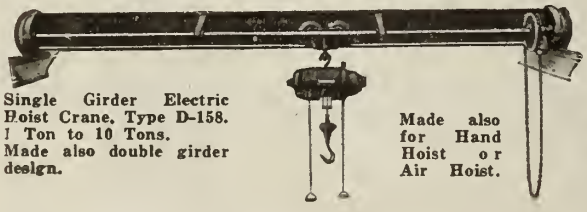


Type E—3-Motor Electric Traveling Crane, 2 Tons to 100 Tons



Northern Type E Crane Trolley, Rigid, Enclosed Construction. Patented in Canada.

We make a wide range of CRANE and HOIST designs. All sizes and capacities, 1 ton to 100 tons.



Single Girder Electric Hoist Crane, Type D-158. ½ Ton to 10 Tons. Made also double girder design.

Made also for Hand Hoist or Air Hoist.

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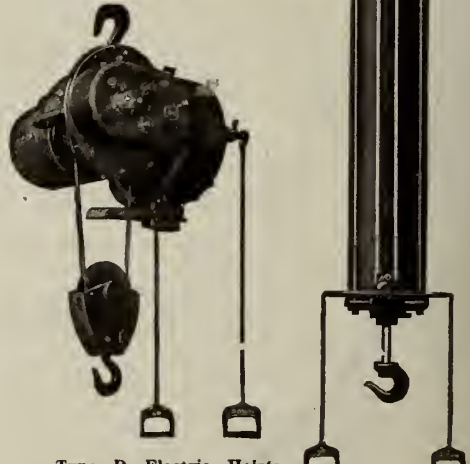

Type D Electric Hoists —½ to 10 Tons.

Air Hoists, Trolleys and Tracks.

Type No. 20 Air Hoist.

Northern Crane Works, Limited

Walkerville, Ontario, Canada

Heavy Duty

The Ford Tribloc quickly responds to a pull on the hand chain, yet has the strong rugged construction which keeps it in constant trouble-free service at **heavy duty** year after year without break down.

In operation, a Ford Tribloc develops high speed. The Loop Hand Chain Guide (patented) permits operation **from any angle** without the chain "gagging" or overriding the hand wheel flange.

Drop forged steel hooks and high test steel chain, cut steel gears in planetary drive, and strong dust-proof housing, all contribute toward this perfect service.

Our catalog lists and fully describes various Ford Chain Hoists in capacities from ½ to 20 tons. Just drop us a card and we'll send you a copy.

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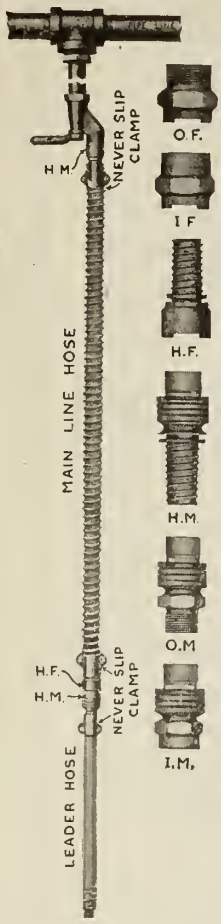

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Standard Equipment Everywhere

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STYLE I.M. is an Inside Thread Male Pipe End. Made in sizes ⅜-in. to 1½-in.
The Male and Female Ends of Bowes Couplings interchange in sizes ¼-in. to ¾-in. Sizes 1-in. and 1¼-in. interchange. The 1½-in. ends interchange only with themselves.

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Are instantly connected or disconnected.
They are absolutely air-tight under all pressures.
They quickly pay for themselves by stopping costly leaks.
They interchange in sizes most commonly used.
They have no loose parts to be mislaid or lost.
They are made of brass and will not rust.
The U-shaped Gasket interchanges in couplings ¼-inch to ¾-in.

The Cleco Never Slip Hose Clamp

Made in same sizes as Bowes Couplings

The adjoining cut of Cleco Never Slip Hose Clamp shows the "Flanges" which engage the groove provided in all hose ends of Bowes Couplings. The "Model Hose Line" illustrated shows correct styles of couplings and valve to use and proper way to attach the clamps.

CLECO GROOVED HOSE NIPPLE

Grooved Nipples when attached to hose with the wire clamp cannot "blow-out," as one-half of the Wire Clamp lies in Nipple Groove, and the other half on the hose, uniting nipple and hose permanently.

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To apply Wire Clamps to Grooved Hose Nipples you need the Wire Clamp Tool illustrated, a small hand-operated tool at moderate cost which we carry in stock for immediate delivery. In Stock: Riveting and Chipping Hammers, Four-piston Air Drills, Corner Drills, Emery Grinders, Sand Rammers, Holder Ons, etc.

Use Annealed Wire No. 14

Write for Bulletin 38 illustrating Cleco Hose Fittings, Couplings, Valves, etc.

IMPORTANT:—The Small Leaks in your "AIR LINE" mean serious loss in DOLLARS. Have you any idea of the amount of "Air" wasted in small leaks at your connections? Air Leakage through 1-16 in. opening equals 5.32 cu. ft. per minute at 80 lbs. It will pay you to install Bowes Couplings and stop costly leaks.

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McCrosky Catalog No. 7 has the details.

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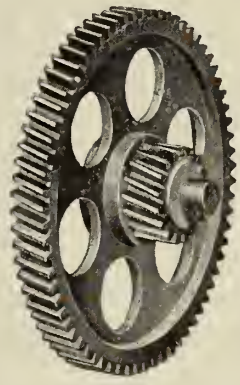
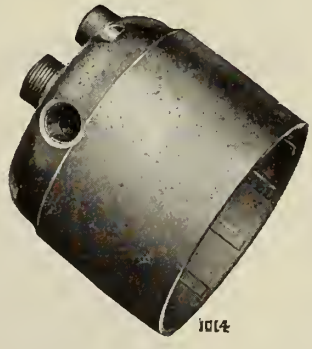
THE FISHER MOTOR CO., LIMITED, ORILLIA, ONT.

Die Castings

Doehler Service





Die Castings

Doehler Quality

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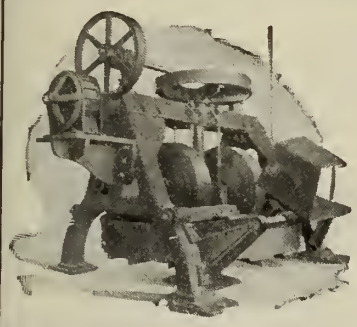

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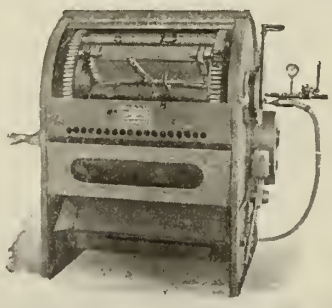

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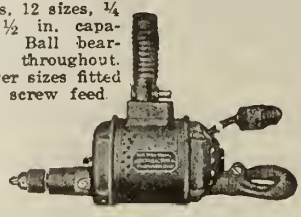

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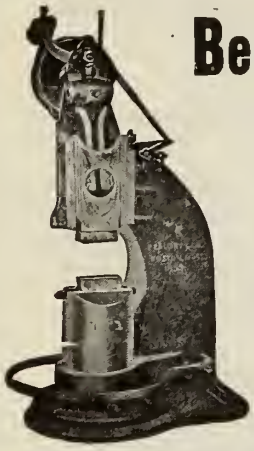

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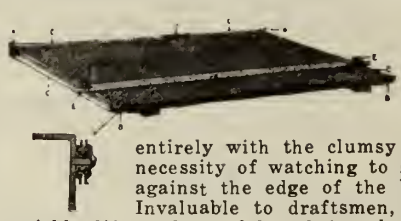

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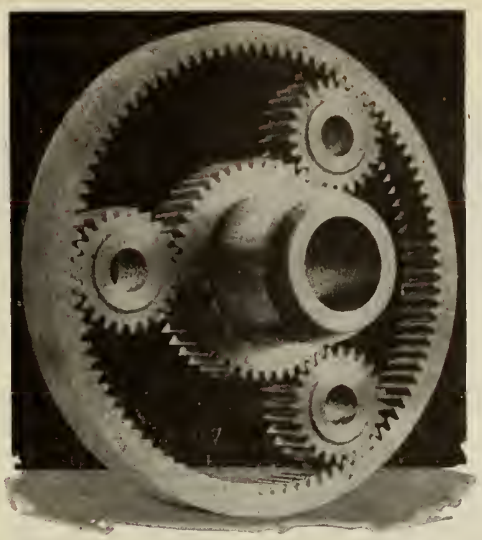

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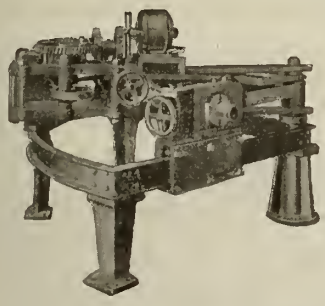

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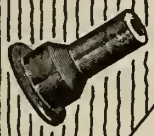

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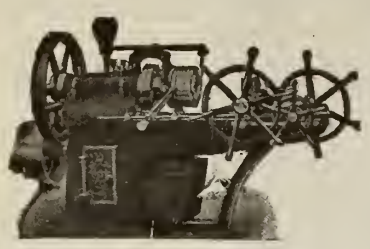

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CALKS, BOOT
Luftin Rule Co., of Can., Windsor, Ont.

CANNERS' MACHINERY
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Can.

CANNERS' CONVEYORS
Can. Link-Belt Co., Toronto, Ont.

CARBIDE
Carter Welding Co., Ltd., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.
Union Carbide Co., of Canada, Limited, Weland, nt.

CARBONIZING BOXES
Can. Driver-Harris Co., Ltd., Walkerville
Katie Foundry, Galt, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
Swedish Crucible Steel Co. Windsor.

CARRIERS, PNEUMATIC TUBE
Jones & Glassco, Montreal.

CARS, INDUSTRIAL
Can. Blower & Forge Co., Kitchener, Ont
Can. Fairbanks-Morse Co., Ltd, Montreal
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

CASES, FILING
Economy Drawing Table Co., Adrian, Mich.

CASTINGS, ALUMINUM, BRASS BRONZE, COPPER, AND GUN METAL
Algoma Steel Corp., Sault Ste. Marie.
Franklin Mfg. Co., Syracuse, N.Y.
Canada Metal Co., Ltd., Toronto, Ont.

CASTINGS, DIE CAST
Canada Metal Co., Ltd., Toronto, Ont.
Franklin Mfg. Co., Syracuse, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Tallman Brass & Metals Ltd., Hamilton, Ont.

CASTINGS, STEEL—ALL KINDS
Canada Electric Castings, Ltd., Orillia, Ont.
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Electric Steel & Metals Co., Welland.
Meeta Machine Co., Pittsburgh, Pa.

CASTINGS, ELECTRIC AND ALLOY STEEL
Can. Elec. Castings Co. Ltd., Orillia, Ont
Dominion Foundries & Steel Ltd., Hamilton, Ont.

CARRIERS COUPLING BOLTS
John Morrow Screw & Nut Co., Ingersoll
Alexander Fleck Ltd., Ottawa.
Tallman Brass & Metal Co., Hamilton.

CASTINGS, BENCH LEG.
Brown & Sharpe Mfg. Co., Providence, R.I.

CASTINGS, BRASS AND IRON
Algoma Steel Corp., Sault Ste. Marie.
International Machinery and Supply Co., Ltd., Montreal, Que.

CASTINGS, BUILDING
Katie Foundry, Galt, Ont.

CASTINGS, GRAY IRON
Bernard Industrial Co., A., Fortierville, Q.
Brown & Sharpe Mfg. Co., Providence, R.I.
Brown, Boggs Co., Ltd., Hamilton,
Can. Elec. Castings Co, Ltd., Orillia, Ont
Alexander Fleck, Ltd., Ottawa.
Gardner & Son, Robt., Montreal.
Hull Iron & Steel Foundries, Ltd., Hull
International Malleable Iron Co., Guelph
Kennedy & Sons, Ltd., Wm., Owen Sound.
Katie Foundry, Ltd., Galt, Ont.
Hamilton Co. Wm., Peterboro.
McFarlane Engineering Ltd., G. W., Paris, Ont.

CASTINGS, PLUMBERS'
Katie Foundry, Galt, Ont.

CASTINGS, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville

CASTINGS, HARDWARE
Katie Foundry, Galt, Ont.

CASTINGS, STEEL CHROME AND MANGANESE STEEL
Thos. Davidson Mfg. Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hull Iron & Steel Foundries, Ltd., Hull.
Kennedy & Sons, Ltd, Owen Sound.

CASTINGS, MALLEABLE
International Malleable Iron Co., Guelph

CASTINGS, NICKEL STEEL
Hull Iron & Steel Foundries, Ltd., Hull.

CEMENT MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gardner, Robt., & Son, Montreal.

CEMENT HANDLING MACHINERY
Can. Link-Belt Co., Toronto, Ont.

CEMENT TOOLS
Atkins & Co., E. C., Hamilton, Ont.

CENTERING MACHINES
Victoria Foundry Co., Ottawa, Ont.

CENTRE REAMERS
Bertram & Sons Co., John, Dundas.
Butterfield & Co., Inc., Rock Island, Que.
Gardner, Robt. & Son, Montreal.
Hurlburt, Rogers Mch. Co., South Sudbury, Mass.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co., of Canada, Galt, Ont.

CHAIN, WELDED COIL
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

CHAIN BLOCKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford Chain Block & Mfg. Co., Phila., Pa.
Garlock-Walker Machy. Co., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & HoistCo., Herbert, Niagara Falls, Ont.
Oliver Engineering Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Jones & Glassco, Montreal, Que.

CHAINS, AGRICULTURAL
Canadian Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.

CHAINS, AUTOMOBILE ENGINE
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.

CHAINS, BICYCLE, DRIVE AND BLOCK
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAINS, FOR ELEVATORS AND CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAIN, MALLEABLE, DETACHABLE AND RIVETED
Can. Link-Belt Co., Toronto, Ont.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAINS, POWER TRANSMISSION
Canadian Link-Belt Co., Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, New York.
Glasgow, N.S.

CHAINS, SPROCKET WHEEL
Can. Link-Belt Co., Ltd., Toronto, Ont.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAIN DRIVES
Can. Link-Belt Co., Toronto, Ont.
Coventry Chain Co., Coventry, England.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHASERS
National Acme Co., Cleveland, Ohio.
Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont.

CHEMISTS
Toronto Testing Lab'tory, Ltd., Toronto

CHUCKS, AERO, AUTOMATIC
Garvin Machine Co., New York.

CHUCKS, CENTERING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKS, COLLET, AIR
Elliott & Whitehall Mach. & Tool Co. Galt, Ont.
Smalley-General Co., Inc., Bay City, Mich.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, LATHE AND UNIVERSAL
Aikenhead Hardware Co., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt., & Son, Montreal.
Garlock-Walker Mach'y Co., Toronto.
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Chicago, Ill.
Jacobs Mfg. Co., Hartford, Conn.
Ker & Goodwin Machine Co., Ltd., Knight Metal Products, Toronto.
Modern Tool Co., Erie, Pa.
Rice Lewis & Son, Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, AUTOMATIC AND KEYLESS
Aikenhead Hardware Co., Toronto, Ont
Can. Blower & Forge Co., Kitchener
McCrosky Tool Corp., Meadville, Pa., U. S. A.

CHUCKS, FRICTION AND TAP
Victor Tool Co., Waynesboro, Pa.

CHUCKS, MAGNETIC
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

CHUCKS, RING WHEEL
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.

CHUCKS, WHEEL, CAR
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKING MACHINES
Barber Mchy. Co., Ltd., Toronto, Ont
Brown & Sharpe Mfg. Co., Providence, R.I.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis
National Acme Co., Windsor, Vt.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Wood Turret Mach. Co., Brazil, Ind.
Williams Mchy Co., A. R., Toronto, Ont.

CIRCULATING SYSTEMS FOR LUBRICATING OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

CLAY FIRE
Elk Fire Brick Co., Can., Ltd., Hamilton, Ont.

CLEANERS, METER, WASTE, GENERAL
Oakley Chemical Co., New York, N.Y.

CLEANING COMPOUND
Oakley Chemical Co., New York.

CLOCK SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

CLOCKS, WATCHMAN, PORTABLE
Gisholt Machine Co., Madison, Wis.

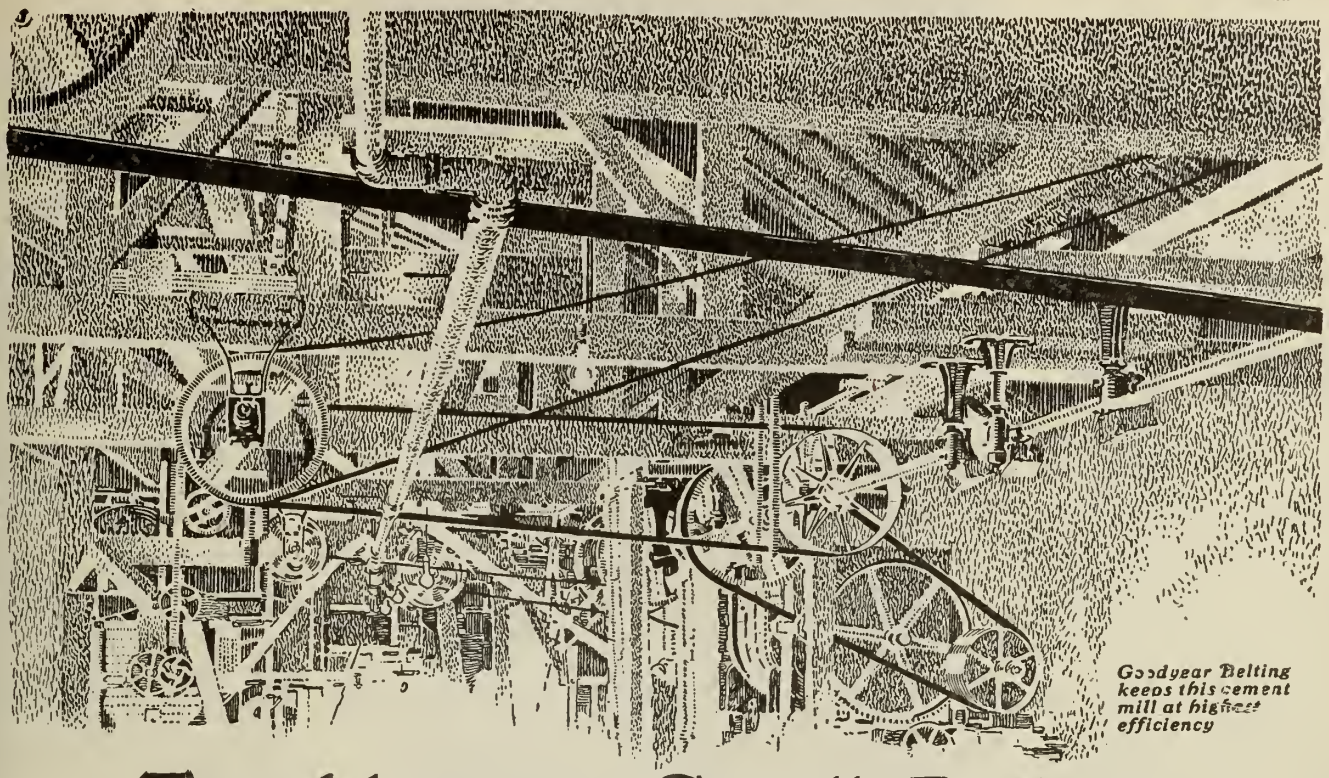
CLOSETS
Crane, Ltd., Montreal, Que.

CLUTCHES, CHAIN
Wright Mfg. Co., Lisbon, Ohio.

CLUTCHES, FRICTION AND PULLEY
Bernard Industrial Co., A., Fortierville, Q
Can. Link-Belt Co., Toronto, Ont.
Carlyle Johnson Mach. Co., Manchester, Conn.
Positive Clutch & Pulley Wks., Aurora Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que

COAL CRUSHERS
Canadian Link-Belt Co., Ltd., Toronto, Ont.
Canadian Mead-Morrison Co., Limited, Montreal, Que.

COAL HANDLING MACHINERY
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Nova Scotia Steel & Coal Co., New



Goodyear Belting keeps this cement mill at highest efficiency

Troublesome Small Pulleys

Have you trouble getting belts flexible enough for small pulleys, yet strong enough to last?

Goodyear has produced Extra Power Belting—belting flexible enough that it need not be too tight! Gripping enough to prevent slipping at any speed!

For this is 5-point belting.

1. It is extremely strong, because of specially-designed, properly-woven fabric.

2. Yet it is very flexible, for it is not stitched, but is welded together with high-grade rubber, forced through and through the fabric and surrounding every thread. It hugs even small pulleys.

3. It has a friction surface which *grips*, dry or damp, and needs no dressing.

4. It has a seam *sealed* tight with high quality rubber.

5. The same rubber which gives Goodyear Extra Power its flexibility, prevents ply separation, even when the edge is worn or torn by shifters or accident.

The list of satisfied users of Goodyear Extra Power Belting on small pulleys is very great—too long to print here. But a few are:

O'Neil Morkin Machinery Co., Edmonton, Alta.
MacEachern Milling Co., Wetaskiwin, Alta.
Silver Standard Mining Co., Ltd., New Hazelton, B.C.
Hollinger Consolidated Gold Mining Co., Timmins, Ont.
Tilbury Flour Mills, Tilbury, Ont.
Chisholm Milling Co., Toronto, Ont.
Essex Canning Co., Essex, Ont.
Border Cities Tool Co., Windsor, Ont.
Brechin Roller Flour Mills, Brechin, Ont.
Nipissing Mining Co., Cobalt, Ont.
St. George Pulp & Paper Co., St. George, N.B.
Ungar's Laundry & Dye Works, St. John, N.B.
Ganong Bros., St. Stephen, N.B.
Robb Engineering Works, Amherst, N.S.
Ed. Sinclair Lumber Co., Newcastle, N.S.
O'Brien, Limited, Nelson.
Dominion Pulp Co., Chatham
Richard's Mfg. Co., Campbellton.

Any one of these firms will be glad to tell you of their experience with Extra Power. Or a Goodyear Belting man will call without obligation to you. Phone, wire, or write the nearest branch.

The Goodyear Tire & Rubber Co. of Canada, Limited

Branches—Halifax, St. John, Quebec, Montreal, Ottawa, Toronto, Hamilton, London, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Vancouver. Service stocks in smaller cities.

GOODYEAR

MADE IN CANADA

EXTRA POWER BELT

If interested, tear out this page and keep with letters to be answered.

COLD ROLLED STRIP, ALL METAL COLLARS, SHAFTING
Can. Driver-Harris Co., Ltd., Walkerville.
Williams & Co., J. H., Brooklyn, N.Y.

COLLECTORS, PNEUMATIC
Can. Blower & Forge Co., Kitchener.
Sturtevant Co., B. F., Galt, Ont.

COLLETS
Becker Milling Machine Co., Boston.

COMPOSITION INGOT
Canada Metal Co., Toronto, Ont.

COMPOUNDS, CUTTING AND GRINDING, DRAWING, STAMPING
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR
Atkins & Co., E. C., Hamilton, Ont.
Can. Ingersoll-Rand Co., Sherbrooke.
Cleveland Pneumatic Tool Co., Toronto.
Curtis Pneumatic Machy. Co., St. Louis.
Elliott & Whitehall, Galt, Ont.
Garlock-Walker Machy. Co., Toronto.
MacGovern & Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Superior Machinery Co., London, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

CONDENSERS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
MacGovern & Co., Montreal, Que.
Smalley-General Co., Inc., Bay City, Mich.

CONDUITS
Northern Electric Co., Ltd., Montreal Que

CONNECTING RODS
Canada Found's & Forgings, Ltd., Welland, Ont.

CONNECTING ROD CUTTERS INTERCHANGEABLE
Eclipse Counterbore Co., Ltd., Walkerville, Ont.

CONTRACTORS' HOISTS
Canadian Mead-Morrison Co., Limited, Montreal, Que.

CONTRACT WORK
Brown Engineering Corp., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.
Globe Engineering Co., Hamilton, Ont.
Homer & Wilson, Iramilton, Ont.
Katie Foundry, Ltd., Galt, Ont.
Victoria Foundry Co., Ottawa.

CONTROLLERS, MAGNETIC BRAKES, ELEC. WINCHES, MONO RAIL HOISTS
Volta Mfg. Co., Welland, Ont.

CONTROLLERS AND STARTERS
Williams Mach'y Co., A. R., Toronto.

CONTROLLING INSTRUMENTS
Taylor Instrument Co., Rochester, N.Y.

CONVERTERS, ROTARY
MacGovern & Co., Montreal, Que.
Can. Link-Belt Co., Toronto, Ont.
Jones & Glasco, Montreal.

CONVEYORS—McCASLIN GRAVITY BUCKET
Canadian Mead-Morrison Co., Limited, Montreal, Que.

COOLERS, WITH DRINKING FOUNTAINS
Pure Sanitary Drinking Fountain Co., Haydenville, Mass.

COPING MACHINES
Bertram & Sons Co., John, Dundas, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Can. Blower & Forge Co., Kitchener.

COPPER, BUS BAR, SHEET, PATES, RODS
British Smelting & Refining Co., Ltd., Montreal, Que.
Brown's Copper and Brass Rolling Mills, New Toronto.
Brown's Copper and Brass Rolling Mills, New Toronto.

CORE OIL
Swan & Finch, Inc., 165 Broadway.

COUNTERBORES AND COUNTERSINKS
Aikenhead Hardware Co., Toronto, Ont.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mach. Co., New Bedford Mass.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.

COUNTERSINKS, INTERCHANGEABLE
Eclipse Counterbore Co., Ltd., Walkerville, Ont.

COUNTERBORES, INVERTED, INTERCHANGEABLE
Eclipse Counterbore Co., Ltd., Walkerville, Ont.

COUNTERSHAFTS
Almond Mfg. Co., Ashburnham, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Gray Ball Bearing Co., Ltd., Toronto.
Baird Machine Co., Bridgeport, Conn.
Ford-Smith Machine Co., Hamilton, Ont.
Foster Machine Co., Elkhart, Ind.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams Mchy Co., A. R., Toronto, Ont.

COUPLINGS, FRICTION
Bernard Industrial Co., The A., Fortierville, Que.
Can. Link-Belt Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

COUPLINGS, RAPID HOSE
Int. Machinery & Supply Co., Ltd., Montreal, Que.

COILING MACHINERY, WIRE AND SPRING
Garlock-Walker Machinery Co., Toronto.

COKE AND COAL
Hanna & Co., M. A., Cleveland, O.

COUPLINGS, PLAIN, FLEXIBLE AND CUT OFF
Cleveland Pneumatic Tool Co., of Canada, Toronto.

CRANES, OVERHEAD, HAND AND
Gardner, Robt. & Son, Montreal.
Independent Pneumatic Tool Co., Chicago

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.
Northern Crane Works, Walkerville.

ELECTRIC
Volta Manufacturing Co., Welland, Ont.

CUPS, OIL
Can. Winkley Co., Ltd., Windsor, Ont.

COVERS, OIL HOLE
Can. Winkley Co., Ltd., Windsor, Ont.

CRANES, GANTRY
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.

CRANE RUNWAYS
MacKinnon Steel Co., Sherbrooke, Que.

CRANES, JIB
Brown Hoisting Machinery Co., Cleveland, Ohio.

CRANES, LOCOMOTIVE
Brown Hoisting Machinery Co., Cleveland, Ohio.

CRANES, GOLIATH, PNEUMATIC AND PORTABLE
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Morris Crane and Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Petrie, Ltd., H. W., Toronto.

CRANES, PILLAR
Brown Hoisting Machinery Co., Cleveland, Ohio.

CRANES, TRAVELLING, ELECTRIC AND HAND POWER
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Machy. Co., St. Louis.
Dominion Bridge Co., Montreal.
Hepburn, John T., Ltd., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Niles-Bement-Pond Co., New York.
Northern Crane Works, Walkerville.
Oliver Engineering Co., Montreal.

CRANK SHAFTS
Canada Found's & Forgings Ltd., Welland
Williams & Co., J. H., Brooklyn, N.Y.

CRANES, PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CRIMPS, LEATHER
Graton & Knight Mfg. Co., Worcester, Mass.

CRUSHERS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Elec. Steel & Metals, Welland, Ont.

CUPOLAS
Can. Blower & Forge Co., Kitchener.
Northern Crane Works, Walkerville.

CURB PUMPS FOR OIL, GASOLINE
Bowser Co., Ltd., S. F., Toronto, Ont.

CURRENT TRANSFORMERS
Volta Manufacturing Co., Welland, Ont.

CUT-OFF COUPLINGS, FRICTION
Petrie, Ltd., H. W., Toronto.

CUTTERS, BOLT
See Bolt Cutters.

CUTTERS, GEARS
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Fellows Gear Shaper Co., Springfield, Vt.

CUTTERS, FLUE
Cleveland Pneumatic Tool Co., Toronto.

CUTTER HEADS
Oliver Machinery Co. Grand Rapids, Mich

CUTTERS, PIPE (See Pipe Cutters)

CUTTERS, MILLING
Becker Milling Mach. Co., Boston, Mass.
Butterfield & Co., Rock Island, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cleveland Twist Drill Co., Cleveland.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Illinois Tool Works, Chicago, Ill.
Ingersoll Mache. Co., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Whitney Mfg. Co., Hartford, Conn.
Wilt Twist Drill Co., Walkerville, Ont.

CUTTER RELIEVING MACHINES
Cleveland Milling Machine Co., Cleveland.

CUTTING-OFF MACHINES
Armstrong Bros., Tool Co., Chicago.
Atkins & Co., E. C., Hamilton, Ont.
Bertram & Sons Co., John, Dundas.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co.,Ltd., Montreal
Foss Mchy & S'ply Co., Geo. F., Montreal
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield, Mass
Hurlburt, Rogers Machy. Co., South Sudbury, Mass.
Hall & Sons, John H., Brantford, Ont.
Kennedy & Sons, Wm., Owen Sound.
Lyman Tube & Supply Co., Montreal, Que.
Niles-Bement-Pond Co., New York, N.Y.
Prest-O-Lite Co., Inc., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Tabor Mfg. Co., Philadelphia, Pa.
Wells Bros. of Can., Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

CUTTING COMPOUND AND CUTTING OIL
Cataract Refining Co., Ltd., Toronto.
Swan & Finch, Inc., New York.

CUTTING OIL, RECLAIMING SYSTEM
Bowser Co., Ltd., S. F., Toronto, Ont.

CUTTING AND WELDING PLANTS
Davis-Bournonville Co., Jersey City, N.J.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

CYANIDE AND LEAD BATH POTS
Swedish Crucible Steel Co., Windsor.

CYLINDERS, AIR
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Smalley General Co., Inc., Bay City, Mich

CYLINDERS, AUTOMATIC REBORING JIGS AND REAMERS
Kelley Reamer Co., Cleveland, O.

DEHUMIDIFYING
B. F. Sturtevant Co, Galt, Ont.

DERRICKS
Aikenhead Hardware Co., Toronto, Ont.
Dominion Bridge Co., Montreal.
Hepburn Co., Ltd., J. T., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

DERRICK HOISTS
Canadian Mead-Morrison Co., Limited, Montreal, Que.

DIAMOND (BORTZ)
Furniss, Clarke & Co., Montreal, Que.

DIAMOND TOOLS
Ford-Smith Machine Co., Hamilton, Ont.
Furniss, Clarke & Co., Montreal, Que.
Joyce-Koebel Co., Inc., New York City.
Wheel Trueing Tool Co., Detroit.
Petrie, Ltd., H. W., Toronto.

DIAMONDS, CARBON AND BORTZ
Wheel Trueing Tool Co., Detroit.

DIAMONDS, BLACK AND ROUGH
Joyce, Koebel & Co., Inc., New York.
Wheel Trueing Tool Co., Windsor, Ont.

DIE CASTINGS
Fisher Motor Co., Ltd., Orillia, Ont.
Tallman Brass & Metals Ltd., Hamilton, Ont.

DIE HEADS, AUTOMATIC
Greenfield Tap & Die Corp., Greenfield Mass.
Wells Bros. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.

DIES, BRASS PRINTING, EMBOSSING AND LETTERING
Matthews, Jas. H., & Co., Pittsburgh, Pa

DIES FOR BIT BRACE USE
Butterfield & Co., Rock Island, Que.
Crescent Mche. Co., Ltd., Montreal, P.Q.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Wells Brothers Co., of Canada, Galt.

DIES AND DIE STOCKS
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Rock Island, Que.
Brown, Boggs Co., Hamilton, Ont.
Crescent Mche. Co., Ltd., Montreal, P.Q.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt. & Son, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Jones & Lamson, Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.
Marshall, Son & Bunney, Toronto.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Rickert-Shafer Co., Erie, Pa.
Stoll Co., Inc., D. H., Buffalo, N.Y.
Wells Brothers of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DIES, HAMMERED
Kimber & Hillier Mfg., Co., St. Catharines, Ont.

DIES, DROP FORGE.
Kimber & Hillier Mfg., Co., St. Catharines, Ont.

DIES, METAL STAMPING
Crescent Mche. Co., Ltd., Montreal, P.Q.
Elliott & Whitehall, Galt, Ont.

DIES, PIPE THREADING
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Crescent Mche. Co., Ltd., Montreal, P.Q.
Landis Machine Co., Waynesboro, Pa.

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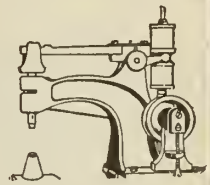

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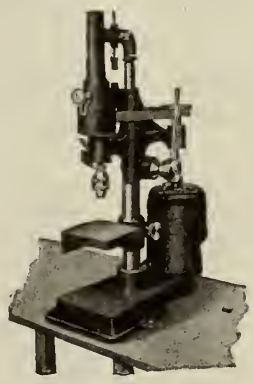

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Gen. Combustion Co, Can., Ltd, Montreal
Mechanical Eng'r'g Co., Three Rivers, Q.
W. S. Rockwell Co., New York, N.Y.
Petrie, Ltd., H. W., Toronto.

FURNACES, BLAST
Bellevue Industrial Furnace Co., Detroit.
Chicago Flexible Shaft Co., Chicago, Ill.
W. S. Rockwell Co., New York, N.Y.
Toronto Iron Works, Ltd., Toronto.

FURNACES — BRASS MELTING
General Combustion Co., Ltd., Montreal.

FURNACES — CRUCIBLE
Chicago Flexible Shaft Co., Chicago, Ill.

FURNACES, ELECTRIC
Electric Furnace Construction Co., Philadelpria, Pa.
Hamilton & Hansell, Inc., New York City.

FURNACES, FORGING
Chicago Flexible Shaft Co., Chicago, Ill.
Gen. Combustion Co. of Can., Ltd., Montreal.
W. S. Rockwell Co., New York, N.Y.

FURNACES — HIGH-SPEED STEEL
Chicago Flexible Shaft Co., Chicago, Ill.

FUSE BOXES, STEEL
Dom. Forge & Stamp. Co., Walkerville.

FUSE PLUGS AND FUSES
Northern Electric Co., Ltd., Montreal Que.

GALVANIZING FLUX
British Smelting & Refining Co., Ltd. Montreal, Que.

GANG PLANER TOOLS
Armstrong Bros. Tool Co., Chicago.

GAS AND STEAM ENGINES
Mesta Machine Co., Pittsburgh, Pa.

GASKETS, LEATHER, ETC.
Graton & Knight Mfg. Co., Montreal.

GASOLINE METERS
Bowser Co., Ltd., S. F., Toronto, Ont.

GASOLINE TANKS
Bowser Co., Ltd., S. F., Toronto, Ont.

GASOLINE PUMPS, SELF-MEASURING
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.

GAUGES
Crescent Mach. Co., Ltd., Montreal, P.Q.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.

GAUGERS, CALIPERS
Williams & Co., J. H., Brooklyn, N.Y.

GAUGES, MERCURY COLUMN, DRAFT
Taylor Instrument Co., Rochester, N.Y.

GAUGES, HYDRAULIC
Taylor Instrument Co., Rochester, N.Y.

GAUGES, MANUFACTURERS, LIMIT, THREAD
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Can., Galt, Ont.

GAUGES, SNAP, THREAD AND CYLINDRICAL
C. E. Johanson, Inc., Toronto, Ont.

GAUGES, VACUUM AND PRESSURE
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Rochester, N.Y.

GAUGES, STANDARD
Brown Engineering Corp., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Crescent Mche. Co., Ltd., Montreal, Que.
Garvin Machine Co., New York.
C. E. Johanson, Inc., Toronto, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Hartford, Conn.
Taylor, J. A. M., 518 Stair Bldg., Toronto
Toronto Tool Works, Toronto, Ont.
Wells Brothers Co. of Canada, Galt, Ont.

GEAR BLANKS
Can. Steel Foundries, Ltd., Montreal.
Dom. Found. & Steel, Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Williams & Co., J. H., Brooklyn, N.Y.

GEAR BLANKS, CAST
Katie Foundry, Galt, Ont.

GEAR BLANKS, RAWHIDE
Lyman Tube & Supply Co., Montreal, Que.

GEAR BOXES, REDUCTION
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEAR SHAPERS AND CUTTERS
Fellows Gear & Shaper Co., Springfield, V.

GEAR-CUTTING MACHINERY
Bilton Mach. Tool Co., Bridgeport, Conn.
Fellows Gear & Shaper Co., Springfield, V.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
A. R. Williams Machy. Co., Toronto.

GEAR-TESTING MACHINE
Gisholt Machine Co., Madison, Wis.

GEARS, CHAIN
Morse Chain Co., Ithaca, New York
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, COMPENSATING
Morse Chain Co., Ithaca, New York.
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, CUT, MORTISE, ANGLE, WORM
Can. Link-Belt Co., Toronto, Ont.
Diamond State Fibre Co., Bridgeport, Pa.
Dom. Steel Products Co., Ltd., Brantford.
Dominion Bridge Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Elliott & Whitehall, Galt, Ont.
Gardner, Robt., & Son, Montreal.
Hamilton Gear & Machine Co., Toronto.
Hull Iron & Steel Found., Ltd., Hull, Q.
Jones & Glassco, Montreal.
Wm. Kennedy & Sons, Ltd., Owen Sound, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia
Victoria Foundry Co., Ottawa.

GEARS, RAWHIDE
Gardner, Robt., & Son, Montreal.
Grant Gear Works, Boston, Mass.
Hamilton Gear & Machine Co., Toronto.
Hamilton Co., Ltd., Wm., Peterborough,
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia.
A. R. Williams Machy. Co., Toronto.

GENERATORS, GEAR
Fellows Gear & Shaper Co., Springfield, V

GEARS, SILENT CHAIN
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, SPRING
Morse Chain Co., Ithaca, New York.

GEARS, SPUN, BENCH, SPIRAL
Brown & Sharpe Mfg. Co., Providence, R.I.

GENERAL MACHINE WORK
Elliott & Whitehall, Galt, Ont.

GENERATORS AND CONVERTORS
Northern Elec. Co., Ltd., Montreal, P.Q.

GENERATORS, MOTOR
MacGovern & Co., Montreal.
Northern Elec. Co., Ltd., Montreal, P.Q.
Sturtevant Co., B. F., Galt, Ont.

GENERATORS, STEAM TURBO
Can. Link-Belt Co., Ltd., Toronto, Ont.

GILDING
Brown's Copper and Brass Rolling Mills, New Toronto.

GLOVES, ASBESTOS, ACID PROOF, WATERPROOF, ETC.
Strong, Kennard & Nutt Co., Cleveland.

GLUE HEATERS
Oliver Machinery Co., Grand Rapids, Mich

GLASSES, SAFETY
Streng, Kennard & Nutt Co., Cleveland.
Willson & Co., Inc., T. A., Reading, Pa

GRAPHITE
Aikenhead Hardware, Ltd., Toronto.
Rice Lewis & Son, Toronto.

GOGGLES
Consolidated Optical Co., Toronto.
Standard Optical Co., Geneva, N.Y.

GRAB BUCKETS—CLAMSHELL and ORANGE PEEL
Canadian Link-Belt Co., Ltd., Toronto, Ont.
Canadian Mead-Morrison Co., Limited, Montreal, Que.

GRAVITY CARRIERS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

GREASE CUPS, PRESSED STEEL, BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES (See Lubricants)

GRINDERS, AUTOMATIC KNIFE
Canada Machinery Corp., Galt, Ont.
Foss Mchry. & S'ply Co., G. F., Montreal
Garlock-Walker Machinery Co., Toronto.

GRINDERS, BENCH
Superior Machinery Co., London, Ont.

GRINDERS, CENTRE COLUMN, PEDESTAL AND BENCH
Can. Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Haskins & Co., R. C., Chicago, Ill.
Wisconsin Electric Co., Inc., Racine, Wis
Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto.
Katie Foundry, Galt, Ont.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford.
Niles-Bement-Pond Co., New York, N.Y.
Perfect Machine Co., Galt, Ont.
United States Elec. Tool Co., Cincinnati.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, CUTTER
Brown & Sharpe Mfg. Co., Providence, R.I
Cincinnati Milling Mach. Co., Cincinnati.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Globe Engineering Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield, M.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Norton Co., Worcester, Mass.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, DIE AND CHASER
Haskins & Co., R. C., Chicago, Ill.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
National-Acme Co., Cleveland, Ohio.

GRINDERS, DISK
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., E. C., Hamilton, Ont.
Ford-Smith Mach. Co. Hamilton.
Gardner Machine Co., Beloit, Wis.
Heald Machine Co., Worcester, Mass.

GRINDERS, FLEXIBLE CASTING
Manhattan Machine & Tool Co., Grand Rapids, Mich.

GRINDERS, DRILL
Aikenhead Hardware Co., Toronto.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield,
Petrie, Ltd., H. W., Toronto.
United States Elec. Tool Co., Cincinnati.
Wells Bros. of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, CYLINDER, INTERNAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I
Foss Mchy. & S'ply Co., G. F., Montreal.
Greenfield Machine Co., Greenfield, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, PORTABLE, ELECTRIC HAND, TOOL POST, FLOOR AND BENCH
Baird Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Ford-Smith Mach. Co., Hamilton, Ont.
Haskins & Co., R. C., Chicago, Ill.
Grant Mfg. & Mach. Co., Bridgeport, Con
Garlock-Walker Machinery Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Independent Pneumatic Tool Co., Chicago
Petrie, Ltd., H. W., Toronto.
United States Elec. Tool Co., Cincinnati
Wisconsin Electric Co., Inc., Racine, Wis.
Williams Mchy Co., A. R., Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.

GRINDERS, MANUFACTURING
Barber Mchy. Co., Ltd., Toronto, Ont.
Universal Grinding Mach. Co., Fitchburg, Mass.

GRINDERS, HOLE, HOLE AND AND DEEP HOLE
Barber Mchy. Co., Ltd., Toronto, Ont.
Bryant Chucking Grinder Co., Springfield, Vermont.
Heald Machine Co., Worcester, Mass.

GRINDERS, PLAIN CYLINDRICAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Fitchburg Grinding Mach. Co., Fitchburg, Mass.

GRINDERS, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal.
Cleveland Pneumatic Tool Co., Toronto.
Garlock-Walker Machinery Co., Toronto.
Heald Machine Co., Worcester, Mass.
Independent Pneumatic Tool Co., Chicago
MacGovern & Co., Montreal, Que.

GRINDERS, PROFILE
Cleveland Milling Machine Co., Cleveland.

GRINDERS, ROTARY SURFACE
Brown & Sharpe Mfg. Co., Providence, R.I
Bristol Machine Tool Co., Bristol, Conn.
Manhattan Machine & Tool Co., Grand Rapids, Mich.

GRINDERS, TOOL AND HOLDER
Armstrong Bros. Tool Co., Chicago.
W. F. & John Barnes Co., Rockford, Ill.
Blount & Co., J. G., Everet, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I
Ford-Smith Machine Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield.
National-Acme Co., Cleveland, Ohio.
Tabor Mfg. Co., Philadelphia, Pa.
Wells Bros. of Canada, Galt, Ont.

GRINDERS, UNIVERSAL, PLAIN
Barber Mchy. Co., Ltd., Toronto, Ont.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Modern Tool Co., Erie, Pa.
Norton Co., Worcester, Mass.
Williams Mchy Co, Ltd., A. R., Montreal

GRINDERS, VERTICAL, SURFACE
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Co., Montreal.
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Norton Co., Worcester, Mass.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDING DISCS
Wausau Abrasives Co., Chicago, Ill.

GRINDING AND POLISHING MACHINES, PORTABLE, PNEUMATIC AND SPRING FRAME
Can. Fairbanks-Morse Co., Montreal.
Cincinnati Elec. Tool Co., Cincinnati, O.
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal.
Garvin Machine Co., New York.
Garlock-Walker Machy. Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Haskins & Co., R. C., Chicago, Ill.
Hall & Sons, John H., Brantford, Ont.
Niles-Bement-Pond Co., New York, N.Y.
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Wisconsin Electric Co., Racine, Wis.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDING MACHINES, CAR WHEEL, CUTTER, CYLINDRICAL, CRANKSHAFT
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I
Norton Co., Worcester, Mass.

GRINDING WHEELS
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Brantford Emery Wheel Co., Brantford.
Can. Fairbanks-Morse Co., Montreal.
Carborundum Co., Niagara Falls, N.Y.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Mchy. & S'ply Co. G. F., Montreal.
Norton Co., Worcester, Mass.

GRINDING WHEEL DRESSER
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.

GUARDS, WINDOW AND MACHINE
Canada Machinery Corp., Galt, Ont.
Canada Wire & Iron Goods Co., Hamilton
Dennis Wire & Iron Works, London, Ont.
B. Greening Wire Co., Hamilton, Ont.
Page Steel & Wire Co., Adrian, Mich.

GUTTERS AND SKYLIGHTS
H. H. Robertson, Ltd., Sarnia, Ont.

HACK SAW BLADES
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Wks., Buffalo.
Ford-Smith Machine Co., Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Plewes, Ltd., Winnipeg, Man.
Pilot Steel & Tool Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Racine Tool & Machine Co., Racine, Wis.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
L. S. Starrett Co., Athol, Mass.
Standard Machy. & Supplies, Montreal.
Victor Saw Works, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.
Williams Mchy Co., A. R., Toronto, Ont.

HANDLES, BALANCE, CRANK AND MACHINE
Williams & Co., J. H., Brooklyn, N.Y.

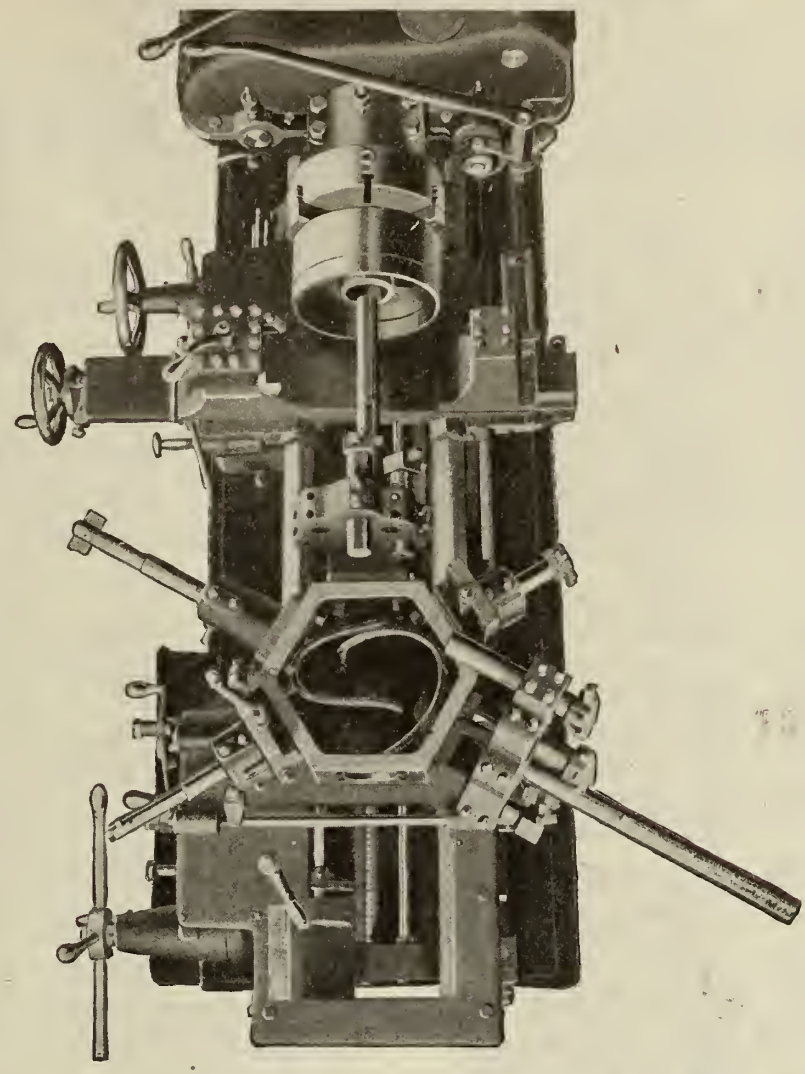
HANGERS, SHAFT
Can. Link-Belt Co., Ltd., Toronto, Ont.

HACK SAW FRAMES
Aikenhead Hardware Co., Toronto.
Atkins & Co., E. C., Hamilton, Ont.
Can. Fairbanks-Morse Co., Montreal.
Ford-Smith Machine Co., Hamilton, Ont.
Garvin Machine Co., New York City.
Victor Saw Works, Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.

HACK SAWS, POWER
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Wks., Buffalo.
Foss Mchy. & S'ply Co., G. F., Montreal.
Ford-Smith Machine Co., Hamilton.
Perfect Machine Co., Galt, Ont.
Starrett Co., L. S., Athol, Mass.
Victor Saw Works, Hamilton, Ont.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

HAMMERS, FORGING
Nazel Eng. & Mach. Wks., Philadelphia.

HAMMERS, ELECTRIC
Haskins & Co., R. C., Chicago, Ill.



A PROBLEM IN INVESTMENT

This 12-inch friction pulley used to be machined complete in the engine lathe in 67 minutes. The Foster 2-B Universal Turret Lathe requires 35 minutes to perform the same operations. The saving effected is 32 minutes.

The wages in each case were 65 cents and the factory overhead 125 per cent. The saving per piece is then 78 cents.

The production per eight-hour day 13 pulleys.

Saving per day $10.14.

Additional investment required in 2-B Turret Lathe with complete tool equipment above that of the engine lathe about $1,360.00.

HOW LONG DOES IT REQUIRE TO PAY FOR NEW EQUIPMENT?

WHAT IS THE RETURN FROM THE INVESTMENT?
SEND IN YOUR ANSWER TO THE

FOSTER MACHINE CO., ELKHART, IND.

If interested, tear out this page and keep with letters to be answered.

HAMMERS (DROP), MOTOR AND BELT DRIVEN
Beaudry & Co., Boston, Mass.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton.
Can. Billings & Spencer, Ltd., Welland.
Canada Machinery Corp., Galt, Ont.
High Speed Hammer Co., Rochester, N.Y.
Jardine & Co., A. B., Hespeler, Ont.
Niles-Bement-Pond Co., New York, N.Y.
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
United Hammer Co., Boston, Mass.
Williams Mchy Co, Ltd., A. R., Montreal

HAMMERS, HELVE POWER
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
West Tire Setter Co., Rochester, N.Y.
Williams Mchy Co, Ltd., A. R., Montreal

HAMMERS, CHIPPING, CAULKING, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Nazel Eng. & Mach. Wks., Philadelphia

HAMMERS, MARKING
Matthews & Co., Jas. H., Pittsburgh, Pa.

HAMMERS, NAIL MACHINE
Rice Lewis & Son, Toronto, Ont.
United Hammer Co., Boston, Mass.

HAMMERS, POWER
Nazel Eng. & Mach. Wks., Philadelphia

HAMMERS, STEAM
Canada Machinery Corp., Galt, Ont.
Niles-Bement-Pond Co., New York.

HAND PLANERS
Oliver Mchry. Co., Grand Rapids, Mich.

HAND PLANING AND JOINTING MACHINERY
Oliver Engineering Co., Montreal, P.Q.

HAND LEATHERS OR PADS
Graton & Knight Mfg. Co., Montreal

HANDLES, FIBRE
Diamond State Fibre Co., Bridgeport, Pa.

HANGERS
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian Link-Belt Co., Ltd., Toronto, Ont.

HANGERS, SHAFT
Algoma Steel Corp., Sault Ste. Marie.
Chapman Double Ball Bearing Co., Toronto.
Gray Ball Bearing Co., Ltd., Toronto.
Baird Machine Co., Bridgeport, Conn.
Can. S K F Co., Toronto, Ont.
Gardner & Son, Robt., Montreal.
Jones & Glassco, Montreal.
Williams Mchy Co, Ltd., A. R., Montreal

HARDNESS TESTING INSTRUMENTS
Shore Instrument & Mfg. Co., New York.

HEAD, AUXILIARY
Hoefer Mfg. Co., Freeport, Ill.

HEATING AND VENTILATING ENGINEERS
Can. Blower & Forge Co., Kitchener, Ont.
Sturtevant Co., B. F., Galt, Ont.

HEAT GAUGES, HARDENING AND ANNEALING
Shore Instrument & Mfg. Co., New York

HELMETS, SANDBLAST, AMMONIA
Strong, Kennard & Nutt Co., Cleveland

HIGH SPEED STEEL
See Steel.

HINGE MACHINERY
Baird Machine Co., Bridgeport, Conn.

HINGES
Butterfield & Co., Inc., Rock Island, Que.
London Bolt & Hinge Wks., London, Ont.

HOBS
Greenfield Tap & Die Co., Greenfield, Mass
Pratt & Whitney Co., Dundas, Ont.
Taylor, J. A. M., 318 Stair Bldg., Toronto
Wells Bros. of Canada, Galt, Ont.

HOISTING MACHINERY
Canadian Mead-Morrison Co., Limited, Montreal, Que.

HOISTS, AIR
Can. Ingersoll-Rand Co., Ltd., Sherbrooke
Morris Crane & Hoist Co., Herbert. Niagara Falls, Ont.

HOISTS, CHAIN AND PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Ford Chain Block & Mfg., Philadelphia.
Independent Pneumatic Tool Co., Chicago
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert. Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

HOISTS, ELEC., STATIONARY, MONO RAIL
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
A. Leatty & Sons, Ltd., Welland, Can.
Oliver Engineering Co., Montreal.
Volta Mfg. Co., Welland, Ont.

HOISTS, ELECTRICAL
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Montreal, Que.
Electric Steels & Metals Ltd., Welland.
Kennedy & Sons, Owen Sound, Ont.
Morris Crane & Hoist Co., Herbert. Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

HOLDERS, ADJUSTABLE LENGTH
Eclipse Counterbore Co., Ltd., Walkerville, Ont.

HOLDERS, STEEL DIE FOR MARKING
Matthews & Co., Jas. H., Pittsburgh, Pa.

HOLDERS, ELECTRIC
Electric Steels & Metals, Ltd., Welland

HOOKS, BELT LACING
Clipper Belt Lacer Co., Grand Rapids.

HOPPERS
MacKinnon Steel Co., Ltd., Sherbrooke.
Dominion Bridge Co., Montreal, Que.
William Hamilton Co., Peterboro, Ont.
Toronto Iron Works, Ltd., Toronto, Ont.

HOSE, FIRE PROTECTION
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal

HOSE, PNEUMATIC
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Gutta Percha & Rubber, Ltd., Toronto.
Independent Pneumatic Tool Co., Chicago.
Quaker City Rubber Co., Philadelphia, Pa.
Wells Bros. Co. of Canada, Galt, Ont.

HOSE, ALL KINDS
Goodyear Tire & Rubber Co., of Canada, Ltd., Toronto.
Gutta Percha & Rubber, Ltd., Toronto.
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.

HOSE, SAND BLAST
Pangborn Corporation, Hagerstown, Md.
Goodyear Tire & Rubber Co. of Can., Ltd. Toronto
Quaker City Rubber Co., Philadelphia, Pa.
Intern'l. Machine Tool Co., Indianapolis.

HOSE, STEAM, SUCTION AND WATER
Gutta Percha & Rubber, Ltd., Toronto.
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.

HUMIDIFIERS
Sturtevant Co., B. F., Galt, Ont.

HYDRAULIC ACCUMULATORS
Dom. Steel Products Co., Ltd., Brantford.

HYDRAULIC MACHINERY
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
West Tire Setter Co., Rochester, N.Y.
Victoria Foundry Co., Ottawa.

HYDRAULIC TURBINES
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

HYDROMETERS, HYGROMETERS, HYGRODNIKS
Taylor Instrument Co., Rochester, N.Y.

INDICATORS, SPEED
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol, Mass.

INDEX CENTRES
Brown & Sharpe Mfg. Co., Providence, R.I.
Dickow, Fred. C., Chicago, Ill.
Ford-Smith Machine Co., Hamilton, Ont.
Garvin Machine Co., New York.
Petrie, Ltd., H. W., Toronto.

INDICATING INSTRUMENTS
Taylor Instrument Co., Rochester, N.Y.

INDICATING SCALES
Can. Kron Scale Co., Montreal.

INDUSTRIAL SITES
City of St. Johns, Quebec.

INGOTS, BRASS, BRONZE, GUN METAL, PHOSPHOR
Thomas Moore & Son, Montreal.

INGOTS, FORGING AND ROLLING
Electric Steel & Metals Co., Welland.

INSULATING COMPOUNDS
Robertson Co., Ltd., H. H., Sarnia, Ont.

INSTRUMENTS, ENGINEERING
Consolidated Optical Co., Toronto.

IRON ORE
Hanna & Co., M. A. Cleveland, O.

IRON, WROUGHT, ROLLED, PIG
Swedish Steel & Impt. Co., Ltd., Montreal

JACKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
The Engineering Co.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Norton, A. O., Coaticook, Que.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.

JACKS, PIT AND TRACK
Canadian Fairbanks-Morse Co., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Northern Crane Works, Walkerville.

JAWS, FACE PLATE
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford.
Skinner Chuck Co., New Britain, Conn.

JIGS, TOOLS, ETC.
Brown Engineering Corp., Toronto.
Crescent Mach. Co., Ltd., Montreal, P.Q.
Elliott & Whitehall Mach. & Tool Co., Galt.
Gisholt Machine Co., Madison, Wis.
Globe Engineering Co., Ltd., Hamilton.
Homer & Wilson, Hamilton, Ont.
Jones & Lamson, Springfield, Vt.
Toronto Tool Co., Toronto, Ont.

JOURNAL WEDGES
Canada Foundries & Forgings, Welland.
Dominion Foundries & Steel Ltd., Hamilton, Ont.

KEY SEATERS
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Morton Mfg. Co., Muskegon Heights, M.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.

KEYS, MACHINE
Whitney Mfg. Co., Hartford, Conn.
Williams & Co., J. H., Brooklyn, N.Y.

KILNS
Can. Blower & Forge Co., Kitchener, Ont.
General Combustion Co., Ltd., Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Sturtevant Co., B. F., Galt, Ont.

KNIVES, MACHINE
Atkins & Co., E. C., Hamilton, Ont.

LABELS AND TAGS
Matthews & Co., Jas. H., Pittsburgh, Pa.

LABORATORIES, INSPECTION AND TESTING (see Chemists)

LADLES, FOUNDRY
Northern Crane Works, Walkerville.

LACING MACHINES
Clipper Belt Lacer Co., Grand Rapids, M.

LAG SCREW GIMLET POINTERS
National Machy. Co., Tiffin, Ohio.

LATH
Robertson. Ltd.. H. H., Sarnia, Ont.

LATHES, CHUCKING
Acme Machine Tool Co., Cincinnati, Ohio.
Petrie, Ltd., H. W., Toronto.
Wood Turret Machine Co., Brazil, Ind.

LATHE CHUCKS (See Chucks)

LATHE DOGS AND ATTACHMENTS
Armstrong Bros. Tool Co., Chicago.
Hendey Machine Co., Torrington, Conn.
Williams & Co., J. H., Brooklyn, N.Y.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.
Wood Turret Machine Co., Brazil, Ind.

LATHES, AXLE
Barber Mchy. Co., Ltd., Toronto, Ont.
Betts Mach. Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.

LATHES, BORING
Barber Mchy. Co., Ltd., Toronto, Ont.
Bridgeford Mach. Tool Works, Rochester.
Canada Machinery Corp., Galt, Ont.
Ledge & Shipley, Cincinnati, O.
Petrie, Ltd., H. W., Toronto.

LATHES, PRECISION, BENCH
W. F. & John Barnes Co., Rockford.
J. G. Blount & Co., Everett, Mass.
Canadian Fairbanks-Morse Co., Montreal.
Geo. F. Foss Machy. & Supply Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Hardinge Bros., Chicago, Ill.
Pratt & Whitney Co., Dundas, Ont.
Seneca Falls Mfg Co., Seneca Falls, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

LATHES, BRASS
Acme Machine Tool Co., Cincinnati, Ohio.
Hardinge Bros., Chicago, Ill.
Wood Turret Machine Co., Brazil, Ind.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

LATHES, ENGINE
Acme Machine Tool Co., Cincinnati, O.
Barber Mchy. Co., Ltd., Toronto, Ont.
John Bertram & Sons, Co., Dundas.
Canada Machy. Corp., Galt, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cisco Machine Tool Co., Cincinnati, O.
G. F. Foss, Mchy. & S'ply Co., Montreal
Garlock-Walker Machinery Co, Toronto.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
Kennedy & Sons, Wm., Owen Sound, Ont.
Lehman Mach. Co., St. Louis, Mo.
R. McDougall Co., Galt.
Niles-Bement-Pond Co., New York.
Perfect Machine Co., Galt, Ont.
Rae Mach. Tool Co., Hamilton.
Smalley-General Co., Inc., Bay City, Mich.
Standard Equipment & Tool Wks. Montreal, P.Q.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Sidney Tool Co., Sidney, Ohio.
Walcott Lathe Co., Jackson, Mich.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.
Williams Machy. Co., A. R., Toronto.
Wood Turret Machine Co., Brazil, Ind.

LATHES, SPINNING
Bliss Co., E. W., Brooklyn, N.Y.

LATHES, TOOL ROOM
Barber Mchy. Co., Ltd., Toronto, Ont.
Cisco Machine & Tool Co., Cincinnati, O.
Canada Machinery Corporation, Galt, Ont.
Knight Metal Products, Toronto.
Lehman Machine Co., St. Louis, Mo.
Rae Mach. Tool Co., Ramilton.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.

LATHES, QUICK CHANGE
Lehman Machine Co., St. Louis, Mo.

LATHE SAWS
Atkins & Co., E. C., Hamilton, Ont.

LATHES, TURRET
Hardinge Bros., Chicago, Ill.
Acme Machine Tool Co., Cincinnati, Ohio

LEAD, PIG AND BAR
British Smelting & Refining Co., Ltd., Montreal, Que.

LEAD BURNING OUTFITS
Turner Brass Works, Sycamore, Ill.

LEATHER STRAPPING
Graton & Knight Mfg. Co., Worcester, M.

LENSES FOR GOGGLES
Standard Optical Co., Geneva, N.Y.

LEVELS
Hughes, Owens Co., Ltd., Montreal, Que.

LIDS, SCREW TOP AND HINGE
Can. Winkley Co., Ltd., Windsor, Ont.

LINK BELTING
See Belting, Chain.

LIFT TRUCKS
Can. Kron Scale Co., Montreal.

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LOCKERS, STEEL WARDROBE AND STEEL MATERIAL
Canada Wire & Iron Gds. Co., Hamilton.
Dennis Wire & Iron Works, London, Ont.

LUBRICANTS
Cataract Refining & Mfg. Co., Toronto.
Swan & Finch, Inc., New York.

LUBRICANTS, CUTTING AND GRINDING, DRAWING, STAMPING
Calley Chemical Co., New York, N.Y.

LUBRICATING, OIL FILTERING AND CIRCULATING SYSTEMS
Bowser Co., Ltd., S. F., Toronto, Ont.

LUBRICATORS
Trabern Pump Co., Rockford, Ill.

LUMBERMEN'S TOOLS
Thos. Pink Co., Ltd., Pembroke, Ont.

MACHINE COUNTER WEIGHTS
Katie Foundry, Galt, Ont.

MACHINE TOOLS
Barber Mach. Co., F. F., Toronto, Ont.
Knight Metal Products, Toronto.
Rae Mach. Tool Co., Ramilton.

NO TAX ON INTERNATIONAL TIME RECORDERS

New Business Turnover Impost of 1% has been absorbed by the Company, and is in no manner or sense charged to the customer.

TIME RECORDERS AT OLD PRICES WILL HELP YOU TO GRAPPLE WITH INCREASING COSTS

When the new Business Turnover Tax presented itself, the management of the International Business Machines Co., after carefully weighing the interests of their large and valued clientele decided NOT to charge this tax to the buyer of International Equipment,—a decision which it is felt will be appreciated, particularly in the face of ever-increasing costs.

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Make it a rule in your plant to get correct records of each job.

International Time Recorders offer the only sure and certain way of computing the difference between the labor time you buy and the actual results in productive labor.

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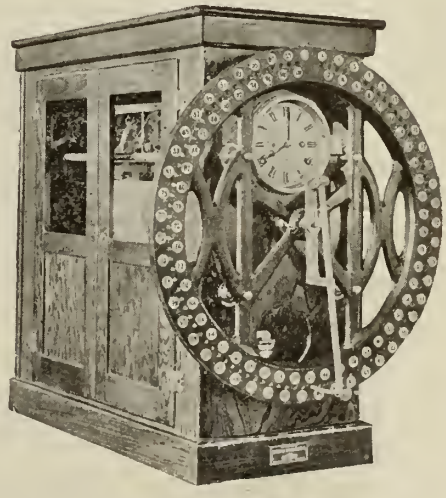

International Business Machines Co. Limited

FRANK E. MUTTON, Vice-President and General Manager

Head Office and Factory: 300 to 350 Campbell Avenue, Toronto

Offices at

HALIFAX, 44 Granville St.; QUEBEC, 506 Merger Bldg.; MONTREAL, 1 and 3 Notre Dame St. W.; OTTAWA, 188 Queen St.; TORONTO, 415½ Yonge St.; HAMILTON, 175 James St. N.; WALKERVILLE, ONT., 44 Lincoln Rd.; WINNIPEG, 227 McDermott Ave.; SASKATOON, 254 Third Ave.; CALGARY, 127 Sixth Ave.; EDMONTON, 10118 102nd St.; VANCOUVER, 110 Water St.

(Also manufacturers of Dayton Scales and Hollerith Electric Tabulators)

MACHINERY DEALERS
Archibald & Co., Chas. P., Montreal.
Barber Mchy. Co., Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Elliott & Whitehall, Galt, Ont.
Foss Mchy. & S'ply Co., ... Montreal
Garlock-Walker Machy. Co., Toronto, Ont.
Williams Machy. Co., A. R., Toronto.

MACHINERY GUARDS (See Guards; MACHINERY SUPPLIES
Crescent Machine Co., Ltd., Montreal.
Globe Engineering Wks., Hamilton, Ont.
Knight Metal Products, Toronto.

MACHINERY, SPECIAL
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Crescent Machine Co., Ltd., Montreal, Que.
McClean Machine & Tool Co., Ltd., Hamilton, Ont.

MACHINISTS' TOOLS
Atkins & Co., E. C., Hamilton, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.

MAGNETIC BRAKES FOR ELECTRIC MOTORS
Volta Mfg. Co., Welland, Ont.

MANDRELS
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Pratt & Whitney Co., Dundas, Ont.

MARKING DEVICES
Matthews & Co., Jas. H., Pittsburgh, Pa.

MARKING MACHINERY
Brown, Boggs Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Perrin, Wm. R., Toronto.
Petrie, Ltd., H. W., Toronto.

MATERIALS, HANDLING PLANTS
Canadian Mead-Morrison Co., Limited, Montreal, Que.

MATS, RUBBER MATTING
Quaker City Rubber Co., Philadelphia, Pa.
International Mchy. Sply., Ltd., Montreal.

MEASURING MACHINES
Pratt & Whitney Co., Dundas, Ont.

MEASURES, REGISTERING
Bowser Co., Ltd., S. F., Toronto, Ont.

MEASURING TAPES AND RULES
Chesterman & Co., Jas., Sheffield, Eng.

MERCHANTS, IRON AND STEEL
Samuel Osborne (Can.), Ltd., Montreal.

METALLURGISTS
See Chemists.

METAL CLEANERS
Oakley Chemical Co., New York, N.Y.

METAL CUTTING MACHINES
Atkins & Co., E. C., Hamilton, Ont.
Lyman Tube & Supply Co., Montreal, Que.

METAL SAWS
See Saws.

METAL, ANTI-FRICTION
Thos. Moore & Son, Montreal.

METAL SAWS, POWER
E. C. Atkins & Co., Inc., Indianapolis.
Hoefer Mfg. Co., Freeport, Ill.
Lyman Tube & Supply Co., Montreal, Que.

METALS
British Smelting & Refining Co., Ltd., Montreal, Que.
Brown's Copper & Brass Rolling Mills, New Toronto, Ont.
Canada Metal Co., Toronto, Ont.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.

METAL, STAMPINGS, SMALL
Can. Winkley Co., Ltd., Windsor, Ont.

METERS, OIL, GASOLINE, KEROSENE, ETC.
Bowser Co., Ltd., S. F., Toronto, Ont.
General Combustion Co., Ltd., Montreal, Que.

MICROMETERS
Taylor, J. A. M., 31f Stair Bldg., Toronto.
Petrie, Ltd., H. W., Toronto.

MILLS, BRACE AND TUBE
Elec. Steel & Metals, Welland, Ont.

MILL SPECIALTIES
Atkins & Co., E. C., Hamilton, Ont.

MILLS, SAND
Frost Mfg. Co., Chicago, Ill.

MILL MACHINERY
Alexander Fleck, Ltd., Ottawa.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

MILLING ARBORS
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Kearney & Trecker Co., Milwaukee Wis.

MILLING ATTACHMENTS
Barber Mchy. Co., Ltd., Toronto, Ont.
Becker Milling Machine Co., Boston, Mass.
Bertram & Sons Co., John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence.
Canada Machinery Corp., Galt, Ont.
Cincinnati Milling Machine Co., Cincinnati.
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
National Machy. Co., Tiffin, Ohio.
Gooley & Eduud, Inc., Cortland, N.Y.
Hardinge Bros., Inc., Chicago, Ill.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Knight Metal Products, Toronto.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.

MILLING MACHINES, PROFILE
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

MILLING TOOLS
Aikenhead Hardware Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence.
Ford-Smith Mach. Co., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
Rice Lewis & Son, Toronto, Ont.
Pabor Mfg. Co., Philadelphia, Pa.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

MINE CARS
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dominion Bridge Co., Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.

MINING MACHINERY
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Elec. Steel & Metals, Welland, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., A. R., Toronto, Ont

MIXERS, SAND
Frost Mfg. Co., Chicago, Ill.
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal
Hardinge Bros., Inc., Chicago, Ill.
Hendey Mach. Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

MILLING MACHINES, AUTOMATIC
Bilton Mach. Tool Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Betts Machine Co., Rochester, N.Y.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.

MILLING CUTTERS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Milling Machine Co., Cleveland.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Marshall, Son & Bunney, Toronto.
Petrie, Ltd., H. W., Toronto.
Wilt Twist Drill Co., Walkerville, Ont.

MILLING MACHINES, HAND
Bristol Machine Tool Co., Bristol, Conn.

MILLING MACHINES, THREAD
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Inc., Chicago, Ill.
Gray Ball Bearing Co., Ltd., Toronto.
United States Mach. Tool Co., Cincinnati.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Smalley Gen. Co., Inc., Bay City, U.S.A.
Standard Equipment & Tool Wks., Montreal, P.Q.

MILLING MACHINES, HORIZONTAL AND VERTICAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Becker Milling Machine Co., Boston, Mass.
Bristol Machine Tool Co., Bristol, Conn.
Brown & Sharpe Mfg. Co., Providence.
Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Knight Metal Products, Toronto.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Rockford Milling Mach. Co., Rockford, Ill.
United States Mach. Tool Co., Cincinnati.
Whitney Mfg. Co., Hartford, Conn.
Williams Machy. Co., A. R., Toronto.

MILLING MACHINES, PLAIN, BENCH AND UNIVERSAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Becker Milling Machine Co, Boston, Mass.
Bilton Mach. Tool Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence.
Canada Machinery Corp., Galt, Ont.
Cleveland Milling Machine Co., Cleveland.
Cincinnati Milling Machine Co., Cincinnati.
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
National Machy. Co., Tiffin, Ohio.
Gooley & Eduud, Inc., Cortland, N.Y.
Hardinge Bros., Inc., Chicago, Ill.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Knight Metal Products, Toronto.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.

MILLING MACHINES, PROFILE
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

MILLING TOOLS
Aikenhead Hardware Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence.
Ford-Smith Mach. Co., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
Rice Lewis & Son, Toronto, Ont.
Pabor Mfg. Co., Philadelphia, Pa.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

MINE CARS
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dominion Bridge Co., Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.

MINING MACHINERY
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Elec. Steel & Metals, Welland, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., A. R., Toronto, Ont

MIXERS, SAND
Frost Mfg. Co., Chicago, Ill.

MORTISING MACHINES
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
Gray Ball Bearing Co., Ltd., Toronto.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
MacGovern & Co., Montreal, Que.
Northern Elec. Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
U. S. Ordnance, Toronto, Ont.
Volta Mfg. Co., Welland, Ont.
Williams Mach'y Co., A. R., Toronto.

MOTOR SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

MOTORCYCLE FRAME AND FORK
The Dunbar Brothers Co., Bristol, Conn.

MOTORS, PNEUMATIC
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto.

MOULDS, RUBBER
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

MULTIPLE INDEX CENTRES
Garvin Machine Co., New York.
Graton & Knight Mfg. Co., Worcester, M.

MULTI-DRILLING, MULTI-BORING, MULTI-TAPPING MACHINERY,
Nat. Automatic Tool Co., Richmond, Ind.

MUNICIPALITIES
City of St. John, Quebec.

NAIL SETS
Morrow Screw & Nut Co., J., Ingersoll, Ont.

NAME PLATES, BRONZE, ETCHED AND STAMPED
Matthews & Co., Jas. H., Pittsburgh, Pa.
Turner Brass Works, Sycamore, Ill.

NICHROME CASTINGS
Can. Driver-Harris Co., Ltd., Walkerville.

NICKEL
Pilot Steel & Tool Co., Montreal, Que.

NICKEL STEEL
See Steel.

NICKEL SILVER—SHEETS, ROLLS, PLATES and RODS
Brown's Copper and Brass Rolling Mills, New Toronto.

NIPPLE THREADING MACHINES
Hall & Sons, Ltd., John H., Brantford.
Landis Machine Co., Waynesboro, Pa.

NITROGEN
Carter Welding Co., Toronto, Ont.

NUTS, STEEL, CASTELLATED AND COLD PRESSED
Galt Machine Screw Co., Ltd., Galt, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

NUTS, SEMI-FINISH AND FINISHED
Galt Machine Screw Co., Galt, Ont.
National-Acme Co., Cleveland, Ohio.
Wilkinson & Kompass, Hamilton.

NUT LOCKS
Edw. W. Robinson Co., Ltd., Montreal.

NUT BURRING AND NUT MACHINES (HOT)
National Machy. Co., Tiffin, Ohio.

NUT FACING AND BOLT SHAVING MACHINES
Garvin Machine Co., New York.
National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
Victor Tool Co., Waynesboro, Pa.

NUT TAPPERS
Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
Hall & Son, J. H., Brantford, Ont.
Jardine & Co., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.

OILERS
All-Way Oiler Mfg. Co., Toronto, Ont.

OIL SEPARATORS
Can. Fairbanks-Morse Co., Montreal.

OIL STONES
Aikenhead Hardware Co., Toronto, Ont.
Carborundum Co., Niagara Falls, N.Y.
Norton Co., Worcester, Mass.
Rice Lewis & Son, Toronto, Ont.

OIL STONE GRINDERS
Oliver Machy. Co., Grand Rapids, Mich.

OIL STORAGE SYSTEMS
Bowser Co., Ltd., S. F., Toronto, Ont.
St. Lawrence Welding Co., Ltd., Montreal.

OPENING DIE HEADS
Greenfield Tap & Die Corp, Greenfield.
Wells Bros. of Canada, Galt, Ont.

OPTICAL SUPPLIES
Consolidated Optical Co., Toronto, Ont.

ORE HANDLING EQUIPMENT
Brown Hoisting Machinery Co., Cleveland, Ohio.
Canadian Link-Belt Co., Ltd., Toronto, Ont.
Canadian Mead-Morrison Co., Limited, Montreal, Que.

OSCILLATING VALVE GRINDERS (PNEUMATIC)
Cleveland Pneumatic Tool Co. of Canada, Toronto.

OVENS FOR BAKING, BLUING, DRYING, ENAMELING, JAPANNING AND LACQUERING
Brantford Oven & Rack Co., Brantford.

OVEN TRUCKS, STEEL
Brantford Oven & Rack Co., Brantford.
MacKinnon Steel Co., Sherbrooke, Que.

OVENS FOR DRYING, TEMPER AND OXYGEN, ELECTROLYTIC CELLS UNDER TRUCKS
Welding & Supplies Co., Montreal, Que.
Brantford Oven & Rack Co., Brantford.

OXY-ACETYLENE WELDING AND CUTTING AND OUTFITS
Carter Welding Co., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.
Prest-o-Lite Co., Inc. Toronto, Ont.
Davis-Bournonville Co., Toronto, Ont.

OXYGEN
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto, Ont.
Nat. Electro Products Ltd., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.

OXYGEN PLANTS (ELECTROLYTIC)
Davis-Bournonville Co., Toronto, Ont.

PACKINGS, ASBESTOS
Cleveland Wire Spring Co., Cleveland.

PACKING, ROD AND SHEET
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.
Goodyear Tire & Rubber Co., Can., Ltd., Toronto
Gutta Percha & Rubber, Ltd., Toronto.
International Mach. Spls., Ltd., Montreal
Petrie, Ltd., H. W., Toronto.
Quaker City Rubber Co., Philadelphia, Pa.

PANS, WET AND DRY
Frost Mfg. Co., Chicago, Ill.

PAPER MILL CONVEYORS AND DRIVES
Bertrams, Ltd., Edinburgh, Scotland.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Gutta Percha & Rubber, Ltd., Toronto.
MacKinnon Steel Co., Sherbrooke, Que.

PARTITIONS, WIRE
See Guards

PAPER MILL MACHINERY
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Machinery Co., Toronto.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

PATTERN SHOP EQUIPMENT
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Oliver Machy. Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto.

PATTERN MAKERS' LATHES
See Lathes.

PATENT SOLICITORS
Budden, Hanbury A., Montreal.
Fetherstonhaugh & Co., Ottawa.
Marion & Marion, Montreal.
Ridout & Maybee, Toronto.

PECK CARRIERS FOR POWER PLANTS
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MacDougall Co., R., Galt.
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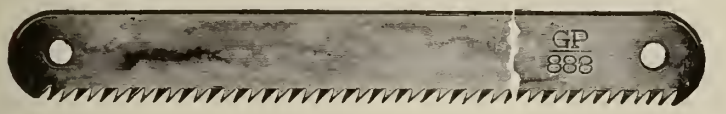

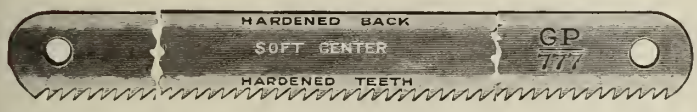

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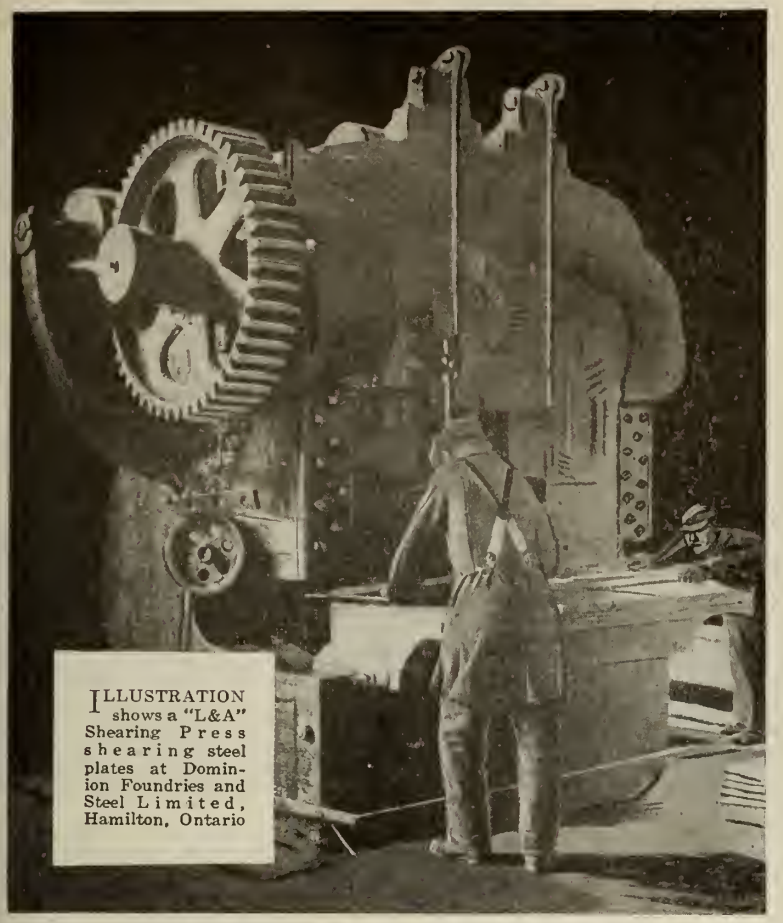

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RULES, BOXWOOD, FOLDING
Lufkin Rule Co. of Can., Windsor.

RULES, BOARD AND LONG
Lufkin Rule Co. of Can., Windsor.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N.Y.

SAW MILL CONVEYORS
Can. Link-Belt Co., Toronto.
Petrie, Ltd., H. W., Toronto.

SAND MILLS
Frost Mfg. Co., Chicago, Ill.

SAND-BLAST EQUIPMENT
SAND BLAST SUPPLIES AND ACCESSORIES
Pangborn Corporation, Hagerstown, Md.

SAND BLAST ABRASIVES
Pangborn Corporation, Hagerstown, Md.

SAND MIXING MACHINERY
Frost Mfg. Co., Chicago, Ill.

SANITARY DRINKING FOUNTAINS
Puro Sanitary Drinking Fountain Co. Haydenville.

SANDING MACHINES
Canada Machinery Corp., Galt.

SAW MILL MACHINERY
Can. Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt.
Robert Gardner & Son, Montreal.
Curtis Pneumatic Machy Co., St. Louis
Hamilton Co., Ltd., Wm., Peterborough, Ont.
A. R. Williams Machy. Co., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

SASH SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

SAWS FOR EVERY USE
Atkins & Co., E. C., Hamilton, Ont.

SAWS, CIRCULAR METAL
Atkins & Co., E. C., Hamilton, Ont.
Wm. Atkins & Co., Ltd., Sheffield, Eng
Marshal, Son & Bunney, Toronto.
Plewes Ltd., Winnipeg, Man.
Simonds Mfg. Co., Fitchburgh, Mass.
Tabor Mfg. Co., Philadelphia, Pa.

SAWS, HACK (See Hack Saws)
SAW GUARDS
Atkins & Co., E. C., Hamilton, Ont.

SAWS, METAL, HACK AND BAND
Atkins & Co., E. C., Hamilton, Ont.

SAWS, SILVER STEEL
E. C. Atkins & Co., Inc., Indianapolis

SAW SHARPENERS
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Can., Galt, Ont.

SAWS, SLITTING
J. A. M. Taylor, Stair Bldg., Toronto.
Atkins & Co., E. C., Hamilton, Ont.
Elliott & Whitehall Machine and Tool Co., Galt, Ont.

SAWS — HIGH-SPEED FRICTION
Atkins & Co., E. C., Hamilton, Ont.

SAWS — PATTERN SHOP
Atkins & Co., E. C., Hamilton, Ont.

SAWS — SWING
Atkins & Co., E. C., Hamilton, Ont.

SCALES
Can. Kron Scale Co., Montreal, P.Q.

SCALES, MECHANICS'
Lufkin Rule Co. of Can., Windsor.

SCLEROSCOPES
Shore Instrument & Mfg. Co., New York.

SCREENING MACHINERY
Can. Link-Belt Co., Toronto.

SCREW EXTRACTORS
Cleveland Twist Drill Co., Cleveland.

SCREW MACHINES, HAND, AUTOMATIC
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Ltd., Toronto
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield.
A. B. Jardine & Co., Hespeler.
National Acme Co. Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont
Warner & Swasey Co., Cleveland, O.
Wells Bros. of Can., Galt, Ont.
Wood Turret Mach. Co., Brazil, Ind.

SCREWS, MACHINE, SET, CAP AND SPECIAL
Galt Machine Screw Co., Galt.
John Morrow Screw & Nut Co., Ingersoll.
National Acme Co., Montreal.
Rice Lewis & Son, Toronto.
Steel Co. of Canada, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.

SCREW COLLARS
Galt Machine Screw Co., Ltd., Galt, Ont.
John Morrow Screw & Nut Co., Ingersoll.

SCREW MACHINES, PLAIN WIRE FEED
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.

SCREW PLATES
Butterfield & Co., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
A. B. Jardine & Co., Hespeler.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto.
J. A. M. Taylor, Stair Bldg., Toronto.
Wells Bros. of Can., Galt.
Wilkinson & Kompass, Hamilton.

SCREWS, SAFETY SET
Galt Machine Screw Co., Ltd., Galt, Ont.

SCREW SLOTTERS
Butterfield & Co., Inc., Rock Island, Que.
Garvin Machine Co., New York.
National Acme Co., Cleveland, O.
Pratt & Whitney Co., Dundas, Ont.

SEPARATORS, MOISTENERS AND OIL FOR COMPRESSED AIR
Pangborn Corporation, Hagerstown, Md.

SELF-OPENING DIES
See Dies.

SEPARATORS, SAND
Pangborn Corporation, Hagerstown, Md.

SET SCREWS, SAFETY
Aikenhead Hardware Co., Toronto.
Bristol Co., Waterbury, Conn.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wilkinson & Kompass, Hamilton.

SHANKS, STRAIGHT AND TAPER
Jacobs Mfg. Co., Hartford, Conn.

SHAPERS
Barber Mchy. Co., Ltd., Toronto, Ont.
John Bertram & Sons Co., Dundas.
Can. Fairbanks-Morse Co., Montreal.
Canadian Machinery Corp., Galt.
Geo. F. Foss Mchy. & Sply. Co., Montreal
Robt. Gardner & Son, Montreal.
Garlock-Walker Mach'y. Co., Toronto.
Hendey Machine Co., Torrington, Conn.
Milwaukee Shaper Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto.
Rae Mach. Tool Co., Hamilton.
Standard Equipment & Tool Wks., Montreal.
Walcott Lathe Co., Jackson, Mich.
Williams Mchy Co. A. R. Toronto, Ont.

SHAPERS, GEAR
Fellows Gear & Shaper Co., Springfield, V.
Knigh Metal Products, Toronto.

SHAFTING
Algoma Steel Corp., Sault Ste. Marie, O.
Can. Fairbanks-Morse Co., Montreal.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Jones & Glasco, Montreal.
Niles-Bement-Pond Co., New York.
Can. Drawn Steel Co., Hamilton.
Peckovers, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas.
Rice, Lewis & Son, Toronto.
A. R. Williams Machy. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

SHARPENING STONES
Norton Co, Worcester, Mass.
Rice, Lewis & Son, Toronto.

SHEARING MACHINES, ANGLE IRON, BAR AND GATE
John Bertram & Sons Co., Dundas.
Bertrams Ltd., Edinburgh, Scotland.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
A. B. Jardine & Co., Hespeler, Ont.
Long & Allstatter Co., Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo, O.

SHEARS, POWER
John Bertram & Sons Co., Dundas.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton.
Can Blower & Forge Co, Kitchener.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Long & Allstatler, Hamilton, Ohio.
A. B. Jardine & Co., Hespeler, Ont.
National Machy. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
H. D. Stoll Co., Inc., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Williams, White & Co., Moline, Ill.
Williams Mchy Co., A. R., Toronto, Ont.

SHEARS, ROTARY
The Quickwork Co., St Mary's, Ohio.

SHEARS, PNEUMATIC
Toledo Machine & Tool Co., Toledo, Ohio

SHEARS, PLATE CUTTING, SLITTING
Dom. Steel Products Co., Ltd., Brantford.
Quickwork Co., St. Mary's, Ohio.

SHEARS, SPLITTING
Dom. Steel Products Co., Ltd., Brantford.

SHEARS, IRREGULAR AND CIRCLE CUTTING
The Quickwork Co., St. Mary's, Ohio.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEARS, SERPENTINE
The Quickwork Co., St. Mary's, Ohio.

SHEARS, SQUARING
Brown, Boggs & Co., Hamilton, Ont.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEET METAL WORKING MACHINERY
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEET METAL WORKING TOOLS
Baird Machine Co., Bridgeport, Conn.
Barber Mchy. Co., Ltd., Toronto, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton.
Peck, Stow & Wilcox Co., Southington, C.
Petrie, Ltd., H. W., Toronto.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEETS, CRUCIBLE, CAST
British Smelting & Refining Co., Ltd., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.

SHEETS, BLACK AUTO AND GALVANIZED
Peckovers, Ltd., Toronto, Ont.

SHEETS, NICKEL, RESIST, ALLOY
Can. Driver-Harris Co., Ltd., Walkerville.

SHELVING, STEEL
Dennis Wire & Iron Works, London.

SHIPYARD MACHINERY, SHOP FURNITURE
Dennis Wire & Iron Works, London.

SIDE TOOLS
Armstrong Bros. Tool Co., Chicago.
J. H. Williams & Co., Brooklyn, N.Y.

SILENT CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glasco, Montreal.

SLEDGES
Aikenhead Hardware Co., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont

SLEDGES, CAST IRON
Katie Foundry, Galt, Ont.

SLICING CLAMPS
Peck, Stow & Wilcox Co., Southington, Conn.

SLINGS, CHAINS
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

SLOTTERS
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
National-Acme Co., Cleveland, Ohio.
Niles-Bement-Pond Co., New York.

SMOKESTACKS
William Hamilton Co., Peterboro, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

SNIPS, TINNERS AND SHEET METAL WORKERS
Kearney & Trecker Co., Milwaukee, Wis.
J. Morrow Screw & Nut Co., Ingersoll, Ont.

SOCKETS
Brown & Sharpe Mfg. Co., Providence.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Keystone Mfg. Co., Buffalo, N.Y.
Modern Tool Co., Erie, Pa.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

SOIL PIPE FITTINGS, CAST IRON
Katie Foundry, Galt, Ont.

SOLDERING IRONS
Aikenhead Hardware Co., Toronto, Ont.
Brown, Boggs & Co., Hamilton, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.

SOLDER
British Smelting & Refining Co., Ltd., Montreal, Que.
Aikenhead Hardware Co., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Tallman Brass & Metal Co., Hamilton.

SPELTER
British Smelting & Refining Co., Ltd., Montreal, Que.

SPEED REDUCING GEARS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glasco, Montreal.

SPRINGS, MACHINERY
Barnes, Wallace Co., Bristol, Conn.
Can. Steel Foundries, Ltd., Montreal.
Cleveland Wire Spring Co., Cleveland.
Dunbar Bros. Co., Bristol, Conn.
Garlock-Walker Machinery Co., Toronto.

SPECIAL MACHINERY
Baird Machine Co., Bridgeport, Conn.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram, John, & Sons Co., Dundas.
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada.
Brown Engineering Corp., Toronto, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Globe Engineering Co., Ltd., Hamilton.
John H. Hall & Sons, Brantford.
Hamilton Co., Ltd., Wm., Peterborough.
A. B. Jardine & Co., Hespeler, Ont.
Katie Foundry, Galt, Ont.
Ker & Goodwin Machine Co., Ltd. Brantford, Ont.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
National-Acme Co., Cleveland, Ohio.
Mesta Machine Co., Pittsburgh, Pa.
Rae Mach. Tool Co., Hamilton.
Stoll Co., D. H., Buffalo, N.Y.
Victoria Foundry Co., Ottawa, Ont.
William R. Perrin, Ltd., Toronto.

SPECIAL TOOLS, MACHINERY
Crescent Machine Co., Ltd., Montreal Que.
McClean Machine & Tool Co., Ltd. Hamilton, Ont.
Hoggson & Pettis Mfg. Co., New Haven Conn.

SPOT FACERS, INTERCHANGEABLE
Eclipse Counterbore Co., Ltd., Walkerville, Ont.

SPRING COILING AND WINDING MACHINERY
Baird Machine Co., Bridgeport, Conn.
Garvin Machine Co., New York.

SPRING MAKING MACHINERY (AUTOMATIC)
Baird Machine Co., Bridgeport, Conn.

SPRINGS, SPIRAL, TOOL
The Dunbar Bros. Co., Bristol, Conn.

SPRINGS STEEL
Barnes Co., Wallace, Bristol, Conn.

SPROCKETS, COMPENSATING
Morse Chain Co., Ithaca, New York.

SPROCKETS, SPRING
Morse Chain Co., Ithaca, New York.

SPROCKETS, CHAIN
Can Link-Belt Co., Toronto, Ont.
Grant Gear Works, Boston, Mass.
Jones & Glasco, Montreal.
Lyman Tube & Supply Co., Montreal, Qu
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia

SPRINGS FOR TOYS AND ELECTRIC DEVICES
The Dunbar Bros. Co., Bristol, Conn.

SPROCKET WHEELS, CAST
Can. Link Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Ltd., Montre

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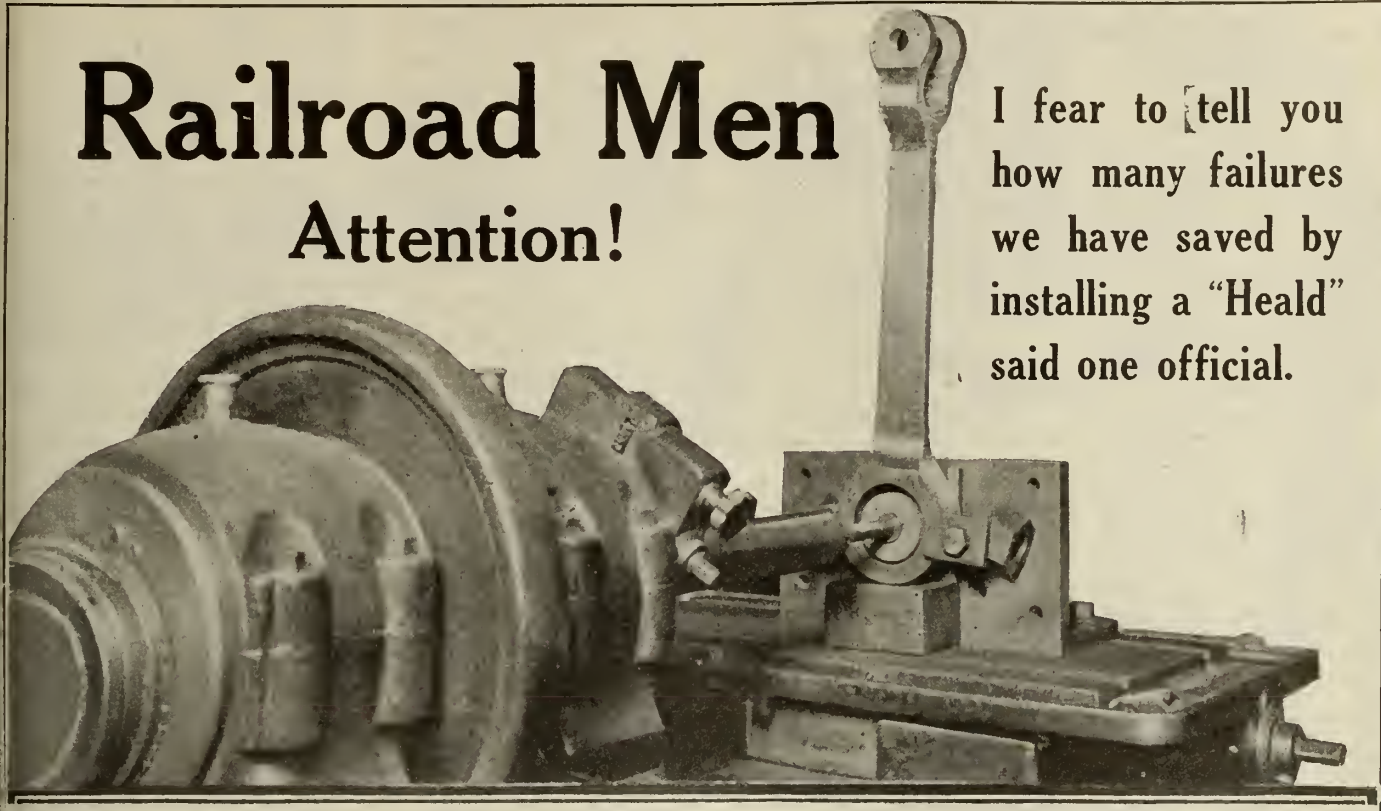

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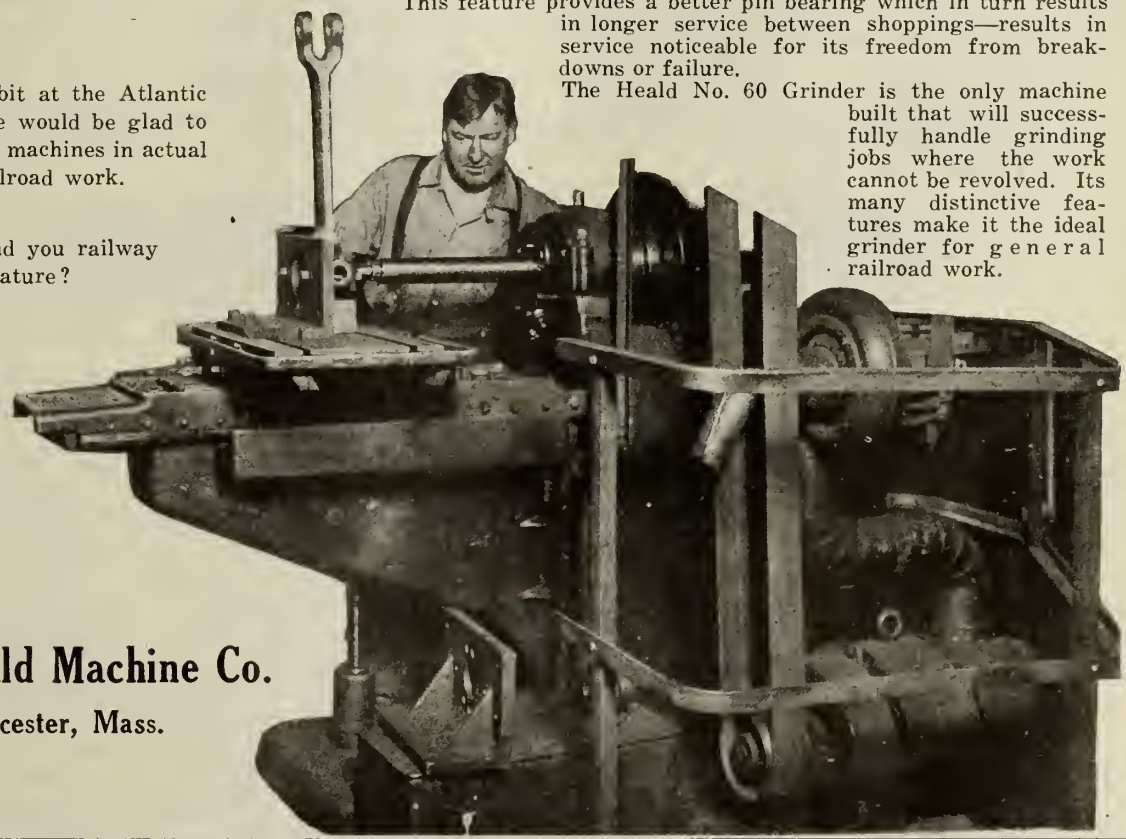

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Worcester, Mass.

SAFETY CYLINDERS
Oliver Mach. Co., Grand Rapids, Mich.

SANDERS
Oliver Mach. Co., Grand Rapids, Mich.

SAW BENCHES
Oliver Mach. Co., Grand Rapids, Mich.

SAW GUARDS
Oliver Mach. Co., Grand Rapids, Mich.

SAWS SWING
Oliver Mach. Co., Grand Rapids, Mich.

STAYBOLT TOPS
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

STAIRS, IRON
Canada Wire & Iron Goods Co., Hamilton, Ont.

STAMPINGS, SHEET BRASS, COPPER, ALUMINUM AND STEEL
Dom. Forge & Stamping Co., Walkerville
Globe Engineering Co., Hamilton, Ont.
Homer & Wilson, Hamilton, Ont.

STAMPING MACHINERY
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs, & Co., Hamilton, Can.
Canada Machinery Corp., Galt, Ont.
Matthews, Jas. H & Co., Hartford, Conn.

SAFETY CYLINDERS
Oliver Mach. Co., Grand Rapids, Mich.

STEAM APPLIANCES
Darling Bros., Ltd., Montreal, Quebec.

STEAM SEPARATORS AND TRAPS
Can. Fairbanks-Morse Co., Montreal.

STEAM HOISTING ENGINES
Canadian Mead-Morrison Co., Limited, Montreal, Que.

STEAM TURBINES
General Combustion Co., Ltd., Montreal Que.
Sturtevant Co., B. F., Galt, Ont.

STEEL BALLS
See Balls Steel.

STEEL, CRUCIBLE TOOL
Atkins & Co., Ltd., Wm. Sheffield, Eng.
Baines & David, Toronto.
Illingworth Steel Co., John, New York.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.

STEEL, CARBON, FERRO-TUNGSTEN
Armstrong, Whitworth of Can., Montreal
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Baines & David, Toronto.
Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Latrobe Electric Steel Co., Latrobe, Pa.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
Marshall, Son & Bunney, Toronto.
Peckovers, Ltd., Toronto, Ont.
Samuel Osborne (Can.), Ltd., Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL, CHROME MOLYBDENUM
United States Steel Corp., Canton, Ohio.

STEEL CHROME VANADIUM
Kayser-Ellison & Co., Ltd., Montreal.
Norton, Ralph B., Agent, Montreal.
Atkins & Co., Ltd., Wm. Sheffield, Eng.
Marshall, Son & Bunney, Toronto.
United States Steel Corp., Canton, Ohio.

STEEL CHROME NICKEL
Firth & Sons, Ltd., Thos., Montreal,
Kayser-Ellison & Co., Ltd., Montreal
Lyman Tube & Supply Co., Ltd., Montreal
Norton, Ralph B., Agent, Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.
United States Steel Corp., Canton, Ohio.

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Can. Elec. Steel Casting Co., Aurora, Ont.
Davidson Mfg. Co., Ltd., Montreal, Que.
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Dom. Iron & Steel, Sydney, N.S.
Joliette Steel Co., Montreal, Que.
Kennedy & Sons, Wm., Owen Sound
Electric Steel & Metals Co., Welland.
Nova Scotia Steel & Coal Co., Windsor
Swedish Crucible Steel Co., Windsor.

STEEL, COLD DRAWN
United States Steel Corp., Canton, Ohio.

STEEL, COLD ROLLED
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Drawn Steel Co., Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co. Ltd., Montreal.
Union Drawn Steel Co., Hamilton, Ont.

STEEL, ELECTRIC FURNACE
United States Steel Corp., Canton, Ohio.

STEEL FJAB
Lincoln Electric Co., of Canada, Ltd., Toronto, Ont.

STEEL, NICKEL
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal
United States Steel Corp., Canton, Ohio.

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Armstrong-Whitworth of Can., Montreal
Baines & David, Toronto.
Wm. Atkins & Co., Sheffield, Eng.
Can. Fairbanks-Morse Co., Montreal
Deloro Smelting & Refining Co., Ltd Toronto, Ont.
H. A. Drury Co., Ltd., Montreal.
Firth & Sons, Thos., Montreal, Que.
Illingworth Steel Co., J., New York.
Kayser Ellison & Co., Sheffield, Eng.
Latrobe Electric Steel Co., Latrobe, Pa.
Marshall, Son & Bunney, Toronto, Ont
Osborne, Samuel, Montreal, P.Q.
Plewes, Ltd, Winnipeg, Man.
Pilot Steel & Tool Co., Montreal, Que.
Ralph B. Norton, Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co., Ltd., Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL, CHROME, MANGANESE
Joliette Steel Co., Montreal, Que.

STEEL, OPEN HEARTH
Illingworth Steel Co., John New York
United States Steel Corp., Canton, Ohio.

STEEL PLATES
Dominion Foundries & Steel Ltd., Hamilton, Ont.

STEEL PRODUCTS AND MACHINERY
Dom. Steel Products Co., Ltd., Brantford

STEEL, ROCK DRILL
Armstrong, Whitworth of Canada, Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal
Lincoln Electric Co. of Canada, Ltd Toronto, Ont.

STEEL, SPECIAL ANALYSIS
United States Steel Corp., Canton, Ohio.

STEEL, SPRING AND REINFORCING
Peckovers, Ltd., Toronto, Ont.
United States Steel Corp., Canton, Ohio.

STEEL, STRUCTURAL
Algoma Steel Corp., Sault Ste. Marie
Dom. Iron & Steel Co., Sydney, N.S.
MacKinnon Steel Co., Sherbrooke, Que.
Peckovers, Ltd., Toronto, Ont.

STEEL, TOOL
Armstrong, Whitworth of Can., Montreal
Atkins & Co., Wm., Sheffield, Eng.
Baines & David, Toronto.
Can. Fairbanks-Morse Co., Montreal.
Drury Co., H. A., Montreal, Que.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.
Firth & Sons, Thos., Montreal, Que.
Hawkridge Bros. Co., Boston, Mass.
Kayser-Ellison & Co., Ltd., Montreal.
Lincoln Electric Co., of Canada, Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Ltd., Montreal
Marshall, Son & Bunney, Toronto, Ont.
Latrobe Electric Steel Co., Latrobe, Pa.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son Toronto, Ont.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL TUBING
Tube Co. of Canada, Ltd,, Toronto, Ont.

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Armstrong, Whitworth of Can., Montreal
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Drury, H. A., Co., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.
Wells Bros. of Can., Galt, Ont.

"STELLITE"
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.

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Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

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Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros., of Can., Galt, Ont.

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A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Wells Bros., Co., of Canada, Galt, Ont.

STONES, COMMUTATORS
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Baird Machinery Co., Bridgeport, Conn.
Bertrams, Ltd., Edinburgh, Scotland.

STRAND
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Page Steel & Wire Co., Adrian, Mich.

SURFACE PLATES
Brown & Sharpe Mfg. Co., Providence, R.I.

STRUCTURAL STEEL WORKS
Williams Hamilton Co., Peterboro, Ont.

SWITCHBOARDS
Northern Electric Co., Ltd., Montreal Que

SWITCHES, RAILWAY
Can. Steel Foundries, Ltd., Montreal.

TABLES, DRAWING
Economy Drawing Table Co., Adrian, Mich.

TABLES, SAND-BLAST
Panghorn Corporation, Hagerstown, Md.

TAPPING MACHINES (PNEUMATIC)
Cleveland Pneumatic Tool Co., Toronto.

TANKS, AIR, EXPANSION
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, GASOLINE, KEROSENE AND OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. John Wood Mfg. Co., Ltd., Toronto
Dominion Bridge Co., Montreal, Que.
Dom. Forge & Stamping Co., Walkerville.
MacKinnon Steel Co., Sherbrooke, Que.
Marshall, Son & Bunney, Toronto.

TANKS, LEAD LINED
Can. Hanson Van Winkle Co., Ltd.,

TANKS, LUBRICATING, OIL STORAGE
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, PNEUMATIC AND CLOSET
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, RUBBER CEMENT
Bowser Co., Ltd., S. F., Toronto, Ont.

TANKS, STEEL, WATER PRESSURE
Bowser Co., Ltd., S. F., Toronto, Ont.
Dominion Bridge Co., Montreal, Quebec.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Toronto Iron Works, Ltd, Toronto.

TANK WAGONS
MacKinnon Steel Co., Sherbrooke, Que.
Toronto Iron Works, Ltd., Toronto.

TANKS WELDED
Can. John Wood Mfg. Co., Ltd., Toronto
Can. Hanson Van Winkle Co., Ltd.,
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.

TANKS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
William Hamilton Co., Peterboro, Ont.

TAPER PINS
Galt Machine Screw Co., Ltd., Galt, Ont.

TAPES, MEASURING
James Chesterman & Co., Ltd., Sheffield, Eng.
Rice Lewis & Son, Toronto, Ont.

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Bertram, John & Sons Co., Dundas.
Canada Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garvin Machine Co., New York.
The Geometric Tool Co., New Haven.
I. H. Hall & Sons, Brantford, Ont.
A. B. Jardine & Co., Hespeler, Ont.
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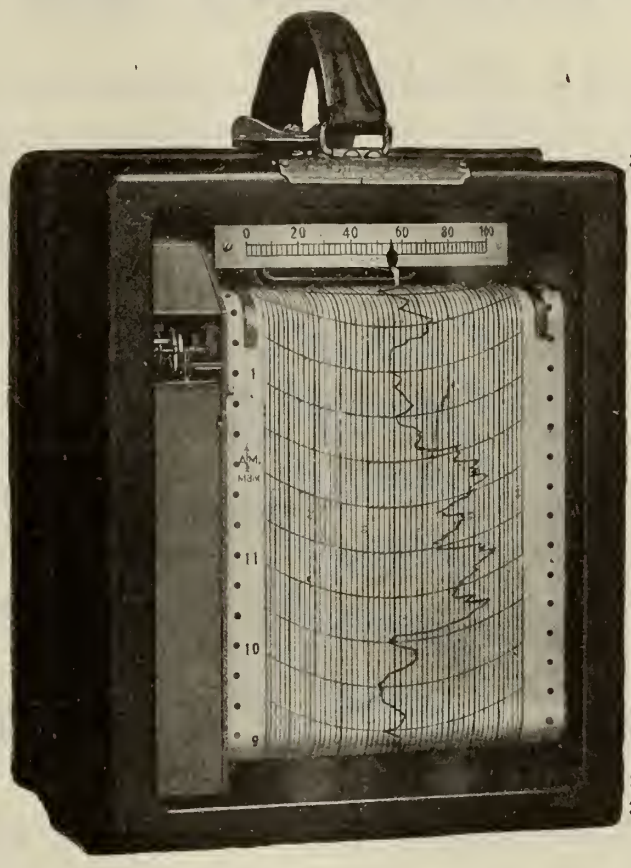

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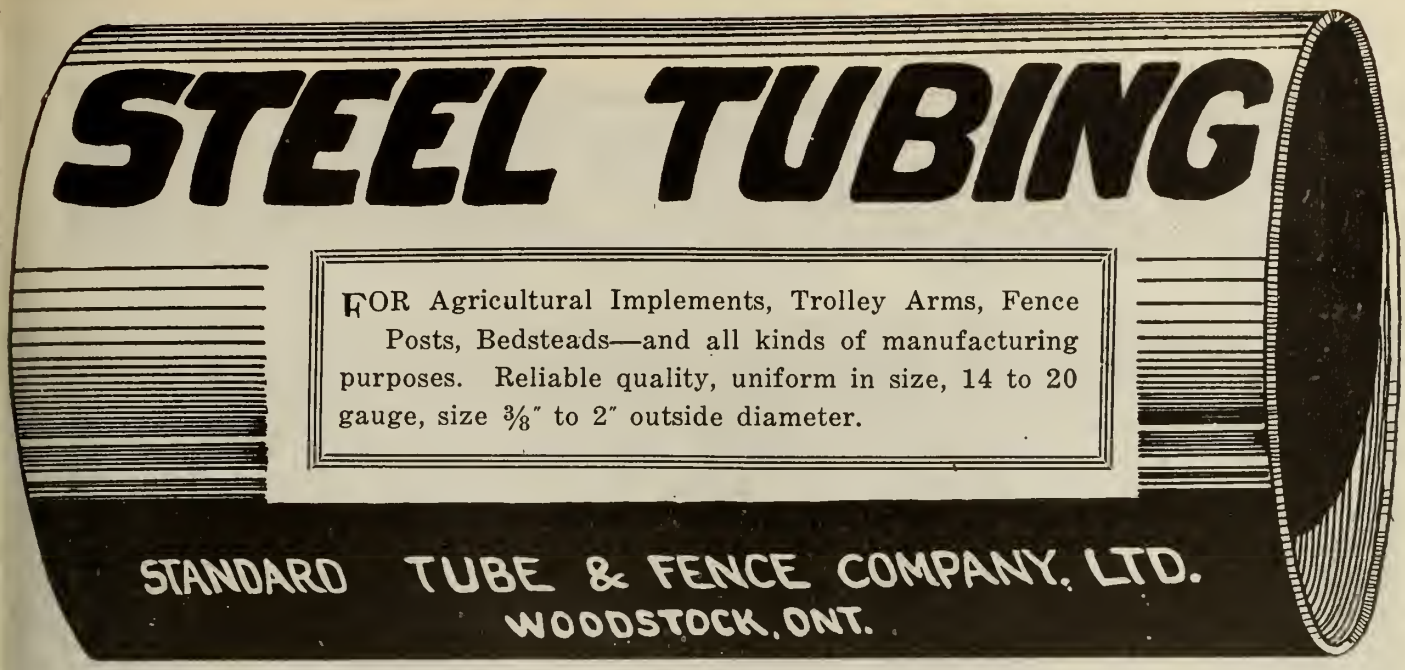
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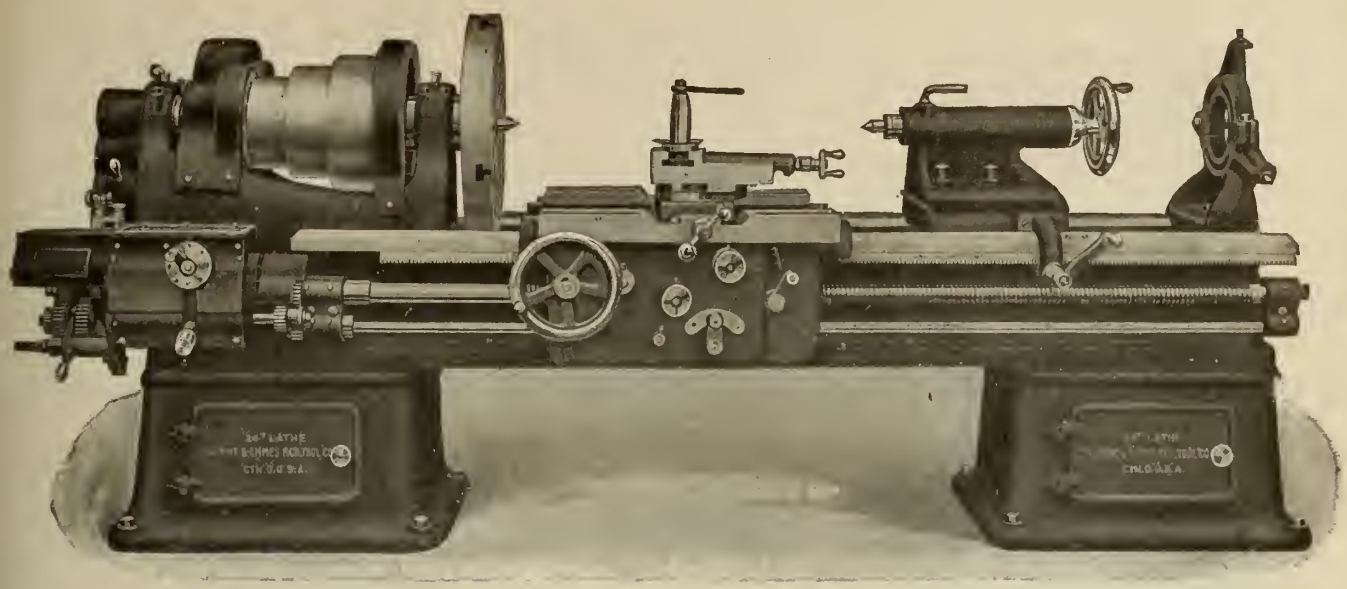

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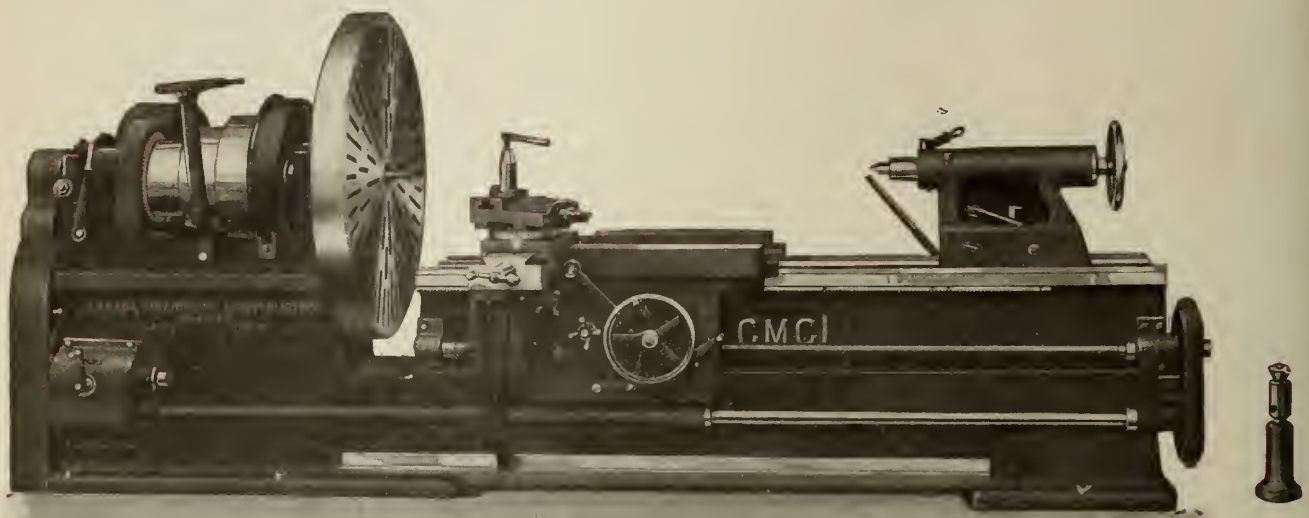

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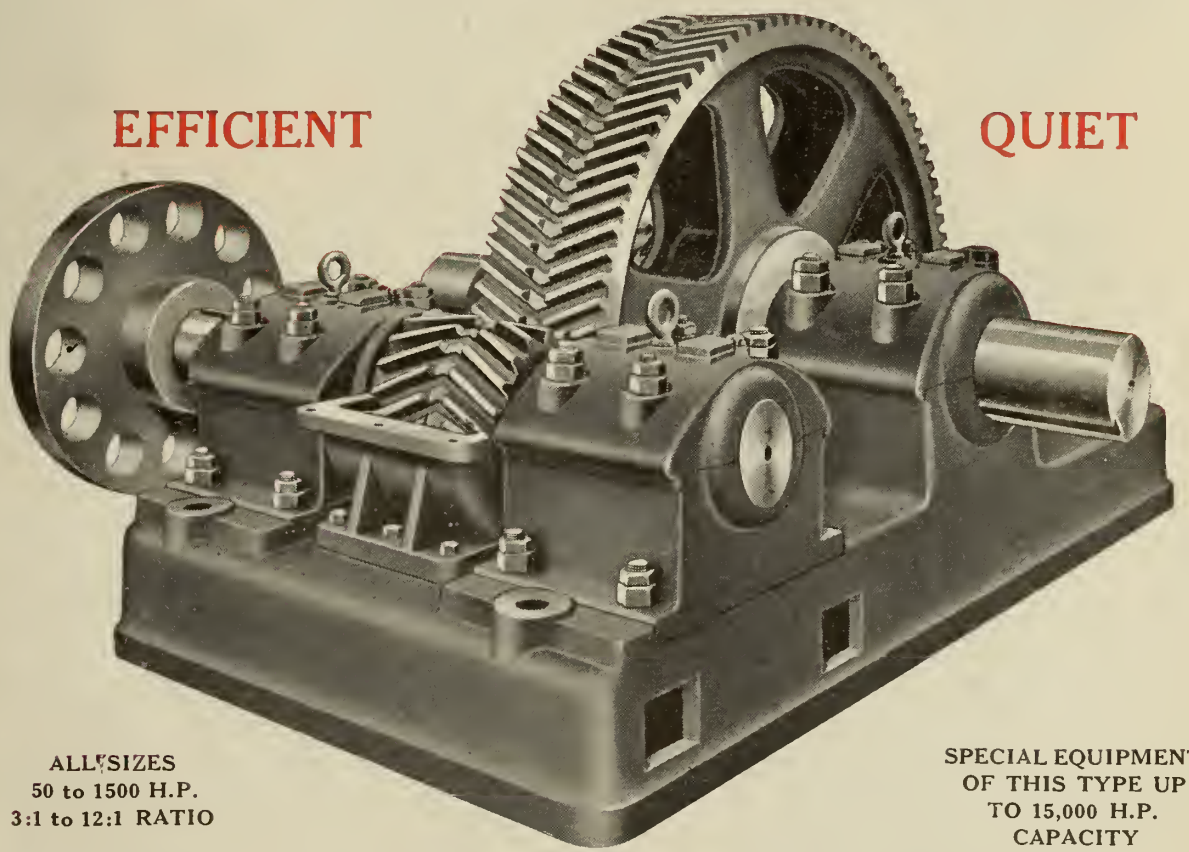

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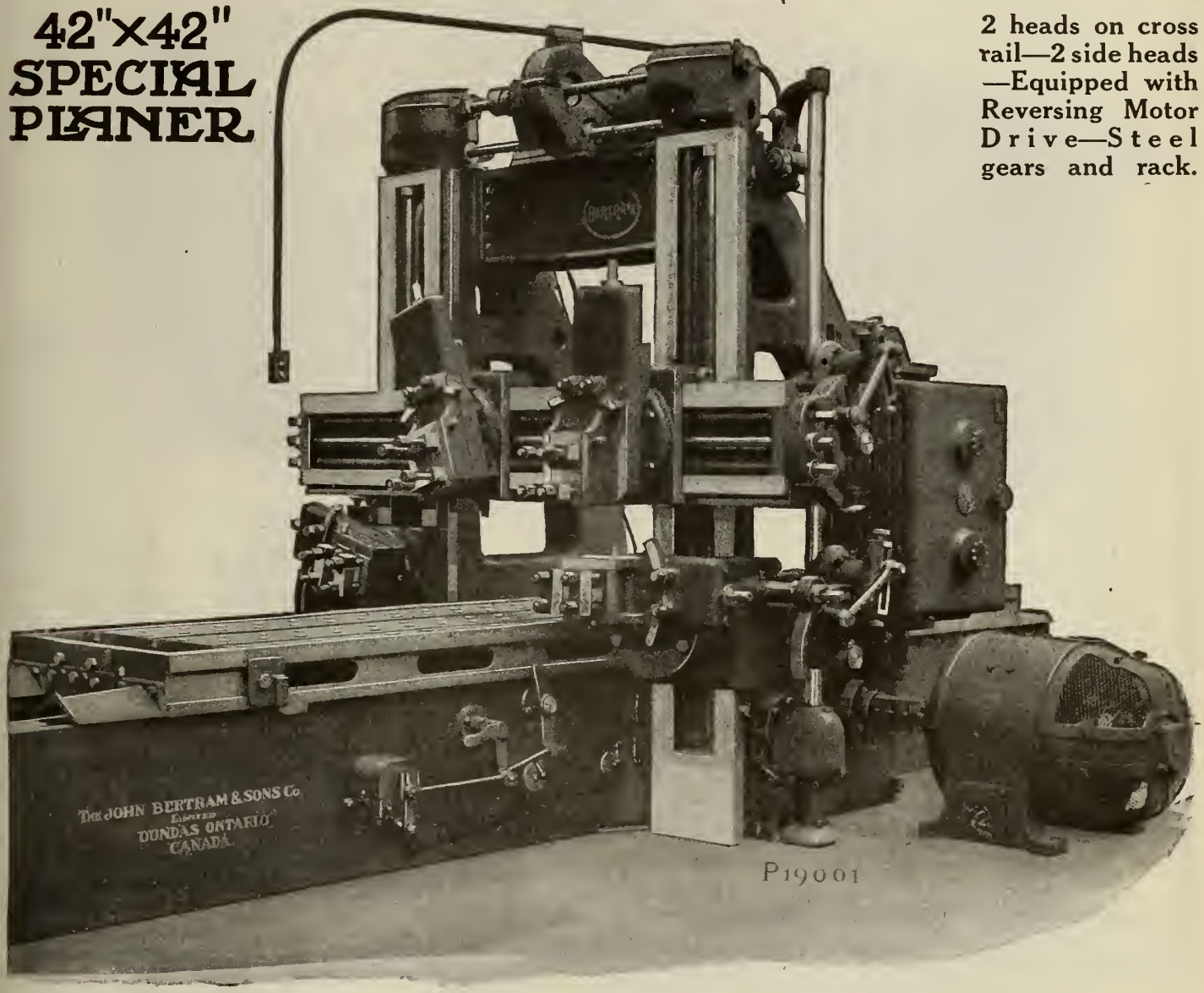

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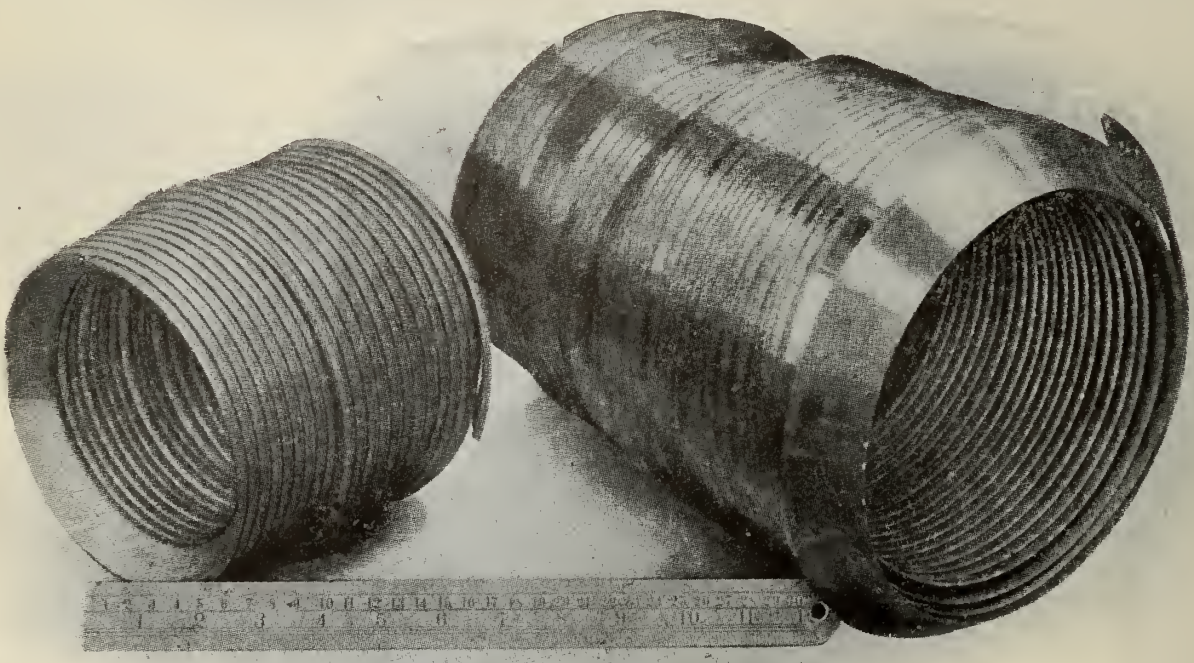

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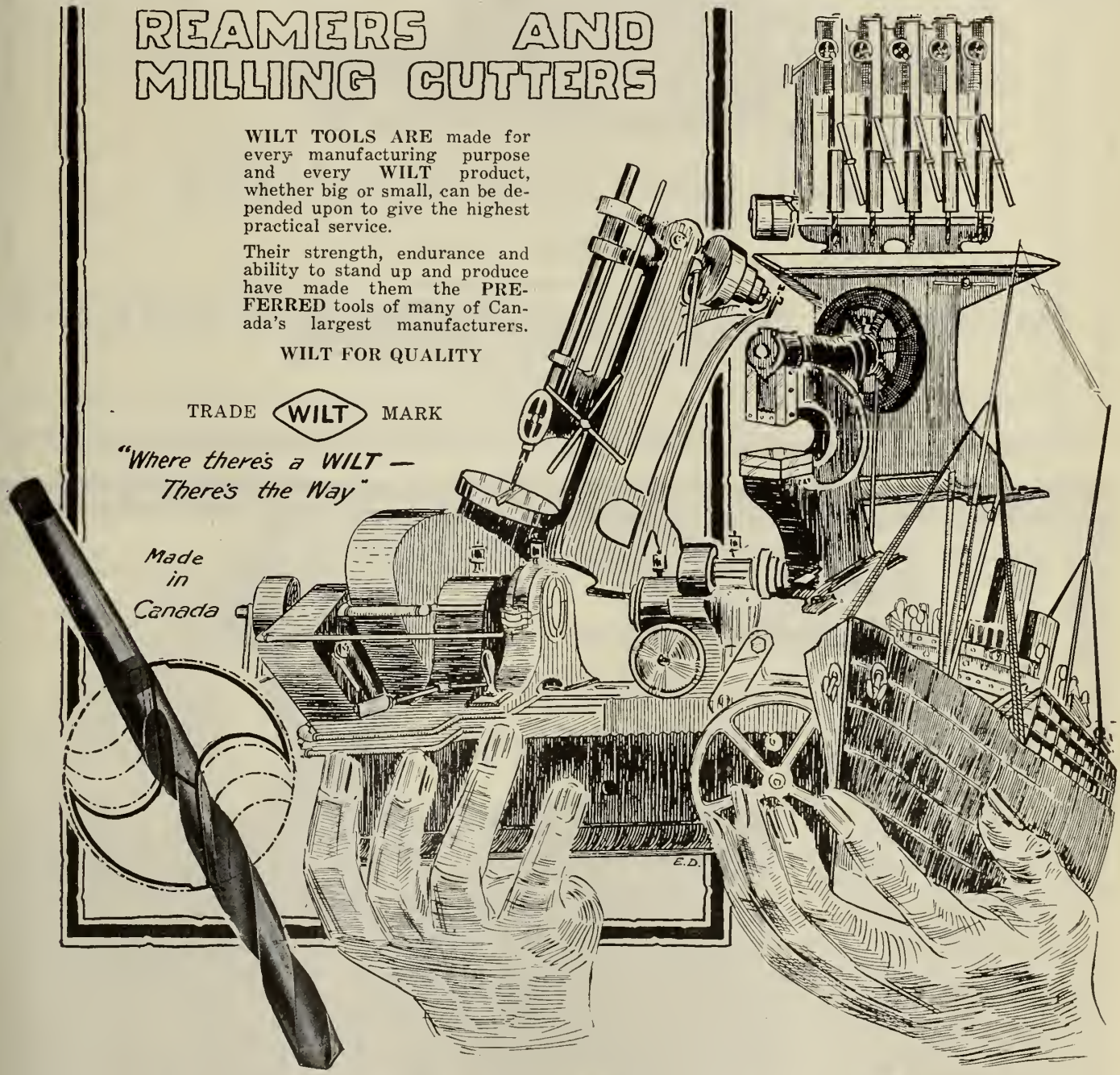

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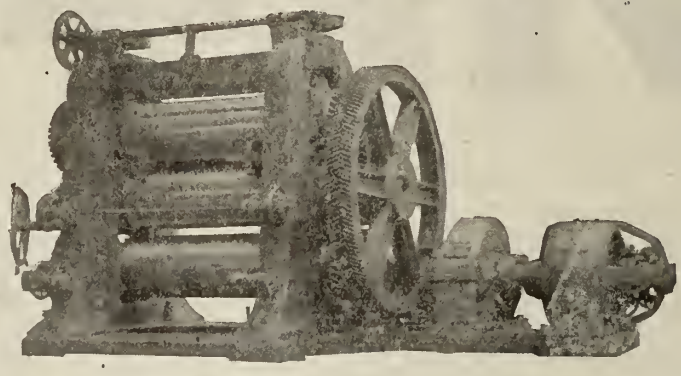

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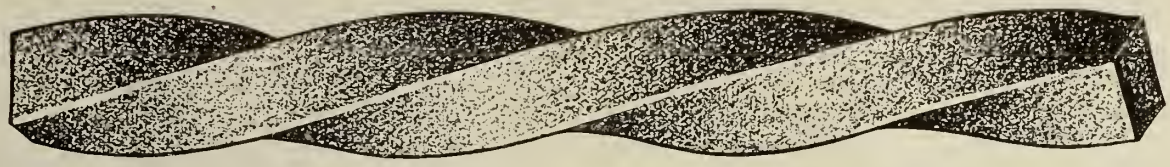

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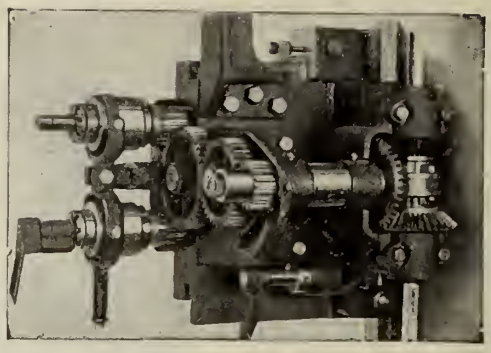

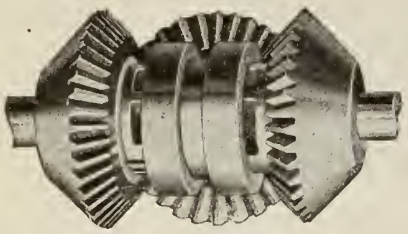

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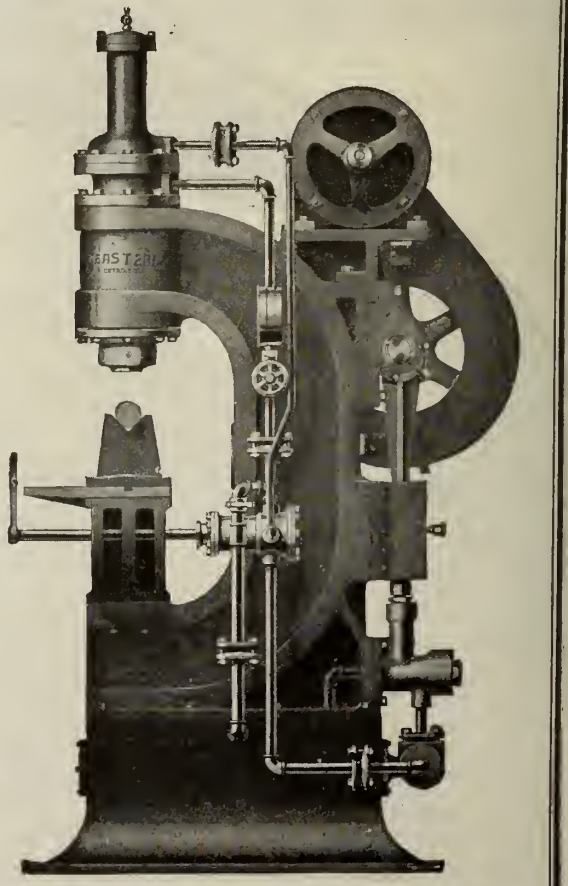

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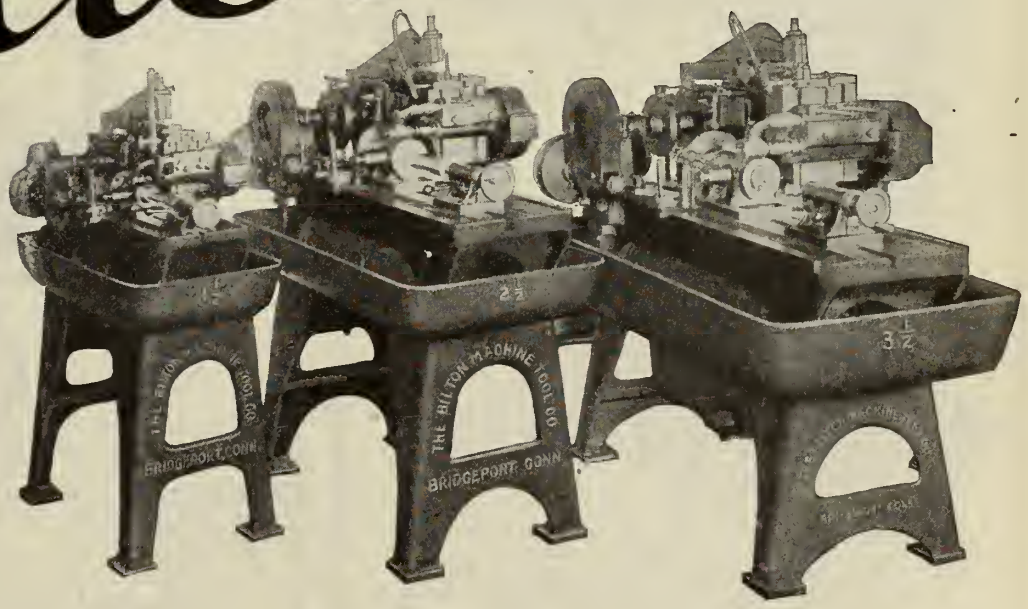

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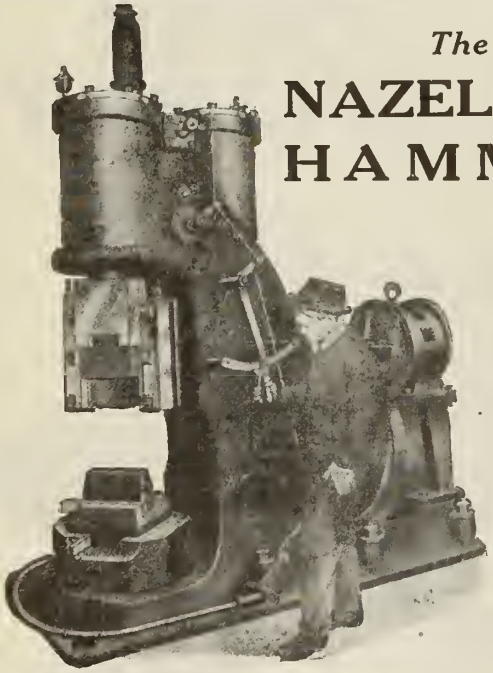

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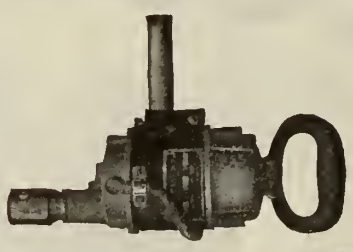

They can be attached to any lamp socket.

For drilling in metal they are superior to any other kind of portable drill. Cost 50% less to run than air drills.

3 SIZES

3-16 in., W.G.T., 6 lbs.
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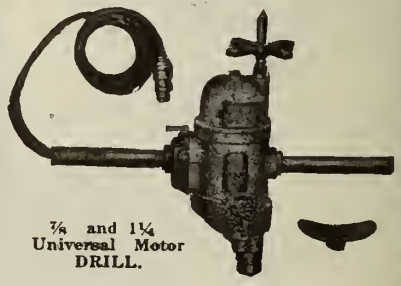
All motors wound for 110 or 220 volts.

Direct or alternating current.

Try a few of our Electric Drills and Grinders and you'll send us an order for more. Our guarantee protects you.



⅞ and 1¼ Universal Motor DRILL.

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THE HIGH SPEED STEEL

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The John Illingworth Steel Co.
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RALPH B. NORTON, AGENT
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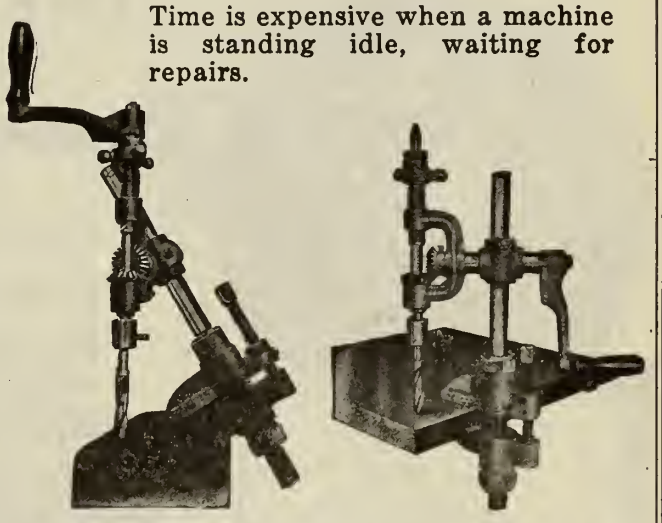
Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.



On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

Weight, 40 lbs. Price, $26.50 net.
Sold by all Machinery and Supply Houses

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The 25-inch Heavy Duty Quick Change Sidney shown below is the last word in lathe construction. Every possible improvement will be found in this late model. Bed lengths available are 10, 12, 14, 16, 18 and 20 feet. Also built with a 27-inch swing.

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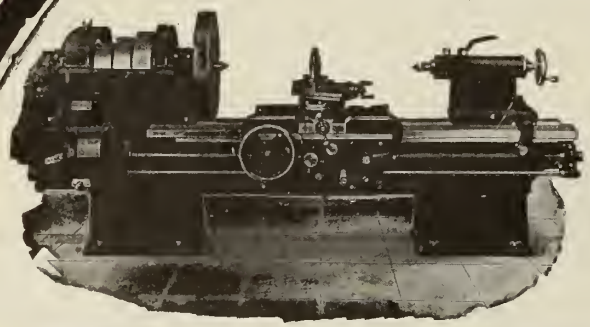

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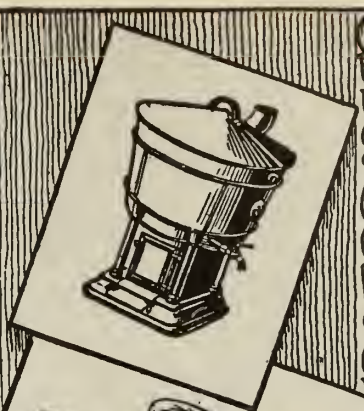
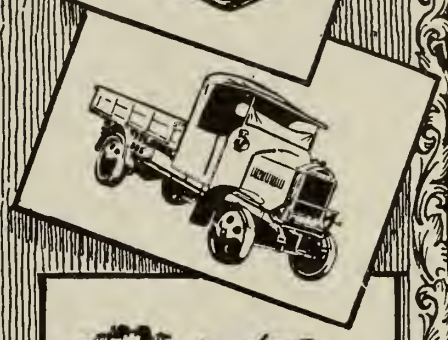
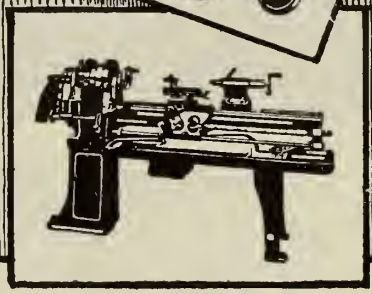
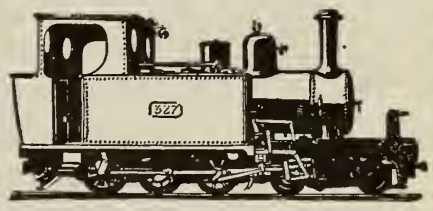
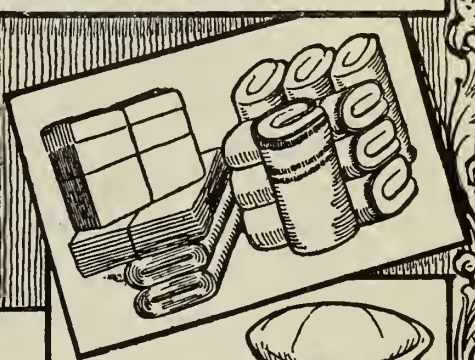

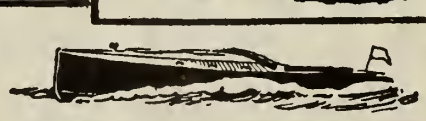
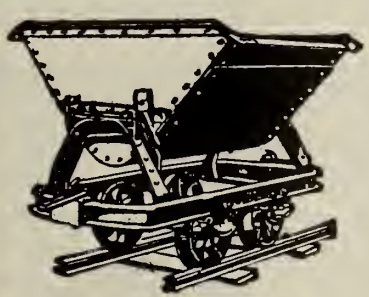
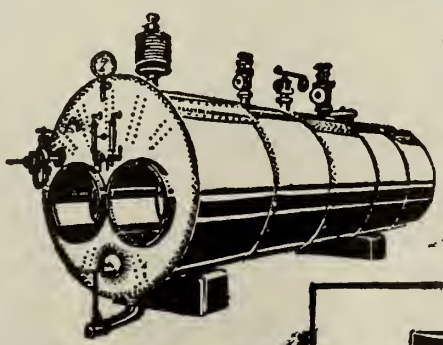

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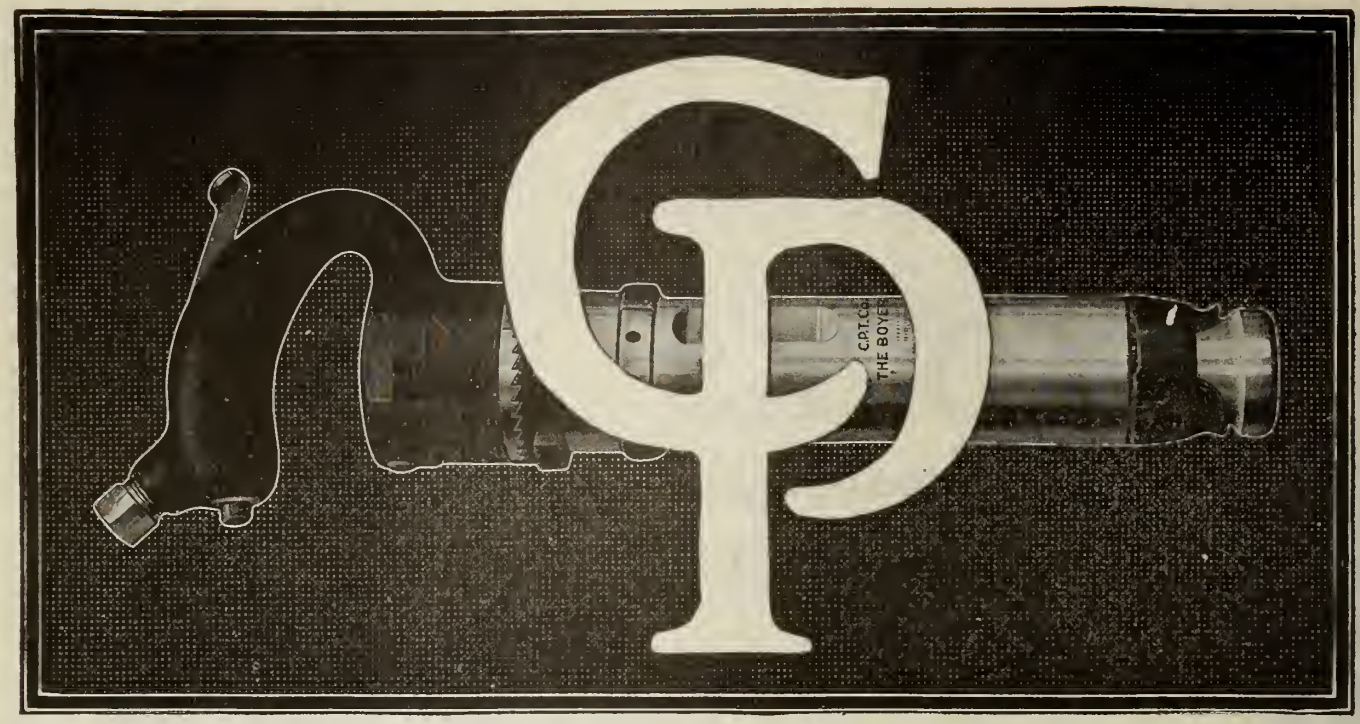

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Starrett Hack Saws

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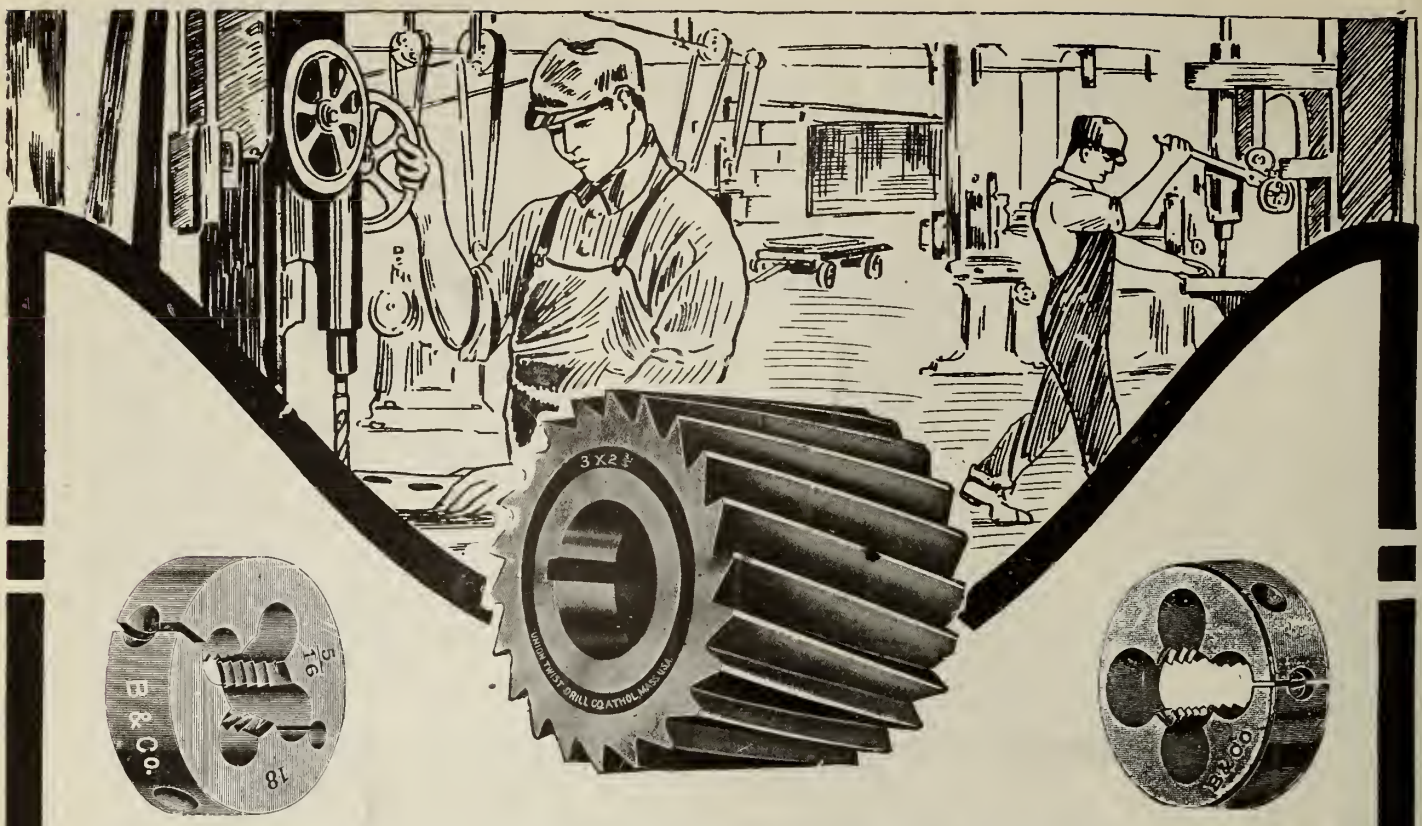

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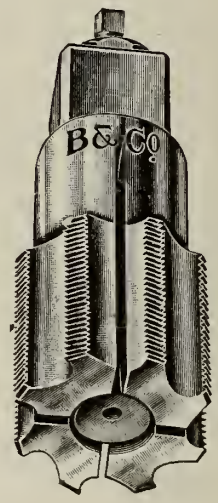

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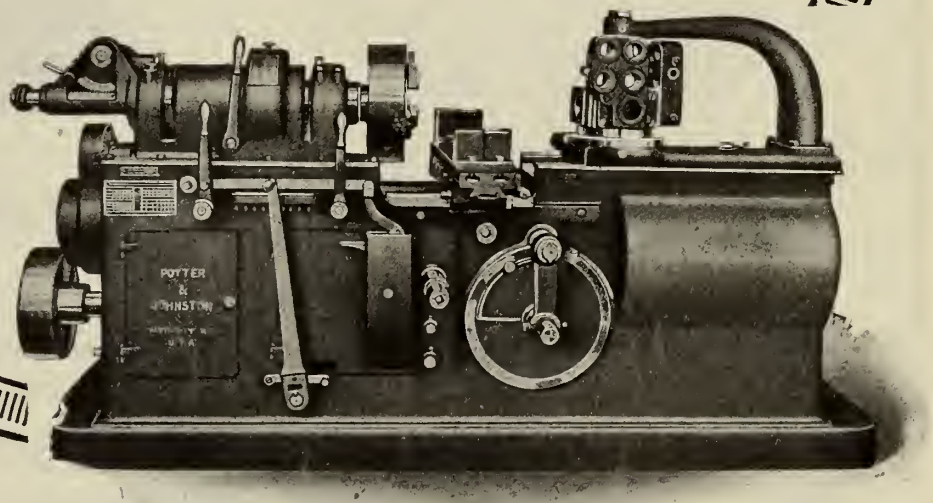

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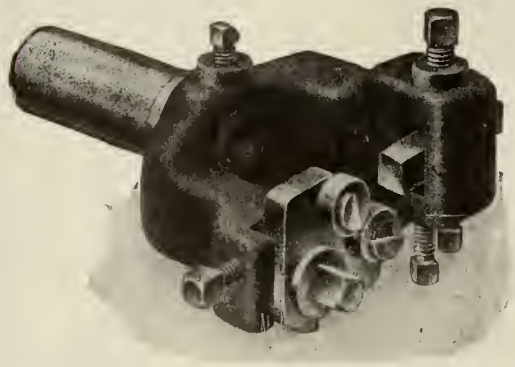

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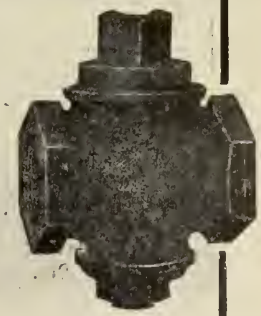

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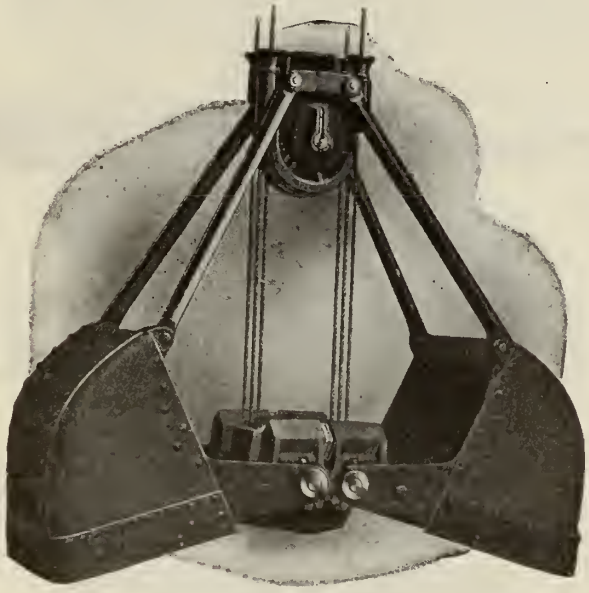

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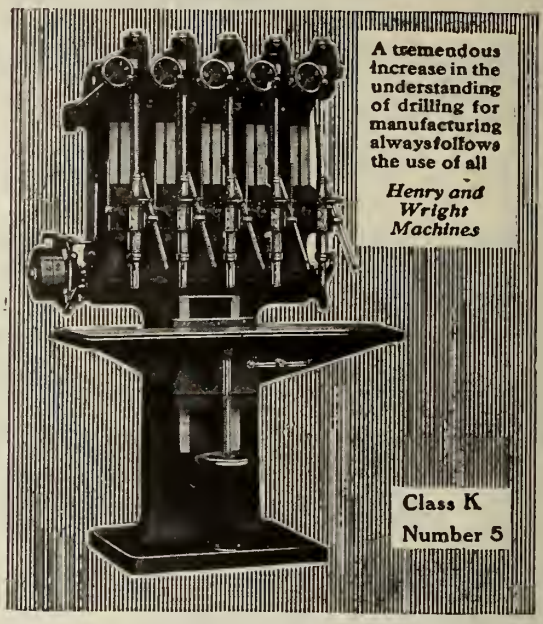
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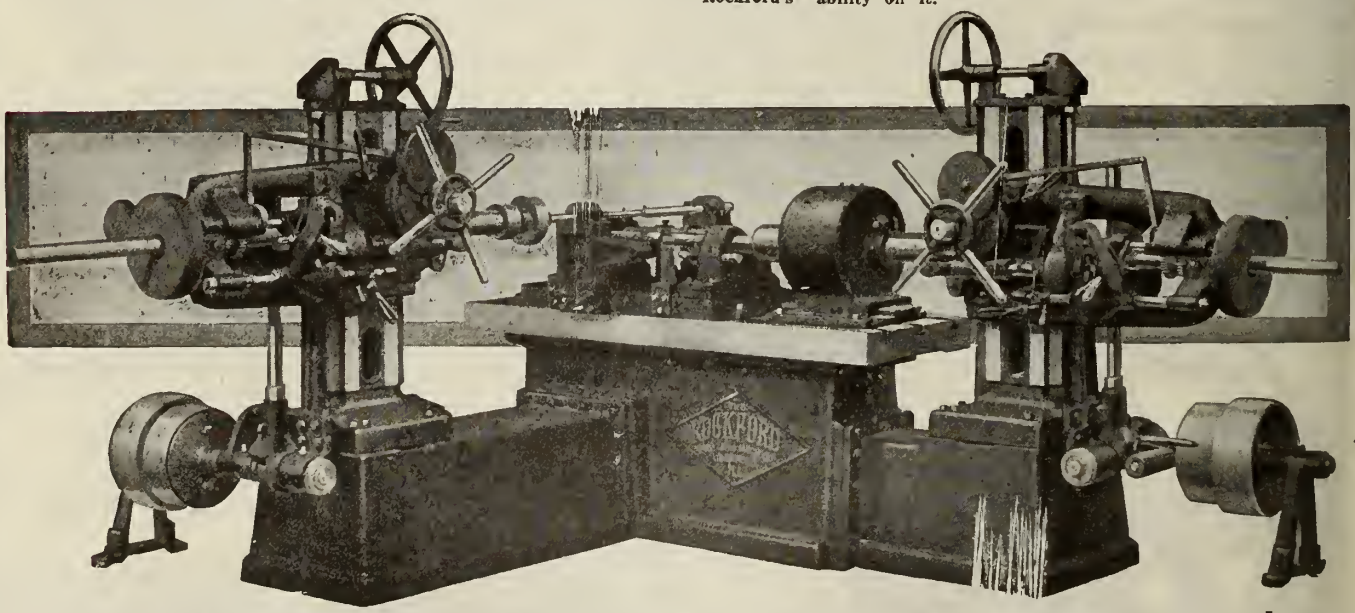

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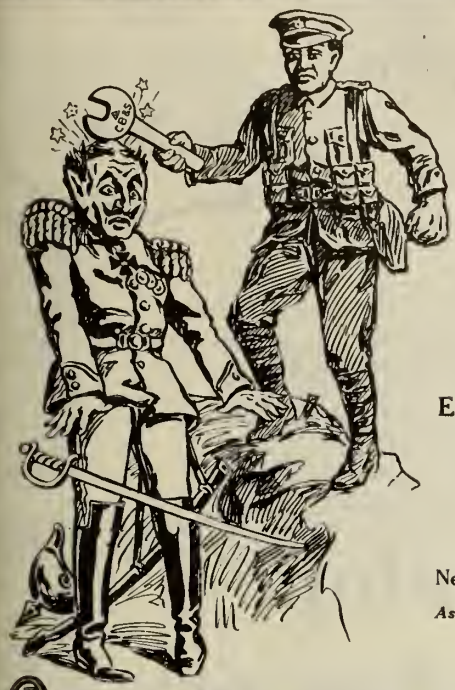

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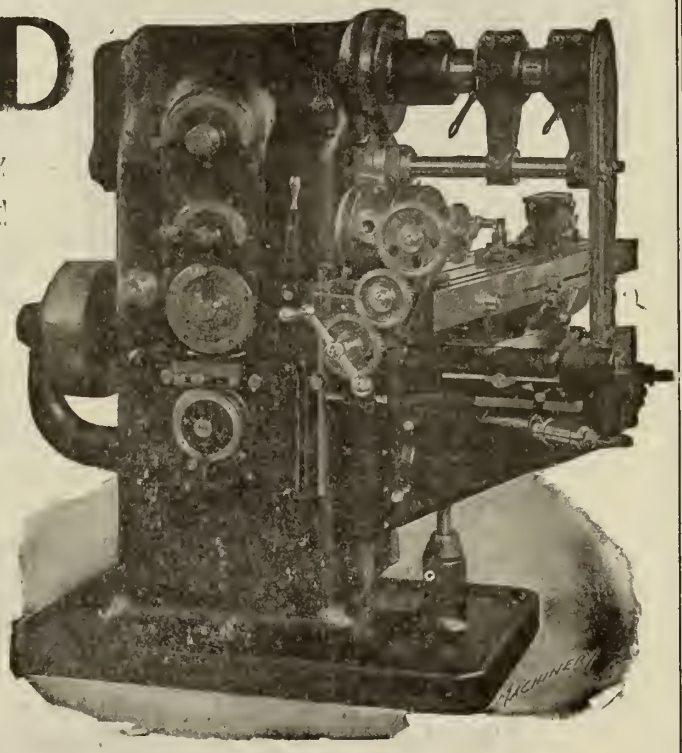
Its speed, simplicity of operation and great utility

Assures Big Profits in whatever work it is used



And another profit-making feature of the "Rockford" Miller lies in its unusual capacity to do all classes of work.

In the tool room, in the shop, in the manufacturing or jobbing establishment this "Miller" is beyond comparison.

Has Power to Spare

Put the power of the "Rockford" to the severest tests. It's built to more than meet the demands likely to be made upon it. It is the pace-maker of the machine shop.

Look into the merits of this machine. Write to us without delay.

ROCKFORD MILLING MACHINE COMPANY, ROCKFORD, ILL.

Canada: Rudel-Belnap Machinery Co., Toronto, Ont.

FOREIGN REPRESENTATIVES: Great Britain, A. A. Jones & Shipman, Ltd., Leicester, England. France and Belgium, Louis Besse, Paris, France. Italy and Colonies, Societa Anonima Adler & Co., Milano. Scandinavia, Rylander & Asplund, Stockholm, Sweden. Spain and Portugal, Casamitjana Hermanos, Barcelona, Spain. Australia, Selson Engineering Co., Melbourne, Australia. Russia, M. Mett Engineering Co., Petrograd, Russia.

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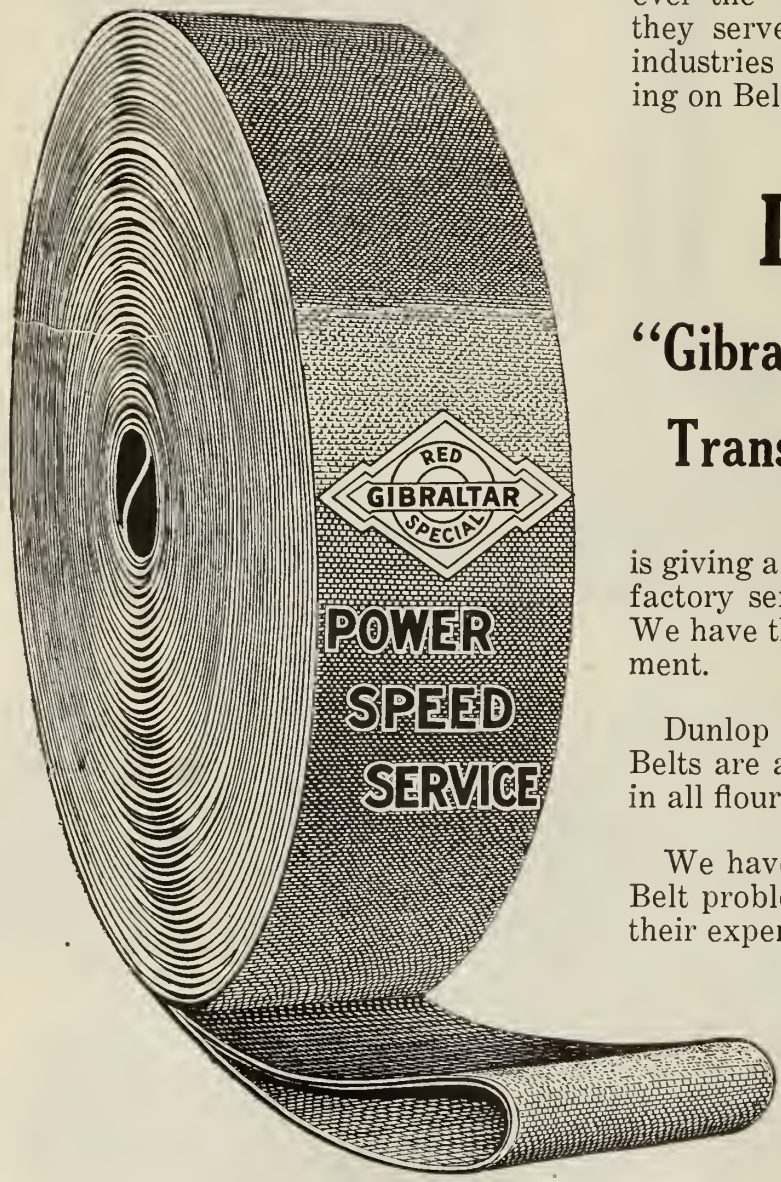
Dunlop Belting is Serving Faithfully In All Kinds of Industries

SEAL OF QUALITY
DUNLOP
RUBBER PRODUCTS



It is a matter of record that wherever the "Two Hands" products go they serve faithfully and well. In industries which are particularly trying on Belting

Dunlop

"Gibraltar RedSpecial" Transmission Belting

is giving a higher percentage of satisfactory service than any other type. We have the facts to prove this statement.

Dunlop Conveyor and Elevator Belts are also prominently employed in all flourishing industries.

We have a staff who specialize on Belt problems. You are welcome to their experience.

Also Makers of High-Grade Hose and Packing.

Dunlop Tire & Rubber Goods Co., Limited

Head Office and Factories: Toronto
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"GOOD WORKMEN KNOW THE DIFFERENCE"

Look for this trade mark on the back of every sheet, belt or disc.

Jim Crowe Boosts His Batting Average

BASEBALL fans of twenty years ago knew Jim Crowe. Jim was a diamond character. When he stepped up to the plate, the outfielders stepped back to the fences. Then when the ball came down in his groove—Zowie! what a clout!! Yes, Jim could hit.

And what a crank he was on bats. He'd spend hours hefting and testing, looking for a new stick. "Half the trick in lining 'em out is getting hold of the right bat," he'd say.

Jim is still in the game, but he's playing in the Industrial World Series this time. Today he's Foreman Crowe of the Chaplin-Fulton Manufacturing Company's plant at Pittsburgh, makers of Vigilant Feed Water Regulators.

Jim is coaching his men in the fine points of putting the finish on the 11-inch Regulator Valve Castings, just as you see him in the picture above. And he's still fussy about his tools.

"What do you know about my new bat?" he yelled above the roar of the factory. "They call it Speed-grits and it sure is a bird! Used to take us five minutes to bunt out a finished casting on the lathe. Bush league stuff!" he went on.

"With Speed-grits Metalite Discs, our new bat, it's all clean-up hits for ours!" He pointed to the big 48-inch abrasive discs spinning at 800 R. P. M. and grinding down several castings at once to a smooth finish with amazing speed.

"We're leading the league now," concluded Jim with that winning grin of his. "With Speed-grits we're batting out a finished casting every thirty seconds; some boost for the team's average, I'll say."

Whether it's abrasives or baseball bats—*good workmen know the difference.*

Write today for "The Difference Book"—Address

THE RITCHEY SUPPLY COMPANY
CANADIAN DISTRIBUTORS
154 Pearl Street **Toronto, Canada**
Or send to The Manning Abrasive Co., Troy, N. Y.

Speed-grits
comes in the following varieties:
GARNET PAPER
GARNET CLOTH
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METALITE CLOTH
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GRINDING DISCS
DURITE CLOTH
DURITE PAPER
DURITE COMBINATION
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Manning Speed-grits
Reg. U.S. Pat. Off.

Don't say Sandpaper —say Speed-grits

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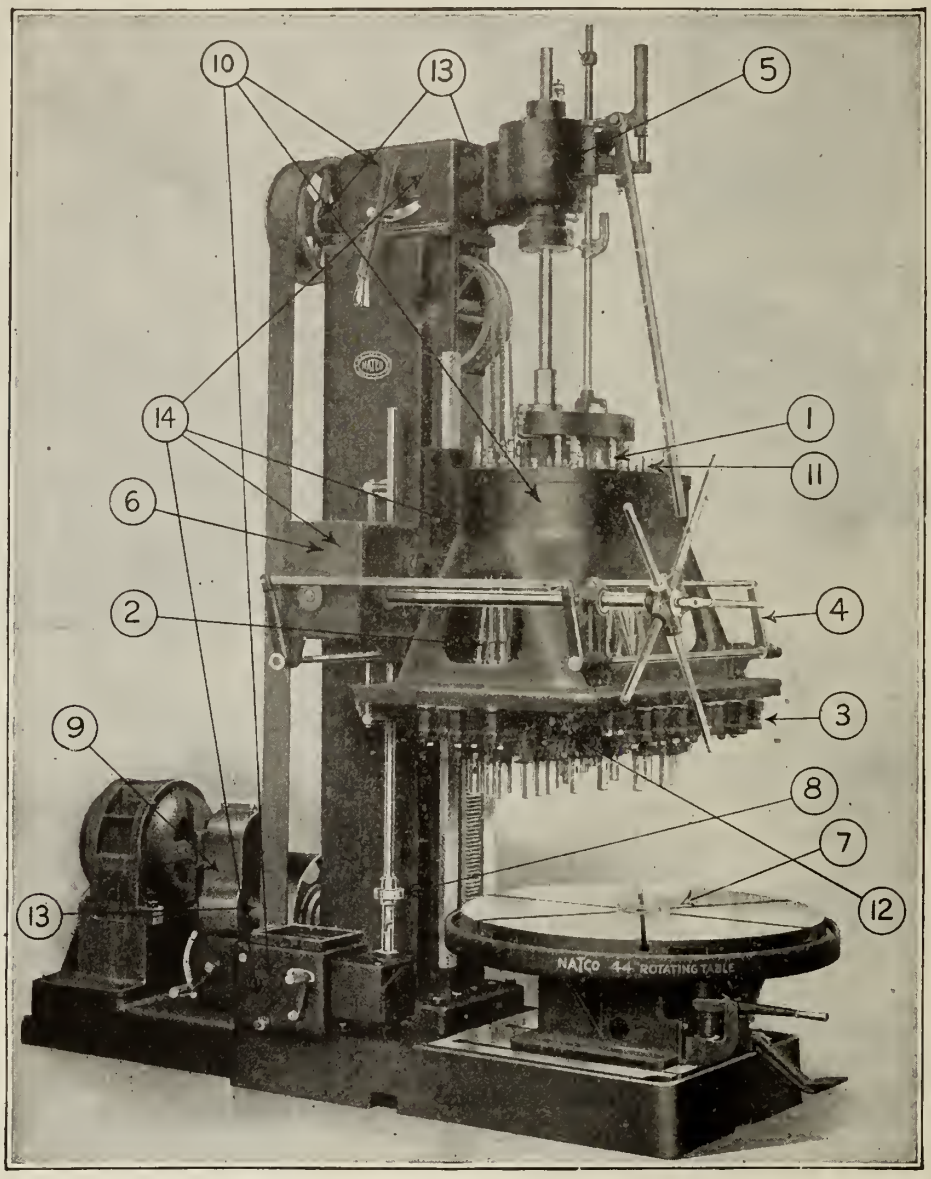
FOURTEEN ESSENTIAL POINTS OF THE NATCO



1. Patented change of speed to each individual drill.
2. Patented universal joints.
3. Patented one-nut adjustable arm, giving two adjustments for different length drills.
4. Front control for throwing in feed and operating machine.
5. Tapping attachment for tapping.
6. Spotfacing attachment for spotfacing, counterboring and countersinking.
7. Rotating tables allow you to load and unload while drilling.
8. Safety collar for feed, shearing pin when anything unusual happens in feeding, instead of stripping gears.
9. Constant speed drive, either belt or motor.
10. All gears run in oil.
11. Stop any spindles not in use.
12. Cluster plates for complicated layouts.
13. Hyatt roller bearings used where necessary; all machines have bronze bushings.
14. All gears of heat-treated steel.

THE NATIONAL AUTOMATIC TOOL CO., RICHMOND, INDIANA U. S. A.

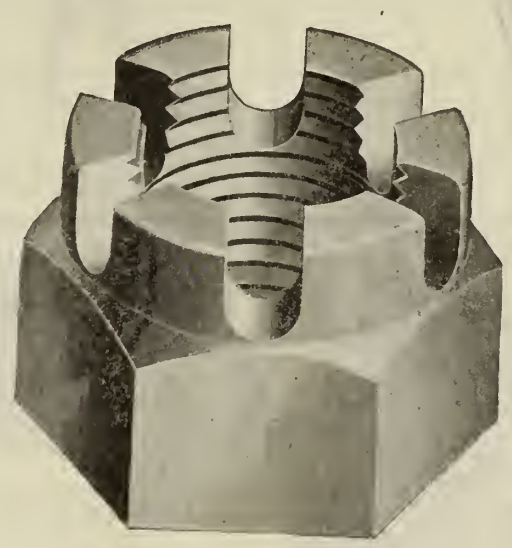
Namco SCREW MACHINE products

STANDARD

V. U.S.S. and S.A.E. Cap Screws
V. and U.S.S. Set Screws
S.A.E. Plain and Castellated Nuts
V. and U.S.S. Semi-finished Nuts

SPECIAL

Screws machine product up to 2¼" diameter to customers' specifications



Owing to the market shortage of raw material, it is to the customers' advantage that they anticipate requirements as far ahead of use as possible.

THE NATIONAL ACME COMPANY

MONTREAL, P.Q.

DeCourcelles G.T.R.R.

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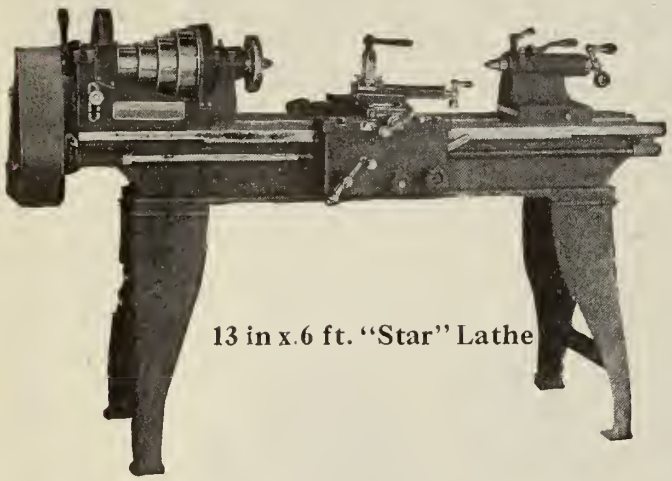
As the Lathe So the Finished Work Will Be



13 in x 6 ft. "Star" Lathe

STAR LATHES

For Small Accurate Work

It is becoming increasingly necessary to concentrate; to have machines, each of which will do its work in a highly efficient manner. Particularly is this true of lathes. A large, heavy lathe can **not,** with economy, be used on large and small work.

For the greatest efficiency adopt "Star" Lathes for the smaller jobs. They will help you turn out **more** and **better** products.

Send for the "Star" catalog and learn more about these lathes

The Seneca Falls Mfg., Company Inc.
366 W. Falls St., Seneca Falls, N.Y.

BRISTOOL

Bristol 12-inch Rotary Precision Surface Grinder

Built for rapid production on grinding work.

It handles work either singly or in multiples within the capacity of the chuck and not thicker than 6-in., and grinds within quarter thousand in. of manufacturing accuracy.

And it is built to last.

It is provided with exceptionally long bearings throughout, especially in the back column. This prevents the wear, which is very slight, from affecting the accuracy of the grinder. The Back Column is made to swivel four degrees, which allows concave or convex grinding.

Bristol Rotary Surface Grinders are made in several types and sizes and are regularly equipped with 8-in., 12-in., and 16-in. magnetic chucks, either belt or motor driven and for dry or wet grinding.

Our Bulletin describes the many good points fully. Send us your name and address and we'll gladly mail you one.

Grinds within .0004 in. of absolute Accuracy

BRISTOL MACHINE TOOL CO.
SUCCESSORS TO C. G. GARRIGUS MACH. CO.
BRISTOL, CONN.

The Acknowledged Leader

In every field of industry there is one acknowledged leader by which all others of its type are judged.

The Chasers of the HARTNESS AUTOMATIC DIE hold this enviable position. Their superior efficiency is not a mere claim, but the verdict of expert mechanics based upon exhaustive tests covering many years of service.

For precision work, we can furnish chasers with a lead guaranteed within 0.001 inch per inch of thread.

Quantity and quality of output are the predominant factors upon which their reputation is built.

Jones & Lamson Machine Company

(AUTOMATIC DIE DEPARTMENT)
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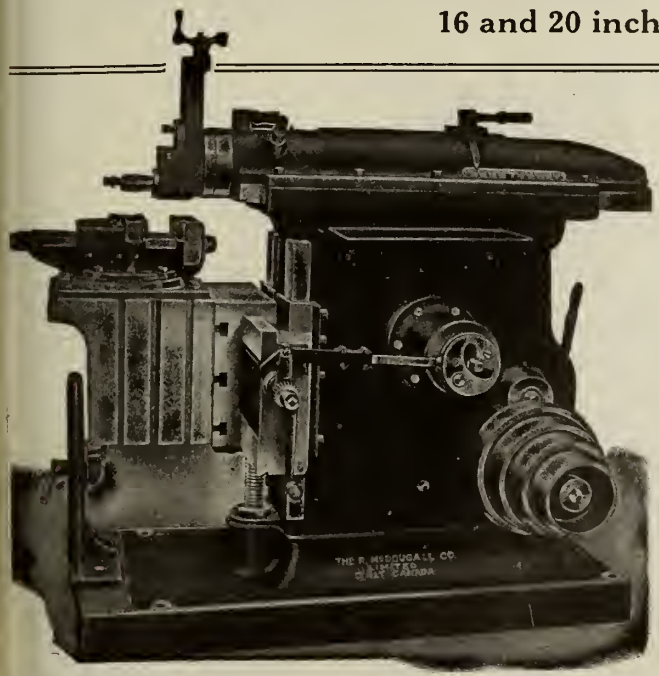
McDougall Crank Shapers

16 and 20 inch

ARE-MAC-DEE IS A GUARANTEE



A Bigger Day's Work—

is made possible with McDougall Crank Shapers than with any ordinary Shaper because the McDougall is built on lines especially for this purpose. It embodies the most approved features of the most practical shapers on the market and care has been taken to exclude all non-essential parts.

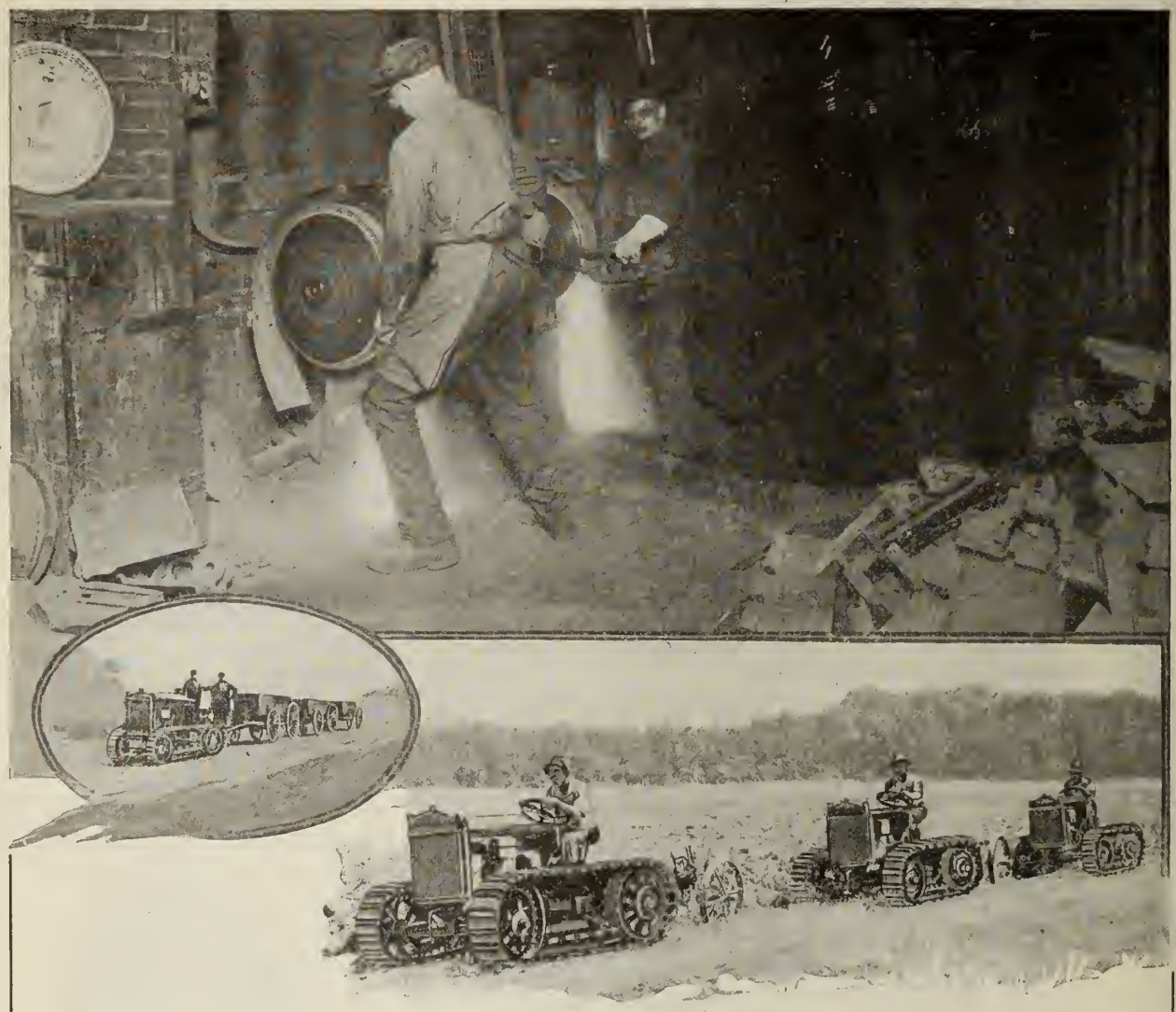
The column is massive in construction, well braced and reinforced internally. Exceptional strength is also seen in the ram, which is semi-circular in form and of box type. It can be set forward by crank conveniently arranged.

Slides are square, accurately fitted and with broad bearing surfaces.

Have us explain the other salient points of this finely constructed machine. Full details on request.

THE R. McDOUGALL COMPANY, LIMITED, Galt, Ont., Can.

The Canadian Fairbanks-Morse Company, Limited
Sales Agents



Grinding Tractor Links

The modern grinding wheel is of tremendous importance in placing the tractor on the market.

Before the tractor reaches the farmer in its finished efficient state it must go through many processes of manufacture. There is practically no part of the finished tractor which the grinding wheel has not touched.

By this means of machining millions of abrasive grains are placed in compact form and with each revolution of the wheel the grains are brought into action and become cutting tools.

The result is rapid production with exactness.

ALUNDUM wheels have been proving their excellence on these many operations. For grinding caterpillar links of manganese steel regular Alundum wheels, 24 x 3 x 2 in., ¾ in. taper per foot both sides, grain 10, grade T, have done remarkable work.

NORTON COMPANY OF CANADA

LIMITED

Hamilton, Ontario, Canada

Electric Furnace Plants

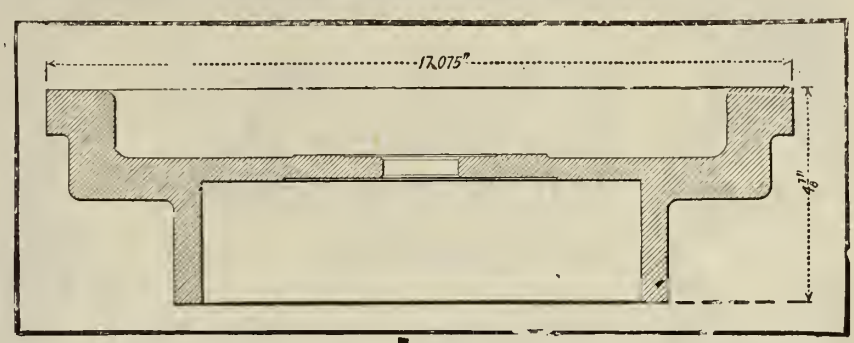
Niagara Falls, N.Y. **Chippawa, Ontario, Canada**

Canadian Agents: The Canadian Fairbanks-Morse Co., Ltd., Montreal, Toronto, Ottawa, St. John N.B., Winnipeg, Calgary, Saskatoon, Vancouver, Victoria. F. H. Andrews & Son, Quebec, Que.

R-18

GISHOLT

18 Minutes



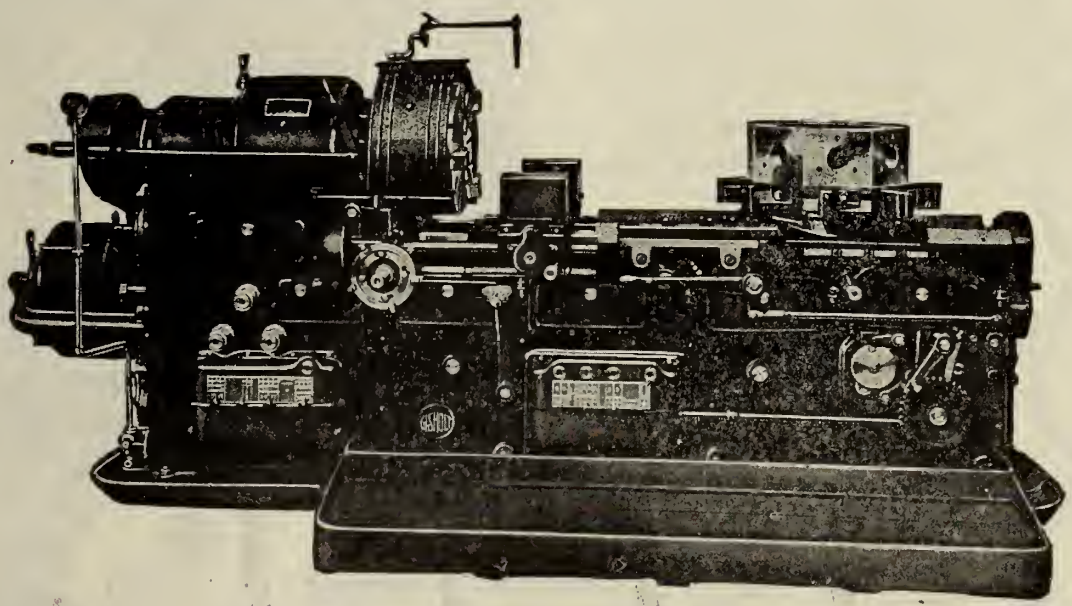
Cast Iron Flywheel

Wouldn't this Production Make a Difference in your Costs?

If you have any work like this fly wheel, or work of a similar nature, requiring boring, turning and facing, it will pay you to investigate and learn for yourself how these machines will help you increase production and reduce costs.

A man with years of experience will gladly tell you whether you can use Gisholt machines profitably.

Wouldn't a visit from such a man be worth while? A single suggestion may point the way to saving thousands of dollars.

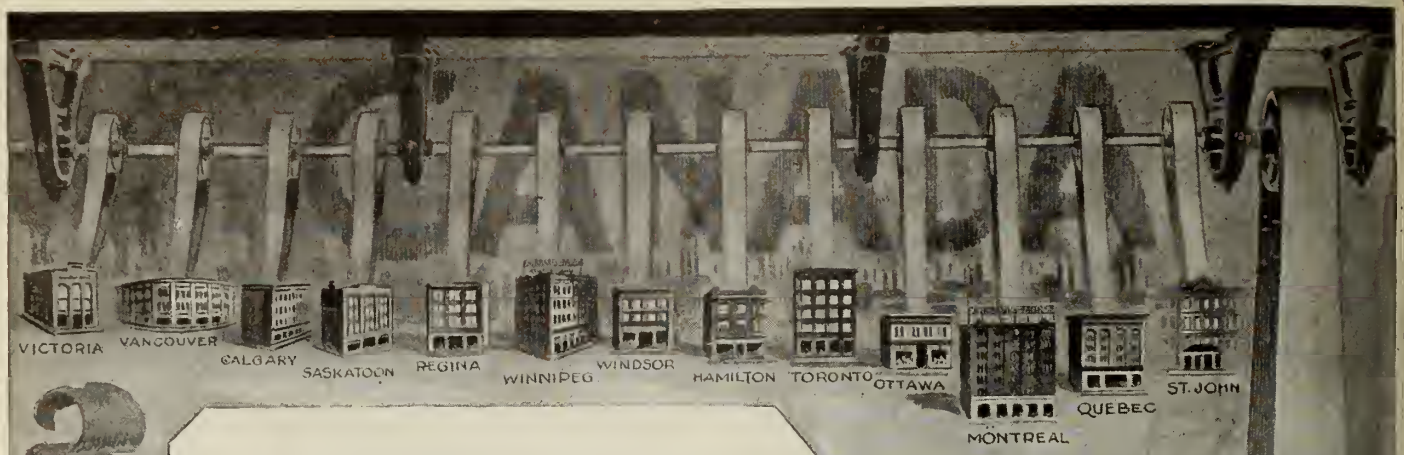


GISHOLT MACHINE CO., 1207 East Washington Ave., MADISON, WIS., U.S.A.

Builders of Standard and Automatic Turret Lathes, Vertical and Horizontal Boring Mills, Tool Grinders, Small Tools, Special Machinery, etc.

Eastern Sales Office: 30 Church St., New York. *Works:* Madison, Wis., Warren, Pa.

Canadian Agents: The Canadian Fairbanks-Morse Co., Ltd., St. John, Quebec, Montreal, Ottawa, Toronto, Hamilton, Windsor, Winnipeg, Saskatoon, Calgary, Vancouver, Victoria



15 Sales Offices Backed by the 100% Standard of Quality

THE Canadian Fairbanks-Morse Company Limited reaches out to you through its sales houses and offers the service and satisfaction that is assured by its 100% standard of quality and service.

To be able to turn to an institution that dominates its field in the industrial world is to safeguard the character of the merchandise you buy. To deal with an organizationthat is doing business at your very door puts upon the man you know that "responsibility which is the conscience of business."

Every one of these 15 offices has been established to bring to you the full advantages and benefit that have made The Canadian Fairbanks-Morse Co. Limited a national institution. Here in these offices is offered everything mechanical that your business requires — they centralize your purchasing—group your orders—bulk your shipments and send but one invoice. And when you buy from The Canadian Fairbanks-Morse Co. Limited you are guaranteed the 100% standard of quality and service in product and organization.

Make our nearest office your buying centre—our catalogue is your buying guide —our 100% quality seal your guarantee.

The Canadian Fairbanks-Morse Co., Limited

Canada's Departmental House for Mechanical Goods

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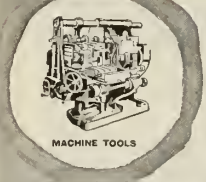
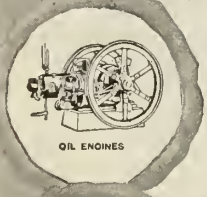
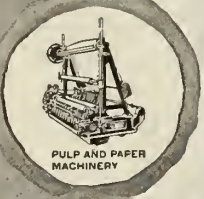
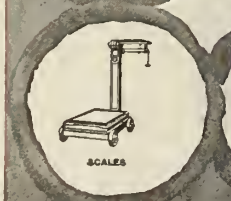
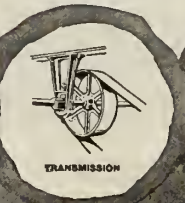










CANADIAN MACHINERY
AND
MANUFACTURING NEWS

Vol. XXIII., No. 24 June 10, 1920

Various Machine Operations on Beveled Shoe

Practical Men in General Will Welcome This Article Describing Interesting Problems Met with in the Machining of This Shoe—Both Milling and Drilling Work Are Entailed.

by F. SCRIBER

A RATHER interesting problem presents itself in the machining of the part shown completely finished in the lower right-hand corner of Fig. 1. This is made of steel and has both ends bevelled, these running tangent to a common centre from which the inner and outer radius is swung. This part is one of a number cut out of the ring illustrated at the left, the cutting out operation being performed with the work set on a suitable angle, so the work will look as shown in the upper right-hand corner of Fig. 1 after the operation of sawing apart.

In considering this piece the first operation determined upon was to forge up steel sleeves of suitable length and diameter, these to be held in a chuck on the lathe while bored, turned and cut off into rings such as are shown. Following this in succession the shoes are cut from the ring—the holes are drilled—one end is milled, followed by milling of the opposite end, after which the lips on the side of the bevelled ends are milled.

Referring to Fig. 2. Here is shown the fixture in which the blank shoes are cut from the ring. It will be noticed in this connection that the ring A is held on an angle so the ring will be cut apart diagonally. The first cut is made as indicated by the two lines B, the work being held in place by clamp C, it being obvious that the ring is centralized by the diameter D on the fixture. At this time spring pin E has been pulled back by means of the knurled knob F, to allow the ring to be put in place, and after the first cut is made the ring is revolved on its seat (the clamp being loosened to permit of this) until the teat on the end of the spring pin enters this slot, thereby indexing the ring correctly for making the next cut and thereby permitting the severing of the first blank. Continuing this operation of revolving the ring, using the spring pin as a stop, clamping the ring and sawing through

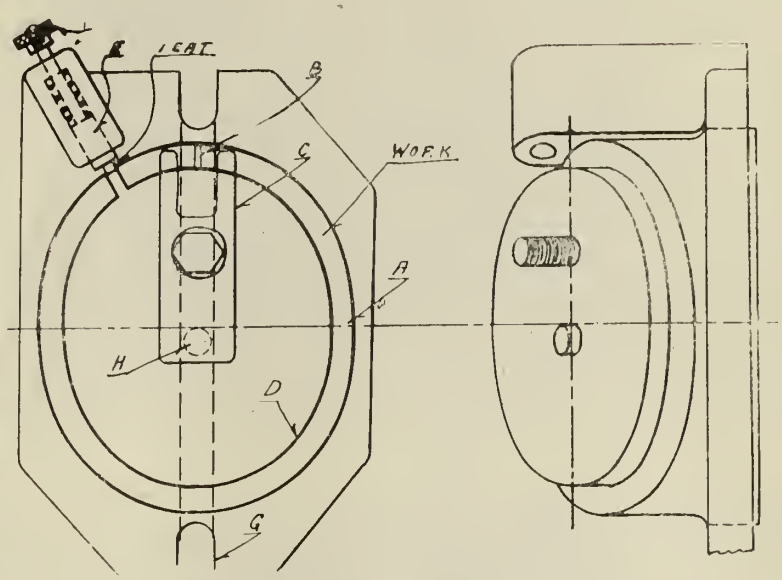


FIG. 2—FIXTURE FOR SAWING SHOES APART.

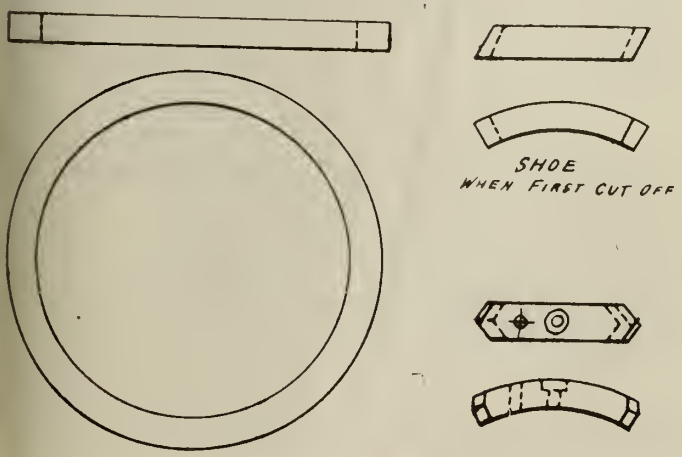


FIG. 1—LAYOUT SHOWING OPERATIONS WHEN MACHINING SHOES.

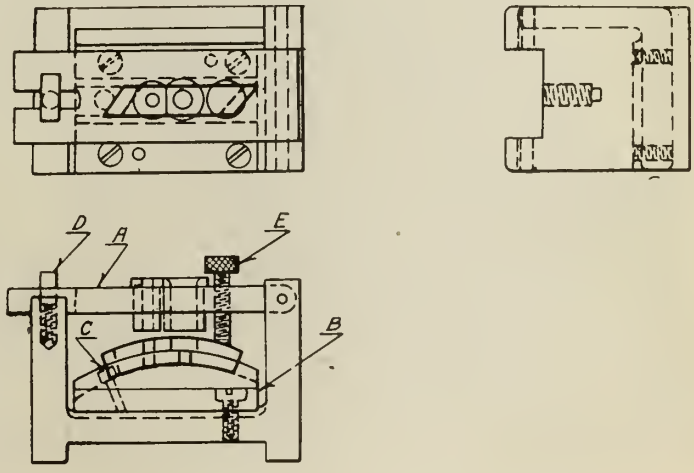


FIG. 3—THE JIG FOR DRILLING OF TWO HOLES.

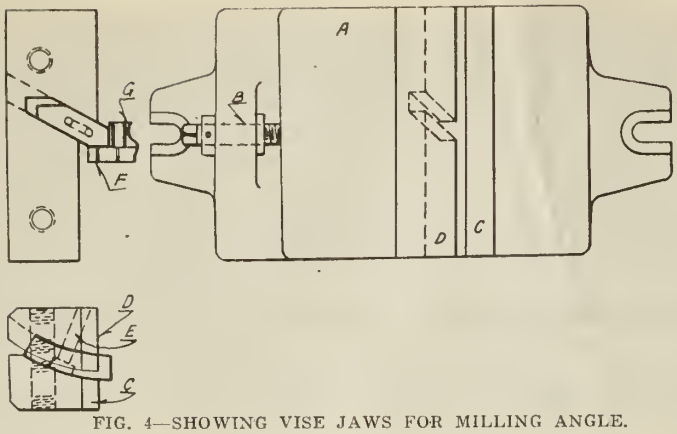


FIG. 4—SHOWING VISE JAWS FOR MILLING ANGLE.

the ring successively, the entire ring is cut into the necessary blanks from which the shoe is made. Slots G are used for holding down bolts to clamp this fixture to the table of the machine, while shouldered pin H is used under the end of the clamp, thereby causing the clamp to bind equally both sides of the ring near the cut.

For convenience in locating the work during the operations which are to follow the next operation is to drill the small hole and also to drill and counterbore the screw hole, all of which is performed in the jig shown by Fig. 3, which is operated as follows: With hinge cover A swung back out of the way the work is placed as shown in the grooved block B, which locates it sideways, while it is located against the pin C for endwise location. The hinge cover is then swung into position, it being locked in place by the quarter turn screw D. Knurled screw E is then used for holding the work in position, while the holes are machined in the usual manner, using a spot drill, reamer size drill and reamer for the small hole, while the other hole is spotted with a counterbore size drill, drilled with a screw size drill and counterbored, this being standard practice where a good degree of accuracy is required without the use of slip bushings.

It would perhaps be hard to devise a simpler method of handling this shoe in a cheaper manner than to use a special set of vise jaws, and while this cannot be termed a speedy operation it is very efficient, reference to Fig. 4 clearly indicating the method of handling at this time, it being necessary to mill both surfaces at one end, following which the work is turned end for end, while the other two surfaces are milled.

The vise proper A is of a standard make in which the movable jaw is operted by screw B. The two jaws C and D are special, being made to accommodate this job only; jaw C is shaped to conform to the outer radius of the work, while jaw D is curved so there will be no interference, and is also grooved to locate the work sideways, a pin E in the screw hole of the work being employed to locate it radially. With the work clamped in the position shown, by operating the vise in the usual manner two cutters F and G are caused to mill both surfaces (which are at right angles to each other and at an angle of forty-five degrees to the centre line of the work) at the same time. Reversing the work and proceeding to hold and mill it in the same manner is all that is necessary for machining the other end.

Fig. 5 illustrates a milling fixture for performing the final operation, that of milling the lips on the ends of the work. This fixture is very simple, inasmuch as two parts, A and B, are placed as shown over pins C and D, and are clamped by strap E through the medium of the stud F and nut and washer G.

It will be noticed in this connection that opposite ends of the work are milled at this time on two separate parts, therefore at each pass of the cutter it is equivalent to completing one shoe, the work being fed under the cut in the direction of the arrow.

No attempt was made to get maximum production from these fixtures, it simply being advisable to get duplicate work in moderate quantity.

INTERESTING FACTS TO BE FOUND IN THIS WEEK'S ADVERTISING SECTION

All about a certain attachment that hangs on to every speck of dirt and muck it comes in contact with.

A machine whose cutter removes metal 90% of its actual working time.

All about certain equipment that saves time, labor, and money.

A mark to look for, that, although inconspicuous, is very significant.

What one firm considers the best thing they make.

Numerous requests that you write and secure valuable information.

That extensive experience is bound to show results.

What to do if a bad nut gets loose.

How one can increase his batting average without even playing baseball.

A machine tool builder that emphasizes fourteen points in his product.

That production is something that depends on your equipment.

That low cost of maintenance is a very important feature.

That it pays to be interested in cutting drilling costs.

That gauging is an expensive operation.

How to cut cutting cost.

That the location of an industrial plant has a vital effect on its prosperity.

SEAM WELDING MADE PERFECT

A vital improvement in the process of "seam welding" by electricity has been made by a British firm of engineers. In this process, as usually carried on, two thin sheets of iron are held together between rollers which carry the welding current, and are moved continuously as the welding proceeds. The metal at the joint must be thoroughly cleaned beforehand, as any scale on the surface melts before the iron and causes the rollers to slip. Another disadvantage is that the welded portion passes on in a half-molten state and is liable to open before the metal sets. In the new machine the process is made intermittent. The rollers grip the sheets in the same way, but as soon as the welding current passes and fuses the metal it is switched off, and the rollers give the work a squeeze, making a firm weld. After a short interval which gives the weld time to set, the rollers move the work a little, current is switched on, another weld is made, and the same process is repeated. Thus a series of overlapping spot welds is produced, forming a continuous water-tight weld. With this machine there is no need to spend time and money in preliminary cleaning of the metal. The serious of actions is effected by the simple automatic mechanism. Most successful results have already been achieved by this invention.

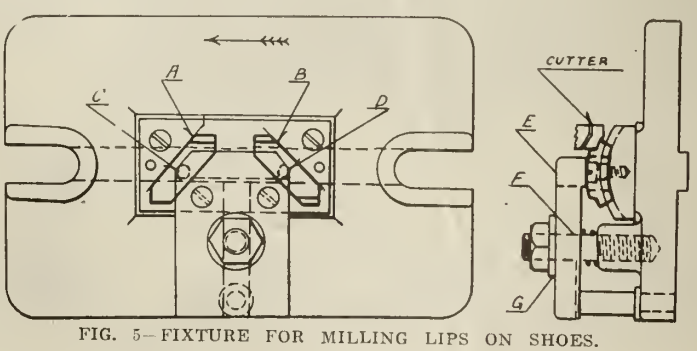


FIG. 5—FIXTURE FOR MILLING LIPS ON SHOES.

Are You Anxious to Increase Your Production?

Believing that Everybody is Scrambling After Increased Production, We Have Compiled Some Interesting Data on a Recent Machine Tool Development—Examples of Work Performed Are Also Given.

By J. H. MOORE

WHILE the article to follow will discuss and describe a certain type of lathe, this does not infer that it is intended as a new equipment notice only. The intention is twofold first, to acquaint designers in general regarding the main points in this machine's design; and second, to place before the practical machinist the possibilities of this type of lathe. The machine under consideration is that of the Multi-Cut lathe, as manufactured by the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio.

As they remark, "Multiple cutting is cost cutting." In these days of keen competition, this feature of cost cutting is a big consideration. What everyone desires is production, and to obtain this condition, we must eliminate every possible leak. It is only by so doing that we can hope to reach maximum efficiency.

The general trend in the machine tool field has been towards "special machine for special work," or in other words, "Definite service machine tools."

Description of Machine

One of these departures is found in the LeBlond Multi-Cut lathe, for this tool has certainly been built for definite service. To get acquainted with its general appearance let us refer to Figs. 1 and 2.

This lathe is of the semi-automatic type, on which one or more facing and

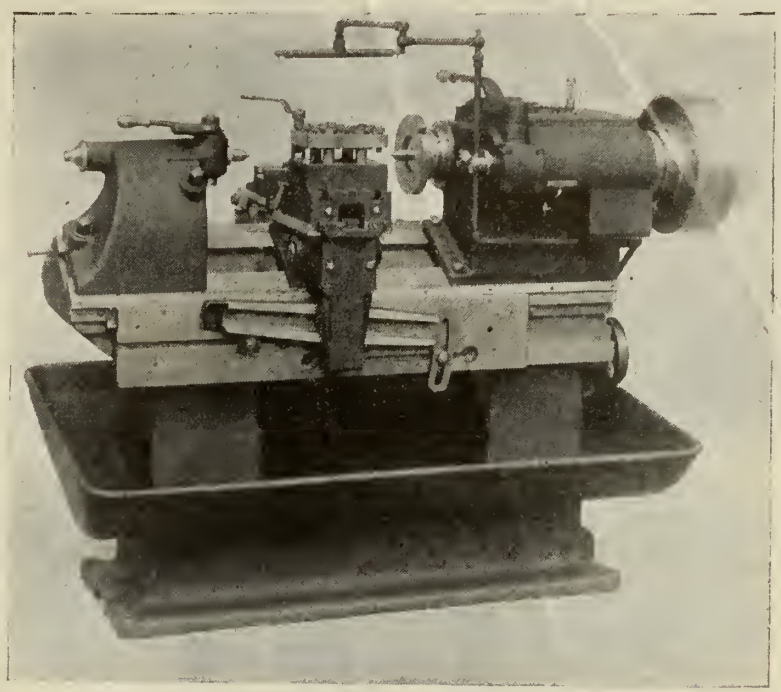
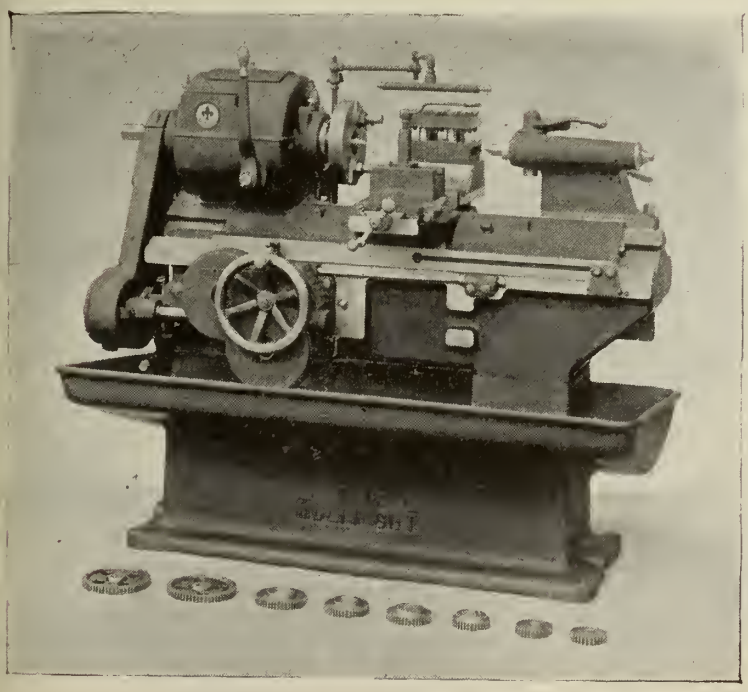


FIG. 3 A REAR VIEW SHOWING THE FACING ATTACHMENT.

FIG. 2—AN END VIEW SHOWING VARIOUS POINTS OF CONSTRUCTION.



GENERAL VIEW OF THE LATHE.

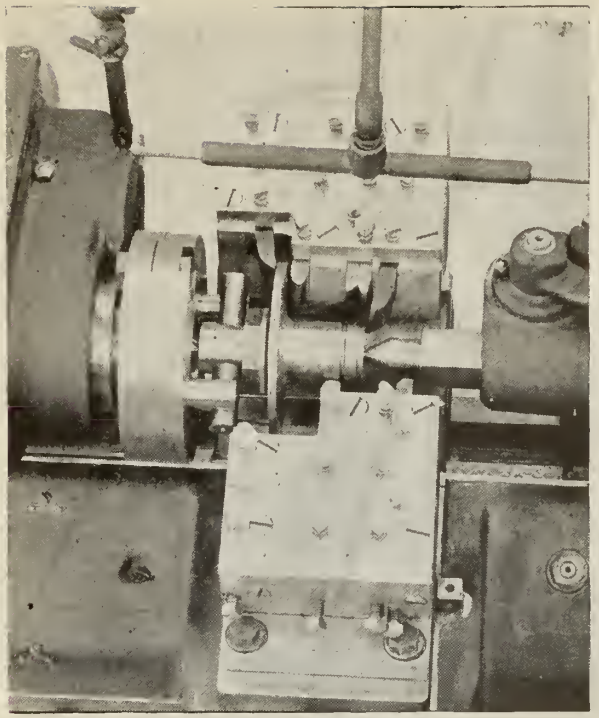


FIG. 4—A TYPICAL TOOL SET UP.

turning operations can be performed simultaneously; one operator running one or more machines. Various drives and equipment can be provided, this feature allowing it to be used in any industry having duplication work to perform.

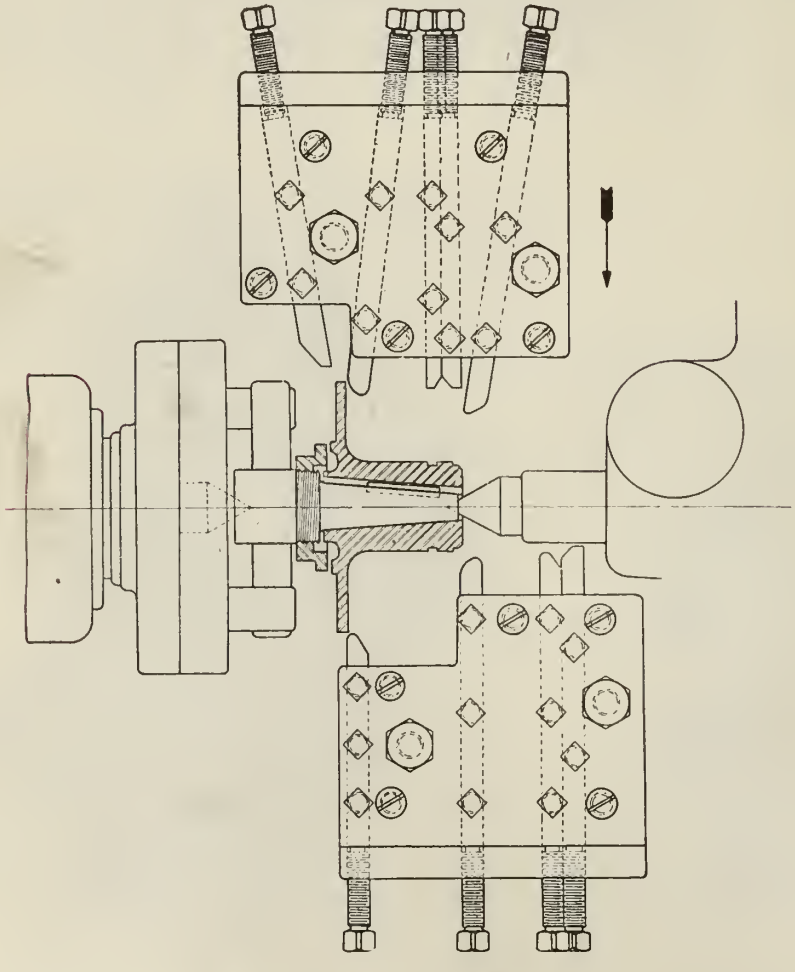


FIG. 5—DIAGRAMMATICAL VIEW OF SET UP SHOWN AT FIG. 4

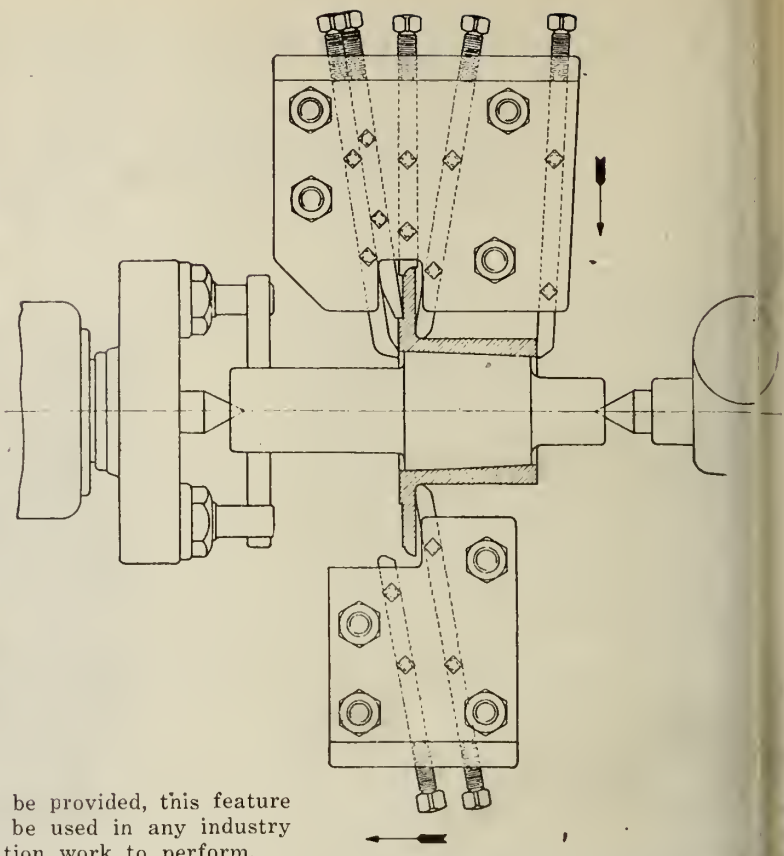


FIG. 6—TURNING, FACING, AND FLANGING OF AUTOMOBILE WHEEL HUB.

The work itself may be centered, held on arbors or expansion chucks of either pneumatic or hand-operated design or work that has been previously bored, reamed, or rough turned on the turret lathe or automatic, this machine fits in ideal for finishing purposes. Finish turning and facing are accomplished very rapidly. This makes the machine very useful in finishing gear blanks, cone pulleys, bevel gears, pistons, steering punches, cam shifts, etc., etc. Of course the lathe is not confined to finishing work only, but owing to its rapid action, it is especially useful for such class of work.

As the word multi-cut signifies, many tools, are used at once. The tools however, are of the lathe type, simple and inexpensive, so that the upkeep of tool equipment is not a large item. The machine is easily set up, there being no cams, either fixed or adjustable, to consider. Having described the uses of the lathe let us proceed with its general design.

General Design

The machine is built in two sizes, No. 6 and No. 9. The former of these has a 6 inch swing, and 10 inch capacity between centres, while the latter has a 9 inch swing and a 16 inch capacity between centres. Both sizes are built with two types of headstock, named F and D. The first style may be motor driven by either alternating or direct current, and is of the selective speed type, providing 6 speed changes through sliding gears from a constant speed driving pulley. This permits of speed variation sufficient

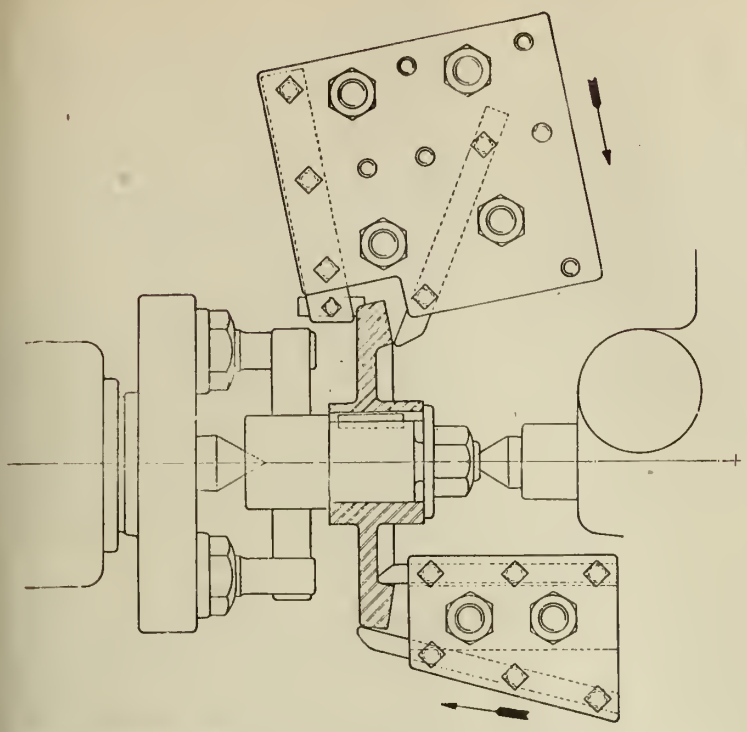


FIG. 7—VARIOUS OPERATIONS ON A CAST STEEL BEVEL GEAR.

o cover all classes of work. If desired he headstock can be made with right ngle drive.

The style D headstock is of the single peed open belt head type. It is pro-ided with a lever operated friction start, top and brake. The pulley on this eadstock is accurately balanced, per-itting of speeds up to 1,000 r. m. p. his, of course, makes it especially daptable on brass, bronze and alumin-m work.

The friction clutch is mounted in the eriphery of the driving pulley, and is f the double finger, wedge acting type, eing adjustable for tension, and bal-nced against rotative forces. A brake mounted on the spindle, bringing it to n instant stop when clutch is released, spring tension holding it into the brake, reventing accidental starting.

The spindle bearings are renewable bronze boxes, babbitt lined and provided with sight feed oilers. The thrust is taken up by ball thrust bearings. This style head is intended to be driven direct from the line shaft, but should this be impossible, jack shafts can be provided.

As the class of work accomplished by these machines is so varied, the equipment provided is optional, and is supplied to meet with the requirements of the work.

A statement of the attachments possible, however, will be well worth while. Plain or universal facing attachments, taper attachment, compound or plain block rest, draw-in attachment with collet special forming attachment, and in fact any special tool and chuck equipment can be provided. As the lathe is really a definite service machine, the tooling is arranged to suit the work, aiming at the turning it out at maximum speed.

Referring to Figs. 1 and 2, it will be noted that the bed is of anvil section, with broad slides for the carriage, bearings, head, and tailstock. These are so arranged that the pressures resulting from the cut tend to force the slides more firmly to a bearing. The slides are very broad and are provided with dovetail guiding shears. These are tapered gibbed and prevent and lifting tendency.

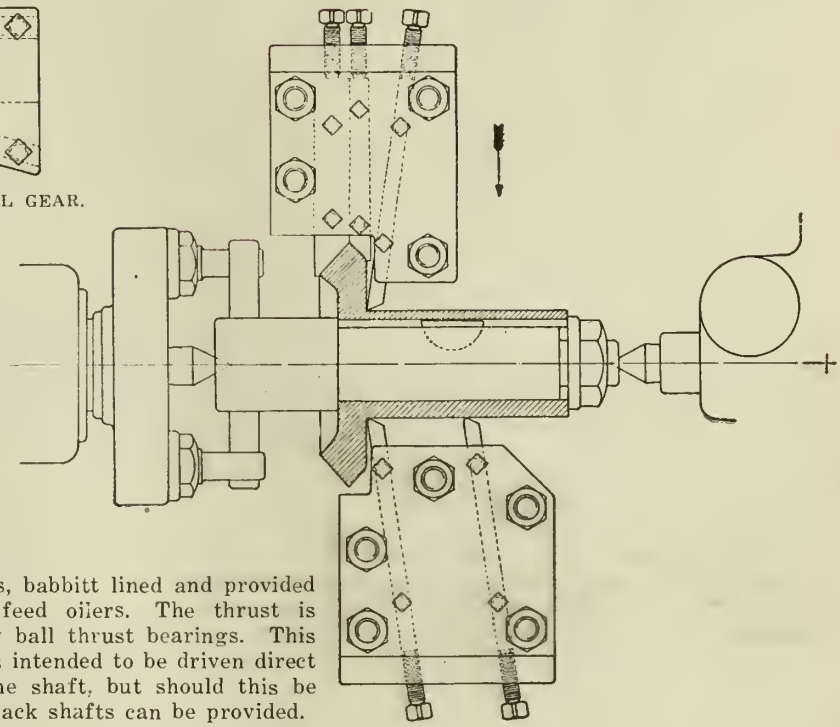


FIG. 9—MULTIPLE TOOLING USED ON TRANSMISSION SHAFT.

The bed is strongly ribbed, and contains a pan for cutting compound in its interior. This pan in turn is provided with a strainer to separate the cuttings from the compound.

The carriage is a broad slide extending practically the full length of the bed, and is scraped to a bearing its entire length. Double taper gibs are provided with fine thread adjustments at both ends. The cross slide is also very massive in construction, and in cast integral with the carriage.

The head and tailstock are located and carried by the rear shear. This permits the carriage to travel past them, thus keeping the slides continuously covered. It is this extreme long carriage bearing that is the big factor in producing rigid-

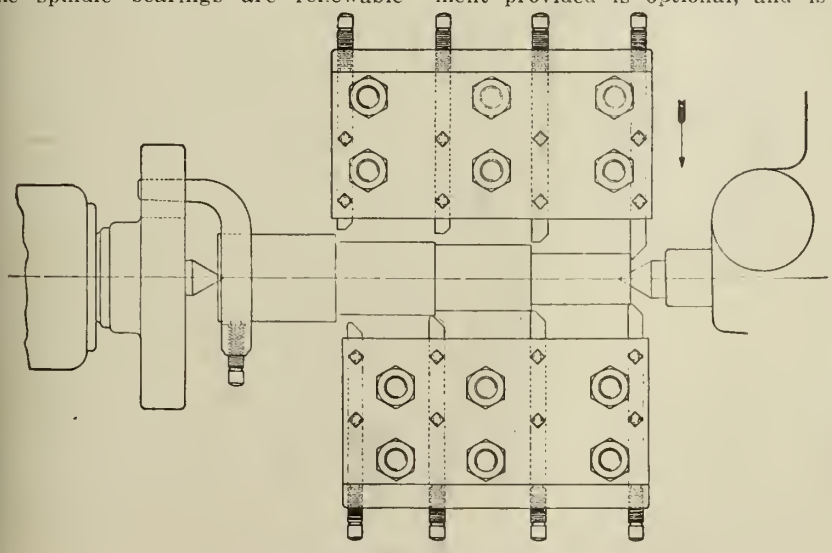


FIG. 8—FINISHING OPERATIONS ON A SLEEVE BEVEL GEAR.

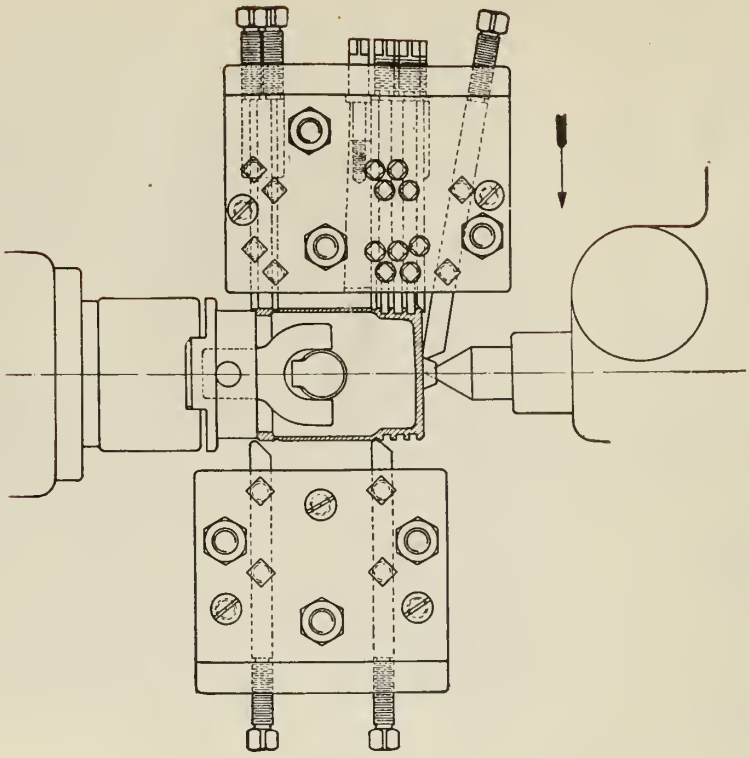


FIG. 10—ROUGHING AND FINISHING TOOLING ON ALUMINUM PISTONS.

ity, and permitting the use of gang tools, forming slides, etc.

The plain facing attachment is shown at Fig. 3. This attachment faces diameters up to the full swing of the lathe at right angles to the turning centres. The feed of the slide is obtained entirely by the relative movements of flat and dovetail slides accurately gibbed and adjustable to compensate for wear. There are no cams either fixed or adjustable to consider. The rest is fed towards the centre employed is a No. 9, and equalizing face on a broad, square lock slide, to which it is accurately gibbed. The cross facing slide is movable along the bed, and rigidly clamped to the shears in any desired position.

The facing bar slide carries the swivel guide bar which is fed along the bed at varying rates of speed. A sliding shoe on the facing attachment slide engages the swivel guide bar, which may be set at any angle within the range, imparting a vertical motion to the shoe which is transmitted through a rack and hardened pinin to the cross slide. By changing the angularity of the swivel guide bar the feed of the cross slide is varied or timed to complete its work at the same time as the turning slide to permit of overlapping on forming and turning tools or vice versa. The feed to both turning and facing slide are tripped by the same clutch and will duplicate within close limits of accuracy. The standard tool block is arranged for multiple tools which can be held parallel or at any angle by reason of the spacing of the binder screws. The tool block is adjustable to the centre of the lathe and firmly clamped in position by two heavy bolts.

The universal facing attachment is adapted to angular facing operations on bevel gears, etc. When used in connection with a taper turning attachment, the back and face angles can be turned and faced simultaneously. A swivel block is accurately graduated to facilitate angular settings and clamped firmly in the selected position by two heavy T slot bolts in a circular T slot. The feed is through a pair of hardened, generated, mitre gears to the feed rack. Aside from the swivel feature,. the universal attachment and tool blocks are identical with the plain attachment as already described.

Feed for Turning and Facing Slides

The variations in feed for turning and facing slides are obtained by loose change gears applied to the feed bracket and worm box. The feeds read in "thousandths per revolution of spindle," and a simple, direct reading is provided with each machine to show the change gear combinations and the resulting feeds.

The feeds of the front slide are fixed by the change gears used, while the feeds of the facing slide may be further varied with relation to the feed of the turning slide by the angularity given the swivel guide bar; resulting in a practically unlimited combination of feed relations. When on forming or heavy reductions with the facing slide it is sometimes desirable to accelerate or retard the feed as it approaches the centre; this is done by replacing the swivel guide bar with a former bar and roller designed to suit a specific job. The feeds are tripped to a line by a sensitive acting, positive jaw clutch, heat treated and hardened, engag-

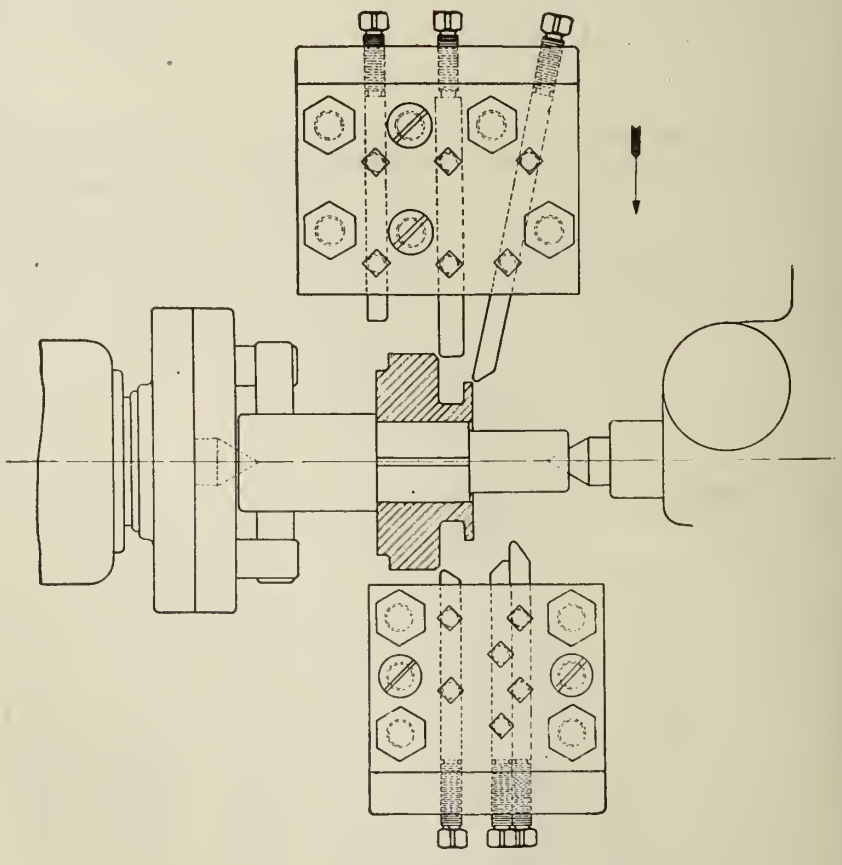


FIG. 11—FINISHING OPERATIONS ON DROP FORGED GEAR.

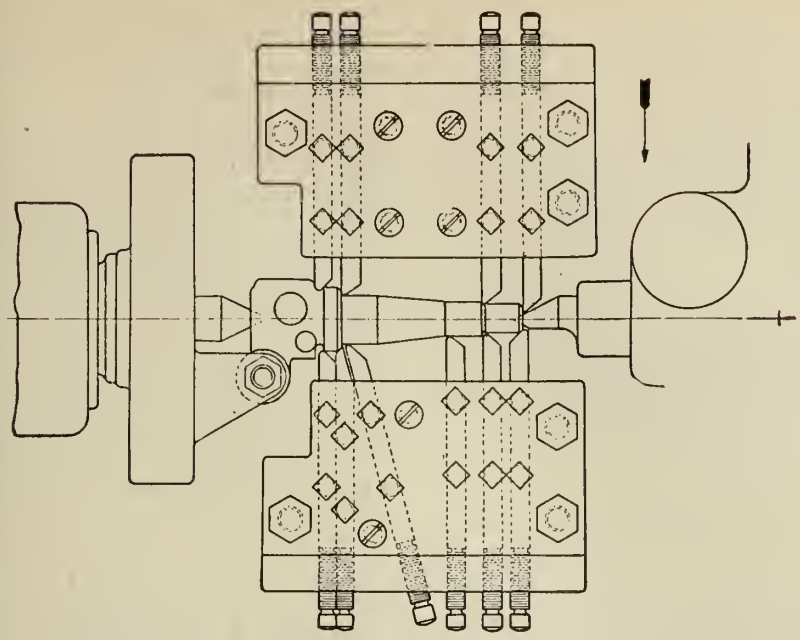


FIG. 12—TURNING OF A DROP FORGED STEERING KNUCKLE.

ing a similar clutch mounted on the worm wheel.

The feed drive is then through changeable gears and a pinion and bullwheel to the rack on the carriage. The drive to the facing slide is through similar change gears, through the bed, to the feed rack on the facing attachment slide on which the swivel guide bar is mounted.

The feed rack for both carriage and facing attachment is placed in the centre of the slides, imparting a smooth, unrestricted feed without the usual binding action occasioned by applying the power away from the centre of the guiding shears and the resultant of the greatest working strain. A hand wheel at the front of the worm box furnishes means of quickly returning the turning and facing slides to the starting position after the completion of each cut. The worm wheel and clutch are running continuously in oil and the thrust of the worm is taken against ball thrust bearings. All of the gears subject to the greatest strains are of nickel steel, heat treated and hardened.

Having given a very fair idea of the various features connected with the machine, we will next consider some examples of work accomplished.

Interesting Examples

At Fig. 4 is shown a typical tool set-up. In this case the machine is equipped with a special compensating face plate driver, special multiple tool block on front and rear slides, and a former bar on the facing attachment in place of the regular guide bar, which furnishes means of slowing up the feed of the facing tools for forming the heavy fillets.

The work being performed is that of machining an automobile wheel hub. These hubs are made of alloy steel forgings. The hub has been previously bored, taper reamed, and the flange end faced and recessed on a turret lathe. The operation on the Multi-Cut lathe is the finishing to size in one operation with nine cutting tools. All tools used are ordinary lathe tools, mounted in quick removable tool blocks and ground to gauges. The operator handles two mandrels, and loads one while the machine is in operation. The turning time on these hubs is 1.6 minutes each.

The feed trips automatically to a line and duplicates to close limits of accuracy. The tailstock spindle is brought up to the arbor and clamped with a single lever movement and the work is flooded with cutting compound from a geared pump, then returned to the base of the machine through the strainers already mentioned. At Fig. 5 is illustrated the tool layout of the work. It will be noted that four of the nine tools are turning tools and the other five facing tools which cut simultaneously.

Another good example is shown at Fig. 6. This is the turning, facing and flanging of an automobile wheel hub in one operation. Two turning tools and five facing tools are at work. Special tool blocks, two mandrels, equalizing face plate driver and plain facing attachment form the equipment. One operator can readily run two machines, which of course means a larges production at lower cost.

The next example is that shown at Fig 7. In this case a cast steel bevel gear is being completed. The work has been previously bored, reamed and scaled off on a turret lathe. The back angle, face angle, fillets and undercuts are being finished in this illustration. The machine plate driver, special multiple tool blocks, universal facing attachment, taper attachment and two mandrels form the remainder of the equipment.

At Fig. 8 is depicted the finishing operations on a sleeve bevel gear which has been previously roughed out on an automatic bar machine. The work being performed in the illustration is that of finishing diameter, also back and face angles, one facing tool, two forming tools and two turning tools are cutting at the same time. An equalizing face plate driver, plain facing attachment, special tool blocks and two mandrels are used.

Next comes Fig. 9, a good example of multiple tooling on a transmission shaft.

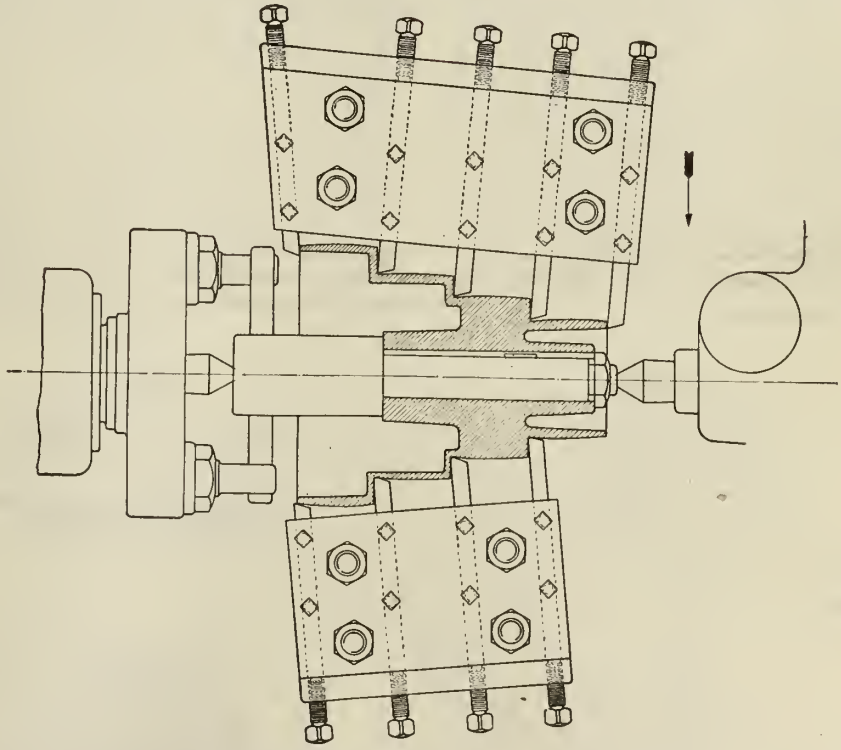


FIG. 13—FINISHING OPERATIONS ON A CROWN FACE PULLEY.

This is a simple turning and facing proposition, four turning and four facing tools being used, each completing their respective operations at the same time. This illustration is a splendid example of the wide variety of work possible in a lathe of this nature.

At Fig. 10 is illustrated an operation on aluminum pistons. Two machines are employed, one equipped with roughing and one with finishing tools. The tools are set and ground to gauge in the blocks, a reserve set being kept on hand ready for use. The pistons are roughed all over and ring grove stocked out at first operation. The finishing operation is of similar nature, only the finishing cut. A special driving chuck, special tool blocks and tools and plain facing attachment are used.

A drop forged transmission gear made from nickel alloy steel is shown at Fig. 11. The hole has been bored, broached square, and one side faced in previous operation. The work is now completed in one handling. It is held on a square centred arbor, three turning, and three facing and forming tools being used. These are held in special blocks. A plain facing attachment is used in this example.

The next example shown at Fig. 12 is the turning of a drop forged steering knuckle. This work is completed on centres, a special drive plate, six turning and chamfering tools, four facing and necking tools being used. The tools are held in special tool blocks for the purpose.

Our last illustration is shown at Fig. 13. This view depicts the finishing of a crown face core pulley. In previous operations the pulley has been bored, reamed, hub faced and keywayed. The material is cast iron.

A former bar is substituted for the taper attachment guide bar on the front slide for producing the crown on the pulley. Four turning tools and five facing tools are used. The other equipment consists of plain facing attachment, equalizing face plate driver, two arbors and special tool blocks and forming attachment.

These examples of work performed will no doubt be of double value. First they will show clearly some of the work completed on this style machine and second they will demonstrate to the practical worker in the shops new possibilities in tool layout.

Novel Relieving Attachment for Lathes*

ALTHOUGH it is usually considered to be uneconomical to make milling cutters and other small tools in a general engineering shop, occasions sometimes arise when it would be extremely convenient to be able to do so. It may easily happen, especially in small shops, that a job may be delayed for days in waiting for a certain tool that could be made in an hour or two if the necessary appliances were available. The lathes, milling machines with dividing heads, gas muffles, etc., needed for the work, form part of the equipment of practically every shop, but main difficulty occurs in connection with the work of backing off, or relieving, the teeth of the cutters. The teeth can, of course, be formed by milling with special cutters, but the number of these required for different shapes and sizes of tools is, in most cases, prohibitive. A relieving lathe, which might be employed, is an expensive tool of very little general utility, so that it is not often found in small shops. It would certainly not pay to instal one for an occasional odd job, but this objection cannot be applied to a comparatively inexpensive attachment which enables relieving work to be carried out on an ordinary screw-cutting lathe.

Such an attachment, which is the invention of Mr. E. M. Wildey, and is being manufactured by Messrs. Milton, Limited, of Besley Street, Streatham, London, S. W. 16, and is illustrated by the drawings, Figs. 1 to 5. On account of the high speed at which the machine will operate, the makers consider that it will be found economical to use it for the manufacture of plain cutters, reamers and similar tools instead of milling them, since the only gashing necessary can be done by a narrow slotting cutter, or even by a metal slitting saw; the expense of a large number of special cutters and end mills would thus be avoided.

The drawings reproduced in Figs. 1 to 5 illustrate the construction of the attachment. Reference to these drawings will show that the attachment is mounted on a gibbed plate, which is screwed on to the lathe saddle. Into this plate is fitted a steel casting having a large hole through which passes the work, or the arbor on which the work is mounted between the centres of the lathe. There are two oscillating tool posts carrying tools which can operate simultaneously on the front and back of the work, though, for relieving, the front tool only is employed. The tool posts are formed by fork-shaped steel castings, each of which is mounted on a separate shaft passing through the lower part of the main casting. These shafts have eccentrics formed at each end, and by turning these eccentrics it is possible to adjust the cutting tools in a vertical direction to allow for any alteration in height which may have been introduced by grinding. The transverse adjustment of the tools is effected by a knurled nut mounted on a stud fixed in the tool post, and working in a slot formed in the side of the tool. The tools themselves fit in slots in the tool posts, and are each clamped in position by a bolt and nut.

The tool posts are rocked by means of two eccentrics mounted on a central shaft passing through the upper part of the main casting, and clearly shown in Fig. 2. These eccentrics, which are con-

*From "Engineering."

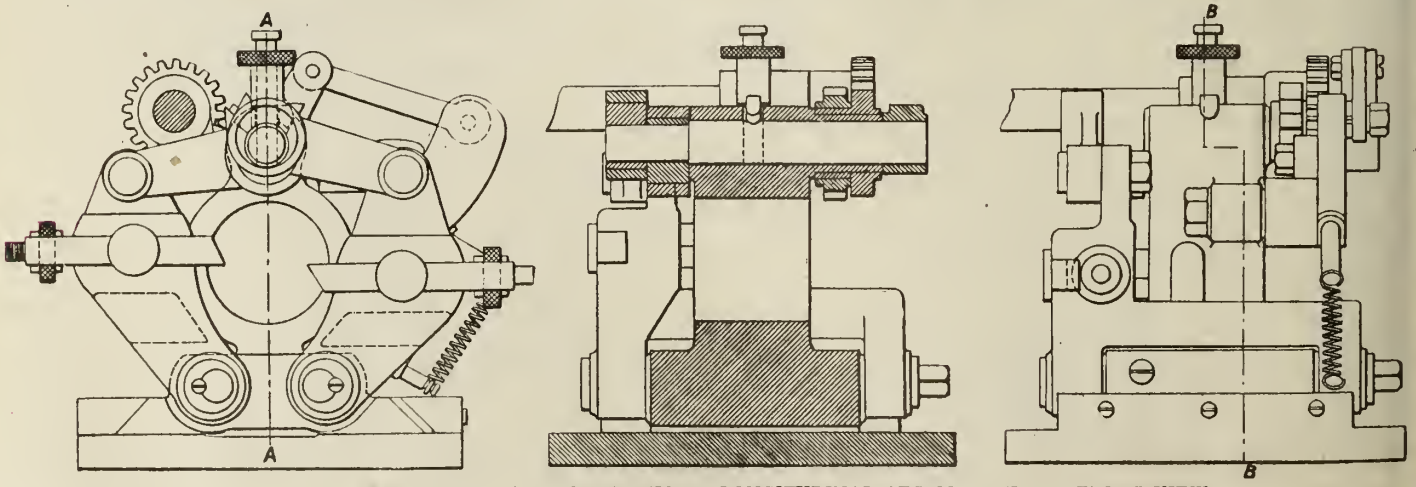


FIG. 1—LEFT HAND VIEW. FIG. 2—LONGITUDINAL SECTION. FIG. 3—FRONT VIEW.

nected to the tool posts by means of short links shown in Fig. 1 are set at an angle of 180 deg., so that angular motion of the shaft will cause both the tool posts to advance into, or recede from, the work together. Mounted loosely on the opposite end of the central shaft bearing is a gear wheel and on a sleeve extending from the boss of this wheel is screwed a ratchet-toothed cam, which can be distinguished in most of our illustrations. The cam is driven from the nose of the lathe by means of a shaft having two universal joints. The key of the gear wheel meshes with the one attached to the cam and fits into a long keyway. This arrangement allows the whole attachment to follow the side traverse of the saddle in screw cutting or other work. The cam rotates at the same speed, and in the same direction, as the work, and it may here be mentioned that the cam must have the same number of teeth as the tool being relieved. The actual diameter of the cam, and the shape of the teeth, are immaterial, but the teeth must be formed with feather edges. Certain special types of reamers and cutters in which the teeth are unequally spaced can be relieved by means of the attachment, but for this purpose the teeth of the cam must, of course, be spaced to correspond with those of the work.

Referring to Fig. 4, it will be noticed that the teeth of the cam engage with an adjustable pawl mounted on one arm of a bell-crank lever, which is pivoted on the main casting. As the cam rotates in an anti-clockwise direction the arm of the bell-crank lever will be pulled downwards until the pawl escapes from the tooth of the cam, when it will be pulled up into engagement with the next tooth by the action of a light helical spring. The combined effect of the cam and spring is thus to impart an oscillating motion to the bell-crank lever. On the other arm of the latter is formed a segmental groove, and in this groove a block, to which a short link is pivoted, can be clamped in any position. The other end of the link is connected to an arm keyed on to central shaft, above referred to, and in this way the oscillating motion of the bell-crank lever is communicated to the central shaft, and also, through the eccentrics, to the tool posts. Two short springs fitted between projections on the forked parts of the tool-posts and the main casting, and clearly shown in Fig. 4, are provided in order to take up any lost motion due to wear of the links, etc.

It will be obvious that the position of the block in the segmental groove determines the magnitude of the angular oscillations of the central shaft, and consequently those of the tool posts, so that, by adjusting the block, the amount of relief can be varied at will quite independently of the shape of the cam. The actual amount of relief is indicated by a scale engraved on the arm of the bell-crank lever, as shown in Fig. 4, the figures giving the amount of relief in millimetres. The motion will, of course, cease entirely if the block is brought

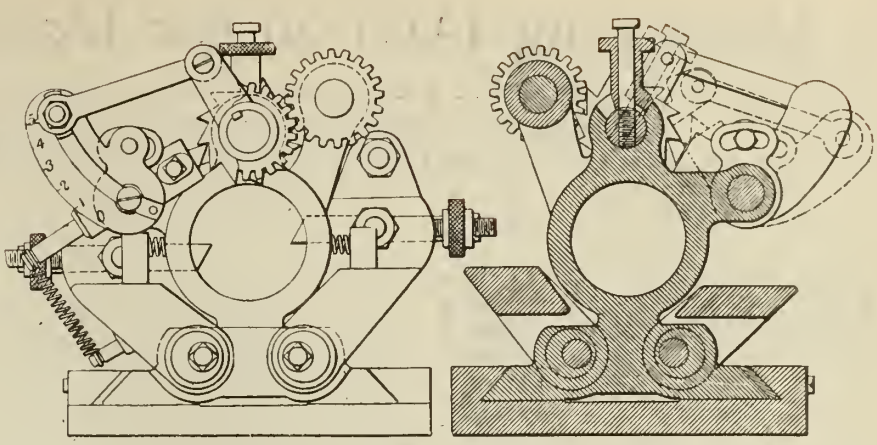


FIG. 4—RIGHT HAND VIEW. FIG. 5—CROSS SECTIONAL VIEW.

down to the centre of oscillation of the bell-crank lever, and this enables ordinary plain turning, or screw cutting, to be done without removing the attachment from the lathe. The only other feature of the mechanism now remaining to be explained is the means provided for limiting the backward movement of the tools in normal working, while allowing them to be brought back clear of the work before reversing the motion of the saddle to commence a new cut. This arrangement is best shown in the cross-section, Fig. 5, from which it will be seen that a bolt fitted with a sliding sleeve is screwed into the middle of the central shaft. A tongue formed on the sliding sleeve fits into a slot in the main casting, and normally limits the movement of the shaft by coming into contact with the end of the slot, but when it is desired to withdraw the tools from the work the tongue is pulled out of the slot by raising the sleeve. This allows the spring attached to the bell-crank lever to pull the latter back into the position indicated by the dotted lines in Fig. 5. In this position the tools will be quite clear of the work and the pawl clear of the cam; the lathe can then be reversed without altering the adjustment of the tools in the tool holders. This is a great advantage when relieving screwed hobs, and is also convenient for ordinary screwing without relief.

As previously mentioned, the front tool only is used for relieving, but for plain turning and screwing both tools are employed, and it is then convenient to be able to feed both tools into the work simultaneously and withdraw them together at the end of a cut; otherwise there could be no necessity for connecting the back tool to the oscillating mechanism. When operating both tools for plain turning or screwing the bell-crank lever is pinned in the position shown by the dotted lines in Fig. 5, and a simultaneous feed is given to the tools by moving the link down the slot in the lever arm. It is, of course, not necessary to disconnect the backpost when relieving; the tool need only be screwed back clear of the work.

An important advantage of the pivoting tool holder in comparison with the horizontal slide of the ordinary relieving lathe, is that, in the former, the tools can be adjusted so that the cutting angle remains constant at all parts of the cut, and consequently greater cutting efficiency is attained and a tool with much less clearance can be used. That it is necessary to tilt the tool for this purpose will be obvious when it is remembered that the normal to the relief curve at the cutting edge of the tooth being formed coincides with the radius of the plain cylindrical blank, since no metal is removed from this part of the tooth, whereas, at the inner end of the curve, the normal is inclined by an amount depending on amount of relief. In ordinary relieving lathe, in which tool moves horizontally, no allowance is made for this feature, and the cutting angle may therefore vary by 15 deg. or 20 deg. from one end of the relief curve to the other. Another advantage of the pivoted tool holder is that the friction is considerably less than that of a sliding holder, and consequently a greater proportion of the power supplied is available for the cut in the former system. It is also pointed out that the fact that the tool-holder is operated from a point well above the tool gives great rigidity in cutting.

The attachment illustrated can be applied to any screw-cutting lathe of 6 in. centres, or upwards, and is capable of dealing with work up to 2¼ in. in diameter for the whole travel of the saddle, while work up to 2½ in. in diameter and 1 in. inch wide can be relieved outside of the central hole in the main casting; larger sizes are, however, now being made. Messrs. Milton, it may be added, themselves use the attachment extensively in the manufacture of small tools.

At the request of the Swiss Standards Association, Baden, Switzerland, for co-operation in the work of standardization of ball bearings, the American Engineering Standards Committee requested the American Society of Mechanical Engineers and the Society of Automotive Engineers to act as Joint Sponsors for the project. These societies have accepted the responsibility and are now organizing a Sectional Committee for the work. The Sectional Committee will be thoroughly representative of all the interests involved and is the body which will be responsible for the detailed formulation of the standards.

Interesting Data on the Design of Flywheels

A Flywheel is a Complicated Part to Design, and Owing to Its Function, it is Dangerous to Guess at its Proper Proportion. The Data and Chart Herewith Should Remove All Doubt.

By JOHN S. WATTS

THE designing of fly wheels is a rather complicated affair, and is not given the attention it deserves in the text-books. A fly wheel designed by rule of thumb, as most of them are, may very easily prove a dangerous article.

Fortunately for the rule of thumb designer, it is impossible to make the fly wheel too heavy, as the heavier it is the more effectively it will perform its function of keeping the periodical fluctuations of speed down. While a heavy fly wheel gives a steadier speed, it is, however, wasteful to use one heavier than is really necessary, as it imposes an unnecessary loss on the power of the engine or motor by reason of the additional friction of the bearings.

The arms of the fly wheel, if not properly designed, may be dangerously weak, as it is essential that these arms be sufficiently strong to transmit the strain, due to the fly wheel alternately taking energy from the shaft, and returning energy to the shaft. The arms are really the weak point in many designs, and the method of calculating the dimensions of the arms by an empirical formulae in proportion to the section of the rim is misleading. The strain upon the arm is more dependent upon the percentage of speed variation which occurs, and upon the length of time during which the fly wheel is giving up energy, than it does upon the weight of the rim.

There are, broadly speaking, two main uses for fly wheels, first, on steam engines, to bring the periodic fluctuations of speed during each revolution due to the varying leverage of the connecting rod, and to the variations in steam pressure in the piston during the stroke, down to a pre-determined percentage necessary for the efficient use of the machinery to be driven by the engine.

Secondly, fly wheels are used on machines that are performing work during only a part of the time, such as punching and shearing machines, etc. The function of the fly wheel in these cases is to store up energy from the motor during the period that the machine is running idle and deliver up this energy while the machine is under load, thus enabling us to use a much less powerful motor than would otherwise be necessary.

Taking up the design of a fly wheel for a steam engine first, the requirements are to know the variation between the maximum and minimum turning efforts on the crank pin. It is obvious that the minimum turning effort is zero, and occurs at each dead centre. The maximum turning effort is when the crank is at an angle of ninety degrees with the connecting rod as shown in Fig. 1. That is assuming that the steam is not cut off until the crank has passed this point, which, as the piston is then at about four-tenths of its stroke, is unlikely.

Calling the effective pressure on the piston P, and the resultant pressure along the connecting C, we have

$$P = C, \cos a$$

and, as the angle

$$C A B = \text{the angle } A D C$$

$$\therefore A B = A C \times \cos a$$

The turning effort being

$$C \times AB = C \times A C \times \cos a$$

$$= P \times A C.$$

We must now decide as to what fluctuation of speed we can allow during one revolution, which depends entirely upon the purpose for which the power of the engine is to be used. The following table may be taken as fairly average practice for the purpose specified therein, the fluctuation being expressed as a percentage of the mean speed.

Hammering and crushing machinery	20%
Pumping and plate shears or punches	5%
Portable saw mills	4%
Machine shop tools	2.8%
Textile and paper making machinery	2.5%
Flour mills and spinning machines	2%
Electric generators	2-3%

The mean turning effort can be arrived at by calculation from the indicated horse power of the engine, as follows:

$$\text{Mean turning effort in inch pounds} = \frac{H P \times 33{,}000 \times 12 \times \frac{S}{2}}{\frac{\pi \times S \times R.P.M.}{2}}$$

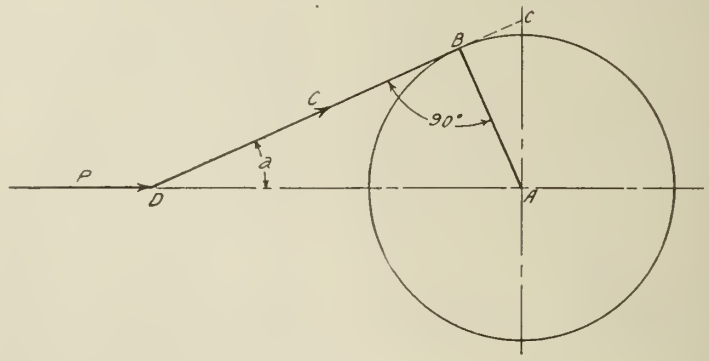
$$= \frac{H P \times 198{,}000}{\pi \times R.P.M.}$$

Where S = stroke in feet
and R.P.M. = revolutions per minute.

The problem can be stated as: to find the dimensions of a fly wheel that will have the weight and velocity required to absorb the energy due to the difference between the maximum and the mean turning effort, and to give up this energy when the turning effort is less than the mean turning effort with a total variation of speed between minimum and maximum, not exceeding that percentage of the mean speed given in the above table.

If we make up a diagram of turning moments, showing graphically the variation by finding the turning moment due to the effective pressure on the piston multiplied by its lever arm, as at A C in Fig. 1, for say each ten degrees of movement of the crank, we get a curve similar to that shown in Fig. 2.

When possible the effective pressure on the piston, as used in making up this diagram, should be taken from an indicator diagram from the same or similar engine. If that is not available, a theoretical diagram can be calculated and drawn. Note carefully that the base line



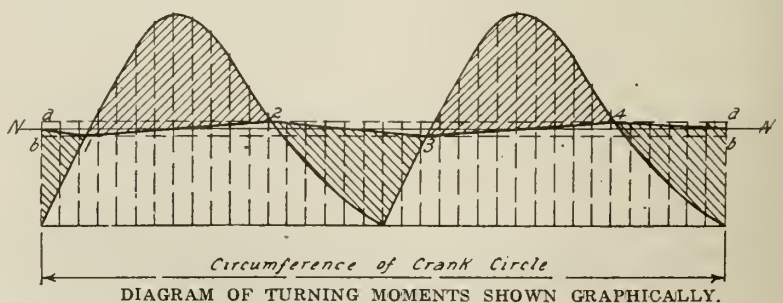


DIAGRAM OF TURNING MOMENTS SHOWN GRAPHICALLY.

of the diagram is equal in length to the circumference of a circle whose diameter is the stroke of the engine, and represents the travel of the crank pin not the piston. The vertical lines represent the turning moment in inch pounds at each ten degrees movement of the crank pin.

The line N N represents the turning moment, and the dotted lines, a a and b b, represent the allowable variation in speed, which will be proportional to the variation in turning moment allowable. That is, the distance between the lines a a and b b is the same percentage of the height to the line N N as the percentage of speed variation allowed.

Now, if the fly wheel absorbs the energy due to the turning moments above the line 1, 2, shown shaded, and gives out this energy to increase the turning moments of the engine, when it falls below the line 2, 3; also shown shaded in the diagram, the resulting combined turning moment of engine and fly wheel will always be between the two lines a a and b b. And it follows that if the turning moment is kept within the prescribed limit of variation so will the speed.

The area of the shaded portions in Fig. 2 represents the energy which is to be absorbed and given out by the fly wheels, and as of necessity, the energy given out must be exactly equal to that absorbed, these two areas must be equal. The dotted lines a a and b b must, therefore, be raised or lowered, keeping the distance between them the same as before until the shaded areas above and below are equal to each other

As the peripheral velocity of the crank pin will be directly proportional to the turning effort at any point of its revolution, we may take the line N N as representing the mean velocity, and a little study will show that the actual velocity of the crank pin, and also of the fly wheel, will vary about as indicated by the line 1, 2, 3, 4, and that the fly wheel must store up the energy represented by the shaded portion above the line 1, 2; while increasing its speed from the minimum at point 1 to the maximum at point 2.

To find the value of this area in foot pounds of energy, the vertical heights being moments in inch pounds, and the horizontal lengths being distances travelled through, the mean height of the area will be the mean effort in inch pounds, which, divided by the radius of the crank pin circle in inches, will give us the mean pressure in pounds on the crank pin, and multiplying this by the horizontal distance between the points 1 and 2, in feet, which is the distance through which this mean pressure acts, the product will be the energy in foot pounds to be stored up in the fly wheel.

The energy to be given out by the fly wheel having, as already shown, been made equal to that absorbed, we need not concern ourselves any further about it.

Now, having determined the energy to be absorbed, and knowing the increase of speed which can be allowed in the fly wheel while taking in this energy, we can evolve a formulae which will give us the required weight at any chosen velocity of rim, which, of course, depends upon the speed of the engine and the diameter of pulley which can be used.

The kinetic energy of a fly wheel in foot pounds is

$$\frac{V^2 \times W}{2 \times g}$$

Where

V = Velocity in feet per second of the centre of gyration of the rim

W = Weight of rim, in pounds

g = Acceleration due to gravity = 32.2

And, in the following formulae:

E = Energy in the fly wheel at the maximum velocity

e = Energy in the fly wheel at its minimum velocity, both in foot pounds

V = Maximum velocity in feet per second

v = Minimum velocity in feet per second

The excess energy, to be absorbed, has already been decided and will be = E — e, and calling this quantity x, we have

$$E - e = x = \frac{V^2 \times W}{2 \times} - \frac{v^2 \times W}{2 \times g}$$

$$\therefore x = (V^2 - v^2) \frac{W}{2 \times g}$$

$$\therefore W = \frac{x \times 2 \times g}{V^2 - v^2}$$

It will be noted that the weight required decreases as the square of the velocity and that it is therefore more economical to make the diameter, and hence the velocity of the wheel, as large as circumstances will permit, up to the limit of velocity of one hundred feet per second, which should not be exceeded as above that speed the stress due to centrifugal force becomes too high for safety, that is for cast iron wheels.

The turning effort for cross compound and triple cylinder engines is much less variable, and can be shown by a design similar to figure 2, and is determined in the same manner, as for the single cylinder engine by adding on the proper lines the turning moments for the other cylinders to that of the first cylinder, thus getting a curve exhibiting the varying moments of each crank position for the combined moments of all the cylinders.

For the fly wheels of punching machines and the like, the power supplied by the belt or motors is taken as being uniform, and the energy to be absorbed can be arived at by calculating the power in foot pounds, supplied to the machine during one cycle. From this should be deducted the percentage necessary to overcome the friction of the machine.

Then calculate the foot pounds of energy required to punch the hole and deduct from it the amount of energy put into the machine (over that required to overcome the friction), during the period of time in which the hole is being punched and the balance left will be the energy which is to be stored up in the fly wheel, and later given out by it with a variation of speed which should be low enough not to injure the belt or driving mechanism.

In the absence of more precise information, this variation between the high and low velocity may be taken as six per cent. of the mean speed.

The formulae given above will then give the required weight of the fly wheel, it being understood that this weight is in all cases the weight of the rim alone, as, although the arms and hub have some effect, it is so small as to be negligible.

The next point to decide is the section of the arms, which is a most important one, and the common method of calculating the arm by rule of thumb, frequently results in cracked arms after a short period of service. The cause of cracked arms is frequently blamed on internal stresses due to unequal cooling after casting, but in my experience is most often due to the arms being too weak to transmit the often severe and alternating stresses imposed upon them in transmitting the turning effort to and from the rim to the shaft.

The possibility of a machine being overloaded, or even stalled, should be also seriously considered in designing the flywheel arms as the stress in the arms of a fly wheel suddenly brought to rest may be infinite, and there is nothing more dangerous than a fly wheel when it breaks loose. The arms should be at least strong enough to break some other part of the mechanism, thus allowing the fly wheel to dissipate its energy by running idle after breaking the weaker part.

This strain on the arm can be determined from the curve of turning moments in figure 2; and while it may be possible to get a satisfactory weight of rim without drawing this curve by using empirical formulae, based on average conditions; this curve should be drawn out both for engines and machines to determine the maximum strains on the arms.

The maximum strain on the arm is found by scaling the length of the extreme turning effort above or below, whichever is the greatest, the mean line N N and the turning moment being in inch pounds, will be divided by the radius of the pulley in inches give the pull an the arms. Or, more simply, this maximum turning moment is the maximum bending moment on the arms.

If the fly wheel is also used as a belt pulley, the pull of the belt must be added to that due to the interior of the fly wheel. It may be assumed that the strain due to the inertia, or turning moment, is taken equally by all the arms, loaded as cantilevers, with the load concentrated at the end, and the stress used should not exceed 1,400 pounds per square inch for cast iron, and 3,500 pounds per square inch for steel castings, on account of the stress being rapidly reversed.

(Continued on page 65)

WHAT OUR READERS THINK AND DO

Is the Drawing Course Dead—or Only Asleep?

The Writer of This Letter Requests Us Not to Use His Name, but We Cannot Help but State that He Holds a Very Responsible Position, and Knows Whereof He Speaks.

ANSWERING to your query on page 225 of the February 25th issue of CANADIAN MACHINERY, I would like to say to you that the trouble is not with the drafting course, it is with those who are following it up. It is but natural that at the start of anything of this nature, many should say to themselves "that is just what I want, I will make up these plates and send them in. As time passes and the work becomes more advanced, all those who do not have a real interest in it will drop out from time to time.

This will hold good for almost any trade or profession, or even for school. Compare the number of pupils entering the first grade each year to those who graduate from the high schools. Compare the number of Freshmen at a University with the Senior Class. There can be nothing obtained in the way of an education of any kind without good, patient, hard work. There is no pleasure or happiness in getting results without it.

There is nothing seriously wrong with the course as laid out. I would have but one suggestion to offer and that is that all elementary work, including projections, be covered before taking up the object drawings. The great trouble with the young men of to-day is, that they want to make lots of money and put up a big front. They are not content to work as apprentices and put in their spare time in study, thereby fitting themselves for higher positions. It is an actual fact that the better the position you have to fill, the harder it is to get a man to fill it.

If the young men of 16 to 21 could only have this brought home to them in such a way that they would realize that these are the best years of their life for laying the foundation of their life's work, we would have a better class of men for these higher positions. It seems that most of these boys want to have a good time, as their sole excuse for working. This is a poor foundation on which to build up a profession. As I look at it, for a man with a leaning towards mechanical lines, there is nothing more interesting than the designing of machines to meet new problems, and there is always lots of room at the top in this work.

I was not at all surprised when your question was put. Your course had just reached the stage that the one working on it had to start and put in some real time and study on the plates. If he had no real interest and patience, he would drop out. I would like to see this course carried out for the benefit of those remaining, provided there are enough to warrant it. This is a duty you owe to those who are really interested and want to benefit by your course.

As one responsible for the design of machinery in one of our large plants, the writer has found from experience that the man who supplements his work by study, is the man who is ready to take a bigger job when the job comes along.

Editor's Note.—We appreciate this letter very much, especially as it comes from a man who is in charge of a large designing department in a modern manufacturing plant. We agree with him in every particular, and to be candid, we were very disappointed to find that readers lost interest in the course as soon as it really meant some careful study.

Suppose we make a fresh start, and, if readers so desire, under new conditions, namely, that it is not necessary to send your plates into this office. Those wishing to do so have that privilege, but the others not caring to submit their work, can study quietly at home.

We particularly wish to hear readers' opinion on this matter. For example: Suppose we ask the following questions: "Do you want the drawing course to continue? Do you want to study at home, or will you send in your plates?"

Providing we receive a reasonable number of letters favorable to the continuance of this course, we will commence it once more, from the point where we left off. It was our intention to take students right through the design of a well-known and popular milling machine, but evidently the benefit of such an opportunity was not properly realized. Let us hear from you.

Does It Really Pay to Study?

By D. A. H.

AN eminent college professor has said that it is "marvellous the power of the mind to resist knowledge." Going this one better, I might say that "it is marvellously sad to think of so many human minds that want to resist knowledge." Only a few short years ago, boys would give their eye teeth to get an apprenticeship in a machine shop, to be one of the envied few who worked among the dirt of levers and wheels and engines; and once the coveted position was obtained (at two dollars a week)—the desire came to burn the midnight oil, studying some of the none too plentiful books of the time, dealing with theoretical mechanics and drawing.

The age of the correspondence school and the trade put the tools of learning within the reach of the humblest apprentice. As the need for more men in industries grew, there came more opportunities for those with special knowledge and more money for all. Also there appeared numerous ways of spending time and money—ways far more pleasant than pounding over dry facts and figures—and there also came opportunities for earning big money on piece work without serving any long apprenticeship.

Ed. Byer and myself had been school mates together. We went to work in adjoining buildings—he in a wood-working establishment and I in a machine shop. Both of us took out correspondence courses, and for awhile we compared notes, but in two or three years the old intimacy waned and we saw little of each other, partly because his place had become unionized and worked shorter

hours than ours. Once I remember I saw Ed. and I asked him how he was getting on with his course. "Dropped it long ago,—it's only a fiasco anyway," was the answer. About a year later, as I was coming home in working clothes, I met him fully dressed for some social affair. "Aw, Don, why don't you join the union?" was the greeting as we passed.

I must admit that I was a little envious to think how he had all that extra time—by the time I was through, he had eaten and dressed and started for an evening's enjoyment. All this while I was plugging away at the old correspondence course, often falling asleep at the table and at an hour when my ex-pal was just having the biggest of times.

Now, Ed. had plenty of ability—he was naturally gifted with a pencil—he wrote a beautiful hand and was an excellent amateur draftsman. He originally intended to learn the wood-working business and study architecture at the same time, but the union seed got planted and he soaked in a full charge of that stuff about doing only so much for day's work and the bosses were out to beat the men from their rights, and so on and so forth, and with this he dropped the studying.

There came a time however when business slackened up and Ed. was laid off. Unable to get work at wood turning, his favorite branch, he grabbed a temporary job in another shop running a variety machine. The first day at this unaccustomed work cost him two fingers. This was a hard blow. He moved to a river town as soon as the wound healed and finally landed a job, moving his family shortly afterward.

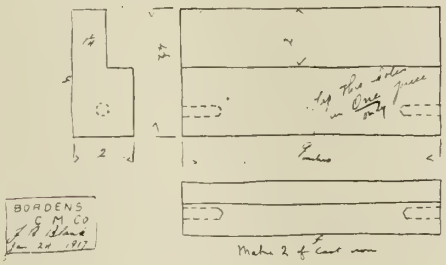
That was the last I saw of Ed. Byer until 1914. I knew that he was working at his trade like so many other good union men, depending on his union and his minimum efforts to keep him in just such a job for life, and his evenings were spent at the pictures or at the park. Ship building had been started in a small way in the river town; the war expanded this into a mighty business and a year later Ed. became one of the gang that punched the time clock at gate.

Draftsmen were needed at the shipyard—needed badly! Little wonder that this put an idea into Ed.'s brain—did more than that, as days rolled by and he saw these men who were trained step into the positions of importance and authority and salaries, not wages. Many were the regrets for the wasted hours of his youth, those hours when learning is easy and fixes itself so firmly in the mind. But our Ed. was made of the right stuff. He didn't let it go in regrets; he took out another correspondence course and started in middle life where he left off as a youth. Union hours then meant hours of deliverance, and a few months of studying to midnight brought its reward in a first promotion.. Thus leaving the rank and file, he advanced as rapidly as the advertisements tell and to-day holds a fine position in the concern which is established on a peace basis.

Another Case

I had heard of Ladue. He was supervising master mechanic for a well-known company. His work brought him to our city for some months, during which we did a number of jobs for him to avoid his having to send them to the home shop. Ladue was smart—there was no question about that—and he knew all about the business. But drawing is the language of the machine trades and Ladue didn't know how to draw. How a man ever got by in his position and how he ever reached it anyway with his ignorance has since been a mystery to me. The more so because he was constantly using drawings and paints made by first-class men—and the contact with these alone should have showed him his faults (rather deficiencies) and spurred him to train himself properly.

The accompanying sketch is a free-hand copy of a blue print made by Mr. Ladue himself. I select this one out of many because it is simple enough for any of CANADIAN MACHINERY'S be-



AN EXACT DUPLICATE OF THE STYLE SKETCH AS DESCRIBED.

ginners and yet it contains—or perhaps I should say "boasts"—no less than seven glaring errors which a two months' student would be ashamed to make. Note—no dash lines for the dimensions, arrows misplaced and turned wrong, a drilled hole shown dotted in the left elevation, the "f" for machine finish not even touching the line, the front elevation shows a full line for an invisible surface, the drilled holes which are invisible and should be dotted are drawn full, "inches" following 9 is entirely wrong, the material note is lettered in both capitals and small, a note in script should never appear on a B.P.

It is not my intention to make fun of mistakes, but this galaxy beat anything I ever saw—and that from a man supposed to be first class—and who didn't even realize his shortcomings. The moral is—Keep up your studies, for everthing you ever learn about your business will come back to repay you many times over in future years.

OIL GROOVE ATTACHMENT

By G. Barrett

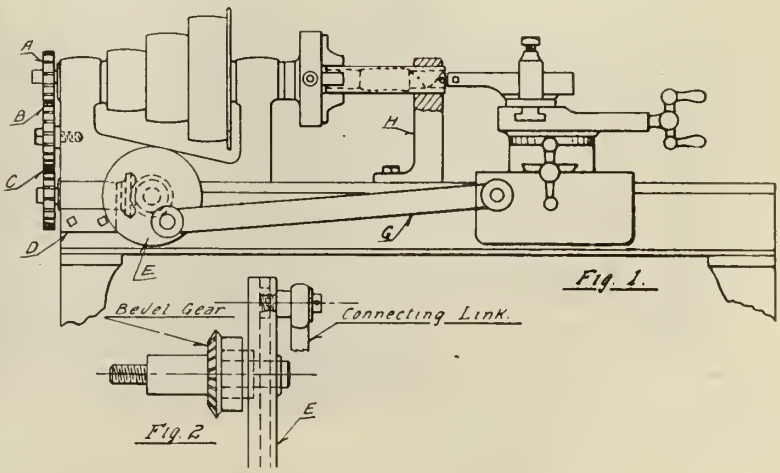
Here is how we cut some oil grooves on one of our lathes. The attachment as shown at Fig. 1 was rigged up on the lathe as shown, while the work we performed on the attachment was the cutting of grooves in drill spindle sleeves and crown gear hubs.

Referring to the front view, Fig. 1, we see that the gear A is keyed to the lathe spindle and drives the gear C through intermediate gear B. The gear C is keyed to a small shaft which is located in the fixed bracket D. At the other end of this shaft is fastened a bevel gear. This bevel meshes with another gear of similar make, which in turn is fastened to the disc E.

This latter disc is held to lathe by the stud F (shown in Fig. 2). The method of fastening the connecting rod to disc is also shown in this view.

The link G is used to adjust the length of travel of lathe carriage. The special overhang noted at Fig. 1, was used on account of the sleeves being too large to enter the spindle of the lathe. The steady rest H, however, overcame this trouble.

Miners' Board Holds Meeting.—An informal meeting of the Conciliation Board composed of representatives of the Dominion Coal Company and the United Mine Workers, District No. 26, was held at Halifax. Several recommendations were made to the board, but nothing definite could be done, the authority for the board to act not having been received from Ottawa.



VIEW SHOWING DETAILS OF ATTACHMENT.

DEVELOPMENTS IN SHOP EQUIPMENT

BAR AND COMBINATION TURRET LATHES

The Albert Herbert Ltd., Coventry, England, whose Toronto office is located at 31 Yonge St., have placed on the Canadian market their well-known lines of bar turret and combination turret lathes. We will take these up in sequence.

At Fig. 1 is shown the bar type machine. This type of lathe is primarily designed for work from the bar, but is also extensively employed for certain forged work—while the combination turret lathe, shown at Fig. 2, is firstly a chucking machine, although, like all machines of its type, by the use of suitable equipment can be used very successfully for either bar or chuck work.

The hexagon turret lathes embody many interesting features, among which may be noted—the roller steady turning tools which are fitted with graduated micrometer adjustment to the tool. The rollers are supported on both sides and can be used for a cut equal in depth to the radius of the roller, thus permitting of the use of very small rollers in relation to the size of the work. The small rollers have, of course, the additional advantage of conveniently dealing with small diameters. Only one cut is required for each diameter, the finish obtained by the side cutting tool in conjunction with the rigidly supported rollers being exceptionally high.

The hexagon turret carries eight tools as standard equipment, viz., three roller steady turning tools as mentioned above, diehead, cutting-off and forming rest; and triple tooth-holder carrying roller steady ending and centering tools and length stop which can be swung clear of the turret face and enables bars to pass through it without interference with the adjustment. The turret is of very liberal proportions, being large in diameter and with very thick walls. It is fitted with power rotation and traverse.

The neat lines of design in the geared headstock and the convenient position of all operating levers can be noted. All speeds are obtainable in either direction. The feeds are direct reading in cuts per inch and are obtained by rotating hand wheel operating sliding spring key. The scale and pointer fitted on bed and the accurate length indicator on turret pilot wheel are worth-while refinements. The chuck design entirely eliminates spring collets, the makers claiming that the solid pad pieces used have many advantages. The design of the double toggle action chuck is very rigid and powerful.

Combination Type

In the combination lathes the same attention to clean-cut lines of design, strength, rigidity and detail is shown as in the hexagon lathe. The general features of the headstocks and turrets are the same in both types of lathes—it is to be noted, however, that the headstock spindle on the combination machines are made from a solid one-piece forging with flange solid with the spindle. This method, and the fitting of the chuck direct to the spindle, makes for rigidity and reduces the chuck overhang to a minimum. A wide range of feeds is provided through the gear box—changes of feed being made by the rotation of the hand wheel shown, which registers feed in cuts per minute. The feed shaft is fitted with a safety slip clutch. The lead screws are driven by a separate shaft which is driven directly through the gear box, and each leader is used to cut threads that are multiples of its own pitch in the ratio of 1, 2, and 4.

One distinct feature of interest is that when the nut is disengaged from the leadscrew the tool or chaser being used is automatically withdrawn from the thread being cut, without changing its relation to the cross-feed screw—or vice versa. All stops are designed to be used as automatic and dead stops. It will be noted that the longitudinal stop bar is in front and below the turret instead of within the bed, and rotates in relation to the turret. Stops may be placed in any position on its length and as many stops as may be desired in relation to any face of turret can be used. The usefulness of this on such work as repetition forming is apparent. A refinement in design in the longitudinal stops by what the makers term their unison stop adjustment is to be noted. In effect this is a means provided for adjusting the stop bar in either direction lengthwise, thus enabling such work

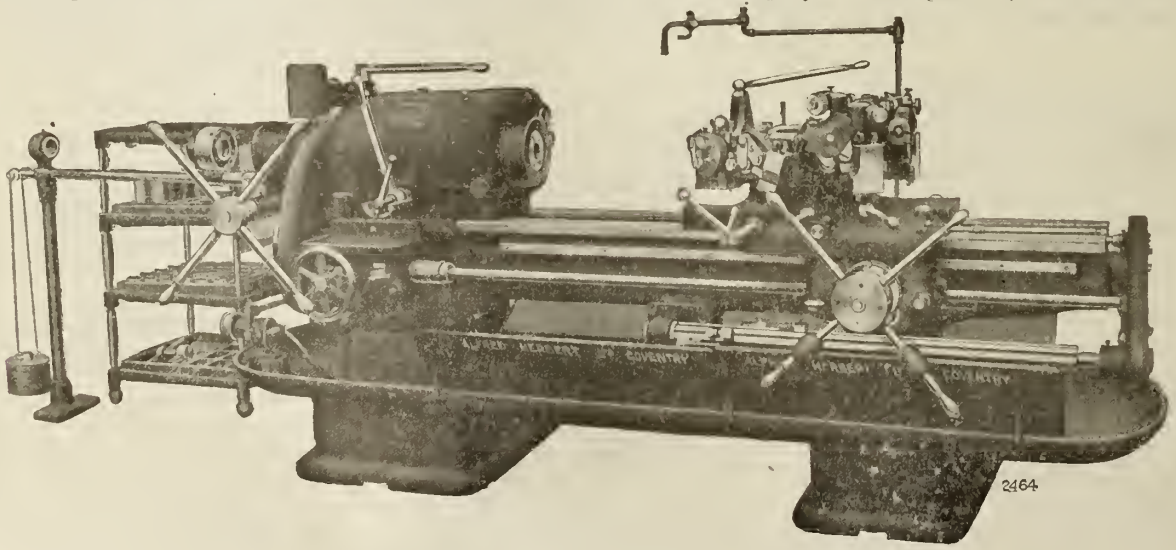


FIG. 1—GENERAL VIEW OF THE BAR TYPE MACHINE.

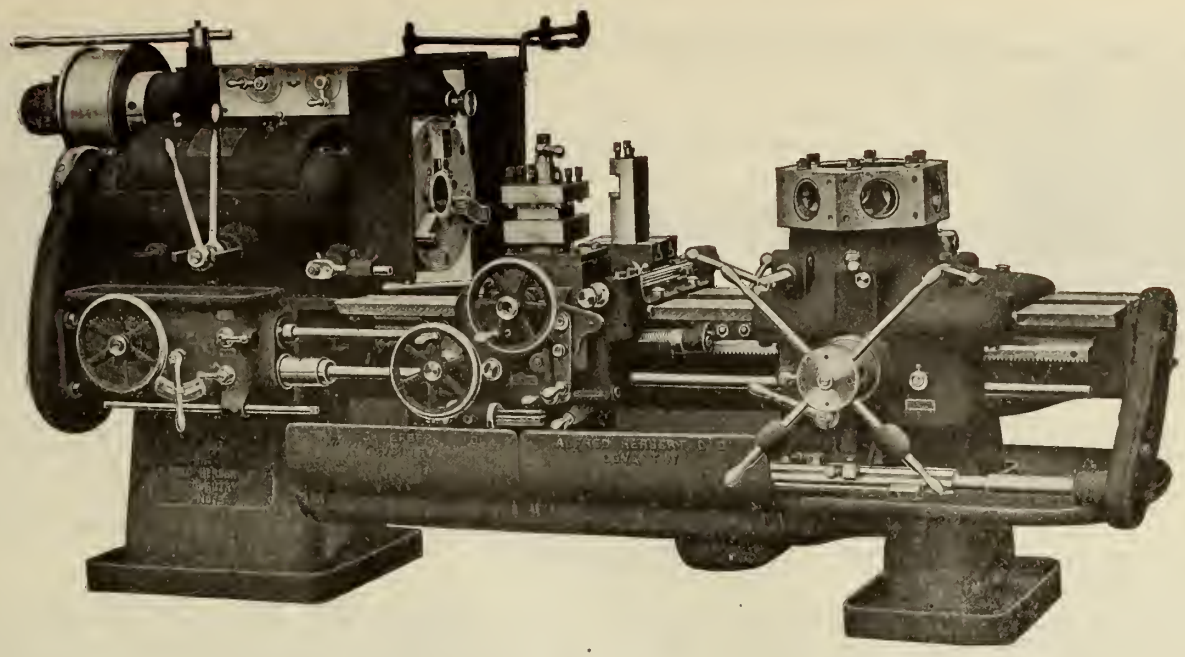


FIG. 2—THE COMBINATION TYPE, WHICH CAN BE USED ON EITHER CLASS OF WORK.

clean up in being machined. to be dealt with without individual resetting of the stops. All lubrication to turret slides and saddles is by outward flow of oil, preventing dirt from working in between these parts and the bed.

The hexagon turret lathes are made in the following sizes, with single pulley drive, bar capacities 1⅝ in., 2 3-4 in., and 3½ in. Maximum length turned, 27 ins. 36 ins., and 42 ins. Diameter of constant speed pulley, 8 ins., 10 ins., 14 ins. Belts, 4 ins., 5 ins., 5½ ins.

Spindle speeds provided, 8, 8 and 16; Feeds provided, 6, 12 and 9.

Combination turret lathes are made in the following sizes with single pulley head—

Swing, 13 in., 16 in., 20 in., 28 in.

Diameter of hole in spindle, 2 in., 2 3-4 in., 3½ in., 6 3-4 in.

Diameter of single pulley, 8 in., 10 in., 12 in., 14 in.

Width of belt, 4 in., 5 in., 5 in., 5 in.

Spindle speeds provided, 8, 8, 16, 16.

Feeds to turret slide provided, 4, 12, 18, 18.

Feeds to saddle provided, 6, 9, 9.

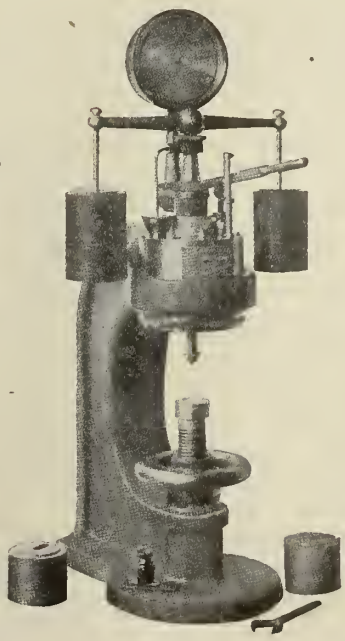
TESTING MACHINE

The Brinell testing machine, as herein illustrated, is known as style A, for 3,000 kilogram pressure, and is placed on the market by the Pittsburgh Instrument and Machine Company, Pittsburgh, Pa., U.S.A.

The Brinell method of measuring the hardness of metals is already well known. A hardened steel ball is pressed into the smooth surface of the metal so as to make an indentation, which is then measured by optical or mechanical means to ascertain the hardness of the material. It was to make measurements by mechanical means that the hardness tester was devised, and it gives direct readings to 1-100 millimeter.

To test metals, the procedure is as follows: After machine has been levelled up and test piece placed in proper position with ball, the pump is brought into action, and a 3,000 kilogram pressure (6,614 lbs.), is created on the piece. Iron and steel are subjected to this pressure for ¼ minute, while softer materials are given about ½ minute.

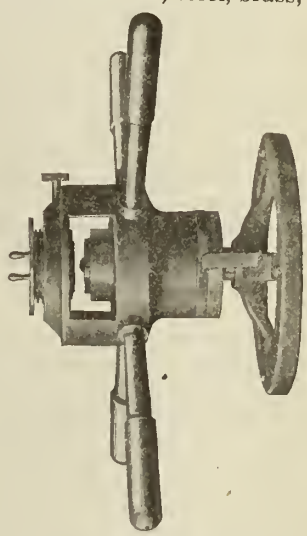
The diameter of impression is then measured with the aid of microscope, and the corresponding hardness number looked for in the table furnished.



THIS ILLUSTRATES THE STYLE A MACHINE.

METAL SHEET TESTER

The Pittsburgh Instrument and Machine Co., 101 Water St., Pittsburgh, Pa., U.S.A., have placed on the market their metal sheet tester, as illustrated. This is a machine to determine the drawing, stamping, compressive and folding qualities of sheets of iron, steel, brass, copper,



THE SHEET TESTER. TO SUIT WIDTH OF ONE-COLUMN WE HAVE TURNED THIS ON ITS SIDE.

gold, silver, aluminum, nickel, zinc, German silver, and plated metals.

In use it shows by a simple operation the workability of metal sheets. In making tests there are two graduations that are observed. One on top of machine is used to measure the thickness of the test piece, and the other, on the lower part of the machine, determines the depth of the indentation.

This machine can also be used for wire tests, a special die and holder being inserted, which permits of tests up to No. 4 B. and S. gauge.

Secured Control.—The American Chain Company has purchased control of the Page Steel and Wire Company, with mills at Monessen, Pennsylvania, and Adrian, Michigan.

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Business Conditions Are Sound

BUSINESS conditions in United States and Canada are fundamentally sound. Circumstances are not the most favorable, and there are many troubles that will not be removed for weeks and months to come. But, allowing for all that, there is nothing of the blue-ruin type in sight.

A representative of this paper attended a meeting of the Editorial Conference of Associated Business Papers in Chicago last week, where business conditions in all the fields represented were discussed by experienced business editors who were in close touch with the trade in their varied fields.

Many of the speakers made the point that the railway situation in United States, following the switchmen's strike, was the root of the trouble. The strike had been a vicious attempt to paralyze the nation's business in the shortest possible way, and for a time success was with the strikers. Canadian industries have a lot of raw material coming from United States. They can look for improvement before long, but the improvement will not be sudden, and it is likely that many months will pass before traffic is passing with the necessary speed between points in the two countries.

One point was brought out that shows a wheel within a wheel, in that the inability of the railroads under present circumstances to transport material to the shops making cars and engines would delay rapid recovery in the railroad problem. In other words, the poor physical shape of many of the roads is making it hard for them to help themselves.

The iron and steel industry has a large volume of perfectly good business on its books. Production is now around 75 per cent. of capacity, but when it is considered that capacity increased some 40 per cent. during the war, it will be seen that 75 per cent. production now is really greater than 100 per cent. capacity in the pre-war days.

The lumber trade reported declining markets, but there were factors that had been in operation to keep the markets from being filled up when these declines were on. Strikes and poor weather had kept the cut down. One expert on the situation claimed that the policy of the larger dealers in a declining market is to force the situation as much as possble and reach bottom at once, depending on past experience of reactions after sharp declines to bring them safely out of any troubles.

The feeling was also expressed that stability could be lent to the present situation in a marked way by a feeling that prices had gone their worst. Of course, there are exceptional cases where this cannot apply. In the main, though, it is worth serious consideration. Several cases were cited where large projects were hung up for the present, because those behind them were not inclined to go into the market for building or equipment, because they knew that costs would be so high that they would be unable to compete with the product of plants that had been built in pre-war times.

Business and banking circles reported that credits were being tightened rather than extended, but they claimed that the general effect was regarded as good. Makers of touring cars were being notified to cut down on their output, while builders of trucks and tractors were being assisted to go ahead. The reason was that the building of the latter would result in a greatly increased area of land being worked on the farms, and thus the new wealth of the country would be added to from year to year.

In all the reports that were delivered, there was nothing to shake confidence, or to cause one to feel that the future had in stire anything that sane commonsense could not surmount.

Knowing Your Business

THE man who knows his business from the foundry to the shipping department has the confidence of the men with whom he does business. It does not take very long to find out if a man knows his own business.

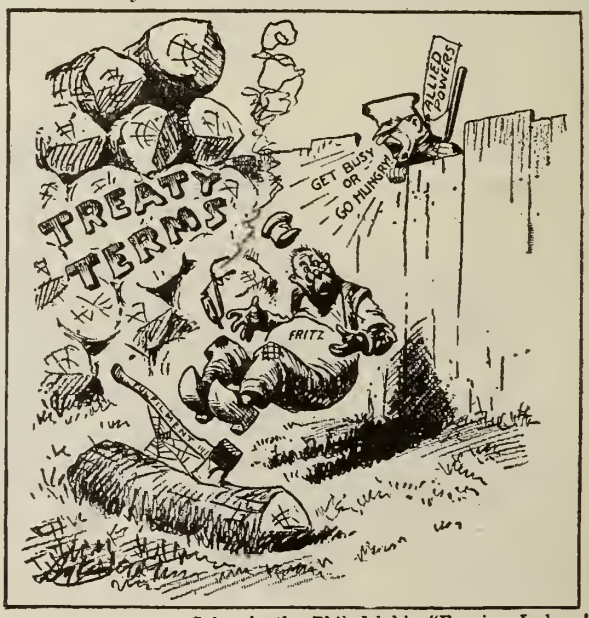
The bluffer can get along for a while, but some day he will face a proposition so big that it cannot be moved by bluff.

A Toronto financier was in an American city a few weeks ago trying to arrange for Canadian rights to a certain process. He asked for information along certain lines regarding costs, profits, markets, etc., and these were given with a thoroughness that impressed the banker at once.

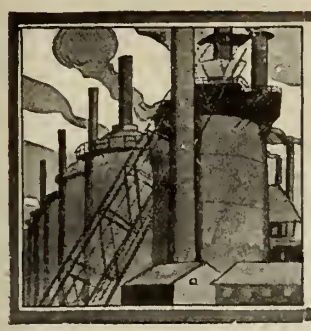
When the matter of production came up the manager of the shop said he could furnish figures for any given period. Just to try this out the banker asked for production from the first of the month. A bell was pressed, and a clerk responded. In turn he received instructions to bring in the shop production figures up to 10.30 that morning. These were produced in about three minutes. At that time it was about 10.45.

Now, there may be shops where this, because of assembled articles, would be impossible. It is possible also to put in a system so cumbersome that it costs more than it is worth to run it.

But the point is this—your banker, your customers, in fact all the people with whom you do business, will be impressed with your proposition in proportion to the degree to which you are master of the situation.



Sykes in the Philadelphia "Evening Ledger."
A Rude Awakening.



MARKET DEVELOPMENTS

Trade Hangs on the Transportation Problem

Recovery is Looked for in Part, but it Will be Some Time Before there is Much Change—The New York Machine Market is a Dull One.

THE manner in which Canadian plants can produce in many lines is measured by the extent to which they can get their shipments of raw material through from United States points. An improvement in transportation should be looked for soon, but it will be gradual, and it will take some time for it to be felt fully. Some of the machine tool dealers in United States are inclined to be critical of the equipment used by their roads to keep up their physical condition, claiming that much of the requirement is fifty years old, and is not fit to do repair work quickly or well.

Some few lines report a better service this week, especially in the importation of steel, but the amount coming through is very small in comparison with the bookings that are piled up against it. Tubes are much needed just now. Plants at this season want to make their repairs, especially in view of the shortage of Hydro power. Very ordinary orders for tubes have been sent all over the country in an effort to have them filled, but with indifferent success. Sizes such as 2", 3", 3½" and 4" are much wanted.

So far, products of the merchant bar mills have been the one bright spot as far as keeping up the steady supplies is concerned, but it is doubtful if the same can be said for bars any longer. Mills that were making good shipments to the Canadian trade find their operations seriously interfered with by reason of the shortage of coal or coke, as well as other shipping facilities, and right now the bar situation is becoming more serious.

There is a good general business moving in machine tools and supplies, although individual orders are not particularly large.

The scrap metal market continues dull and uninteresting. Buyers of steel scrap are not anxious to take on anything in that line. The volume of business in these lines is small at present, and a recovery of the shipping situation is necessary to bring about much improvement.

ABOUT THE WAY NEW TAXES WORK MONTREAL FIRMS ARE NOT SURE

Special to CANADIAN MACHINERY.

MONTREAL, June 10.—There is every reason to believe that the present form of taxation, and the doubt that generally prevails as to the exact interpretation of its application, are among the chief factors that are influencing trade conditions at the present time. The general method seems to be to "pass the buck," in such a way that at each transaction the tax is transferred to the succeeding purchaser, so that in reality, the final customer (or the consumer) foots the bill. In the case of the manufacturer, jobber, and dealer, each has the privilege of passing on the additional cost of the tax—and as the selling price, in each instance, is based on a certain percentage of the cost price, the succeeding costs are increased in proportion, consequently, the final purchaser, while not remitting direct to the Government, is nevertheless paying all the intermediate taxes. As a result of the widely distributed atmosphere of uncertainty, business has become more or less disorganized, and it is the opinion of many that improvement will be much hindered by these conditions.

The soft coal situation has taken on a serious turn here, and some plants have closed down, while others are considering extensive curtailment of operations until more favorable conditions are assured.

Steel Shortage Acute

That manufacturers and jobbers are experiencing continued difficulty in getting material through from the producers, is shown in the falling off in general industrial activity in many parts of the country. "We are advised by officials of our principal mills in the States, that a number of shipments have been on the way for as long as four or five weeks, and that the acumulation of semi-finished steel in the yards is ample to meet present demands of the trade, provided the material could be handled by the railroads." This statement, by a dealer here, reflects the congested state of transportation companies and emphasizes the need of additional rolling stock for the carrying of commodities. It is not entirely a scarcity of cars that has created this condition, but rather the large number of loaded cars that are virtually tied up at different places between the points of shipment and destination. Factories in this district have suffered from insufficient supplies and many will have to consider curtailment in operation in the very near future, unless relief is forthcoming—a hope which at present is shrouded in uncertainty. One shipyard here has reduced operations owing to the non-delivery of steel supplies. Dealers, however, are quite optimistic regarding the summer outlook, but are reluctant to make any definite forecast—an attitude that cannot well be criticized under existing conditions. Minor price adjustments have been made on some lines, but relate more to individual sales than to the general market. Quotations continue firm and nominal.

Little Change in Metals

A passive interest is still displayed in what continues to be an inactive market, the demand for non-ferrous metals being below normal. Railroad troubles in the States and the consequent demoralization of trade in general has tended to quieter conditions and curtailment of output, a natural sequence to restricted supply. The solution appears to hinge on a satisfactory adjustment of operating conditions. Trade, in general, is influenced very largely, by the production and distribution of basic essentials, and when

these elements fail to function properly the disturbing effect is at once felt all along the line. With the exception of tin the metal situation remains unchanged. Tin has weakened under increasing supply and restricted demand.

Dullness Continues

Old material movement continues very quiet, and a tendency to lower quotations has developed. So far, however, no concerted move has been made by dealers here to suggest a decline, although it is believed that sales have been made at figures below those quoted. While the present dullness is quite pronounced, some dealers are anticipating a revival of activity when trade becomes more stabilized. Local demand for machinery scrap is comparatively quiet and general sales are below normal. Dealers are not showing any anxiety as they have little to gain by accumulating warehouse or yard supplies. In some instances they are not in the market for certain scraps.

MUCH DEPENDS ON THE RAILWAYS NOW

More Improvement in Them Means Better Output From Many Canadian Shops

TORONTO—The measure of improvement in railway transportation is to a large extent the measure of improvement that will be possible in the Canadian field. Materials are being used up by the factories as rapidly as they come in. The more rapid the income the greater the production of the plant.

The question of the railroad situation, especially in United States, is receiving a great deal of consideration at all hands. One United States expert stated to CANADIAN MACHINERY this week that the roads of that country were in a poorer position to handle freight and kindred shipments now than they were before the outbreak of the war. In this connection there is a peculiar position, in that the poor physical condition of the roads is one of the things that is keeping them from getting help in the way of new rolling stock and new engines. The roads are unable to carry the raw materials to make these things to the shops where they can be built.

Machine tool builders in recent sessions have had much to say about the business of the railroads, from their standpoint. At the convention a week or so ago of machine tool men the statement was made that many of the railway shops were to blame for their own condition, in that they had not kept their own plants up-to-date. Some cases were cited where machinery half a century old was still in operation, and as a consequence the work of repairing or rebuilding was a slow and uncertain process.

Prices of machine tools are remaining around the same mark as has been prevalent during the past few weeks. In one case one firm making presses came down a five per cent. this week. Most of the buying that is being done, and most of the inquiries that are heard of are from small buyers, or for replacement purposes.

Builders of machine tools are largely concerned with the development of export trade. The automotive industries have been keeping up the demand for machine tools, and the tool industry wants to have something else to turn to in case this particular line of manufacturing fails to sustain its present purchasing power. Reports from several sources indicate that bankers favor financing makers of tractors and trucks more than advancing money to makers of touring or pleasure cars.

The Sale of Small Tools

No complaint comes from the makers of small tools in regard to the volume of business that is being done. Several orders during the past few days that were being figured on by several firms went to Old Country houses. Present selling schedules make it possible for the Old Country seller to get in just under the Canadian price, and there is talk of some readjustment to meet this condition. One of the dealers, speaking to CANADIAN MACHINERY this week, seemed to be in favor of boosting up the carbon goods a little and bringing down the high speed to be on a par with the competition from the British houses.

Some Shipments Coming In

Dealers are finding trouble in getting supplies of light gauge sheets. The trade speaks of No. 10 base, which takes in as a general thing from 10 to 16 inclusive. It is hardly possible to get anything outside of 10 and 12. If the 14 or 16 is wanted, then the consumer has to go to some of the light mills and pay the price. One of these mills was offering a certain tonnage to Toronto interests a few days ago. They were asked 8.50c base at mill for light stuff. According to their own explanation they had just finished a mill that was started about three years ago. The estimated cost was $800,000, but by the time the mill was ready to do business it had cost $2,000,000, and the owners were now trying to sell at prices that would help them to recover a share of that money, while there is an incessant demand at high levels. "If you can tell us how we can put up a mill at such an increase over our estimated price and then start at once to sell its production at the same price as mills that were built at a third or quarter of the cost some years ago, I'd like to know the way," was the manner in which the representative outlined their position.

Any tonnage that was booked was only such as could not be secured from other sources. The demand still keeps very keen for anything in the line of steel. Mills show a decided preference for filling orders of the heavier lines, where their tonnage piles up faster.

Merchant bars has been the one bright spot in the market for some time, but it no longer holds that enviable position, as the bar market is fast falling behind and resting with the other overloaded sections. Mills that were doing well by the Canadian trade are having trouble in securing coke to keep their furnaces in operation, and the output is falling off in proportion.

Shipments of tubes are disappointing. The demanded sizes are 2 in., 3 in., 3½ in. and 4 in. Many of these are wanted for the making of needed repairs to existing plants. Several mining companies are placing large orders. Plants realize that electric power is hard to secure in excess of existing allotments, and they are having their steam plants placed in readiness to make the most of the fuel consumed. Nearly every firm handling tubes has a large amount of orders accumulated against any shipments that may come in.

Scrap Still Dull

There is nothing to show a betterment in the scrap metal market. Dealers do not want to buy steel scrap. In fact several of them would be highly pleased to sell some. There is not likely to be much recovery in this line until traffic conditions are such that steel plants can get enough coal or coke to keep their plants in operation.

POINTS IN WEEK'S MARKETING NOTES

Bar mill products are not coming through as freely as formerly. Some mills that were giving the Canadian trade good service are now being embarrassed by shortage of coal or coke.

—

Boiler tubes are much needed for urgent repair work, while the supplies coming through are small and out of all proportion to the need.

—

The scrap metal market remains very quiet. Buyers of steel are out for the present and dealers would rather sell than take on more stock.

—

Some markets in Canada are still rather confused over the new taxation rulings.

—

Pig iron supplies in Canada are not plentiful, and quotations run as high as $53 and $55.

—

It is estimated that U. S. mills have over 1,500,000 tons of finished steel stacked at the works waiting for delivery.

—

The auto trade in the States has cancelled some tonnage of material on the advice of their banks. There is no retarding on the output of trucks and tractors.

ANY CANCELLED ORDERS ARE FOR THE HIGH-PRICED MATERIAL IN AUTO TRADE

Special to CANADIAN MACHINERY.

PITTSBURGH, June 10. — Production of pig iron in May was at the rate of about 35,550,000 gross tons a year, this comparing with rates of 33,650,000 tons in April, and 40,050,000 tons in March, the March rate having been the highest since October, 1918. Recovery from the effects of the rail strike and the congestion it produced has been greater than indicated by the mere comparison of the figures, since the rail strike did not greatly affect production until about the middle of April, while production increased during the second half of May. The low point in production may be estimated at somewhat under 30,000,000 tons a year about the third week in April, and the rate at the end of May about 37,000,000 tons. By this time the 40,000,000 ton rate of March is probably closely approached, and before the end of the month that rate may be exceeded, for it is a case now, not of any strike, but of working off the congestion.

Traffic Conditions

The rail strike is practically over, so far as there being left many strikers or "vacationists." The men have either gone back to their own jobs or have secured temporary or permanent work elsewhere, with the exception of groups of men here and there. The railroads may still be undermanned to an extent, in point of numbers, but more important is the point that they have some new recruits, not fully trained to their work. Of much more importance still is the fact that the yards and sidings are congested, and it is slow work making the start to relieve them. After one-third the work has been done, the other two-thirds will be accomplished much more expeditiously.

As to how many cars are out of normal service, either through having gone astray or through still being loaded with freight and not arrived at destination, no estimate can be made, as there is widely variant testimony on this. For instance, of two furnace interests not far apart, one reports that it has a large tonnage of Connellsville coke en route to it, but largely stalled, while another reports that it has very little, hardly as much as the average when traffic conditions are normal.

From all quarters one secures the statement that traffic conditions have been improving, although slowly. There are better supplies of empties all around for loading, but the supplies increase almost imperceptibly from day to day. Movements are somewhat better, and there seems to be more loaded cars received by consignees each day than are dispatched by shippers, but the difference is not very great.

Generally speaking, the steel mills are hardly as yet shipping as much steel as they are making, but there is almost an even break in this respect, and probably there will be within a fortnight. As to moving the accumulated steel, perhaps over 1,500,000 tons all told, that is for the future. There are exceptions, however. One mill is reported to have shipped in the past week twice as much steel as it made, but this is probably a little bit of an exaggeration.

Production

Production of steel, on the whole, has not increased much in the past week or two, but it was not particularly important that it should be, the chief desideratum being to move the steel already accumulated. In the Mahoning and Shenango Valleys, however, where output was greatly restricted, there has been much improvement, and the valleys are now operating, in the matter of making crude steel, at about 70 per cent. of capacity. In the case of the valleys and of some mills elsewhere, not all the steel currently made is being put into material in shape for shipment, as there is accumulation of ingots and of partly rolled steel, it being advantageous to hold steel in such forms rather than carry it to the last degree of finish when it cannot be shipped. As a rule finishing departments can stand some overload, and the partly finished steel can be picked up a little at a time from week to week and carried through.

The rate of steel production may be estimated at about 85 to 90 per cent. of the rate attained in March, which in turn was 85 to 90 per cent. of actual capacity. The percentages refer to steel making rather than steel finishing.

Quiet Markets

The various branches of the finished steel market are quieter, or in other words they are more completely stagnant. There is a moderate volume of business being placed by regular customers of mills for forward deliveries, but this business is chiefly with the Steel Corporation, in whose prices the consumers have confidence on account of their being lower than the independent prices. The independents that are filled with business for from two to four months are not booking a great deal, although they are booking some. As to prompt deliveries, there is now relatively little business done in that line, but there is enough to keep prices from sagging entirely to the price level ruling for deliveries a few months hence. The premiums for prompt shipment are simply declining.

As to cancellations, there are no reports of cancellations except in the case of the automobile trade, which is reported to have cancelled some orders for sheets, also some orders for special grades of cold-rolled steel. Details of these operations are not procurable, but it is quite probable that the cancellations refer to particularly high-priced orders in which deliveries were not made according to contract, the buyers having curtailed their consumption so that they can get along with their regular deliveries, purchased previously at lower prices.

Pig-Iron

Even the most sanguine of the pig iron producers now report that they are doing practically no business. The forward market practically stopped some time ago, but there remained some activity in prompt lots, the demand growing chiefly out of consumers being shut off from their usual sources of supply by the rail strike. Now there is fairly free communication, the merchant furnaces being able to ship to practically all their customers. In the circumstances, market prices are nominal. They are not tested to any extent by actual transactions and lower quotataions are not made, for as a rule the furnaces do not offer iron at cut prices when there is no inquiry. The market remains quotable as follows: Bessemer, $43; basic, $43.50: foundry, $45, f.o.b. valley furnaces, freight to Pittsburgh being $1.40.

Connellsville Coke

Production of coke in the Connellsville region is now running at about 185,000 tons a week, against an average of 245,000 tons a week before the rail strike. The present rates represent a fair gain from the low point. Nearly all the coke is going out on contracts, but even with the limited offerings in the open market foundry coke has weakened a trifle, being now at $15 to $15.50 per net ton, Connellsville ovens, while furnace coke remains at $15, both for spot shipment. Some brokers think that as foundries receive better pig iron deliveries the demand for spot foundry coke will increase somewhat in the next fortnight. Generally speaking, of course, the market is marked for a decline.

NEW YORK TOOL MARKET IS QUIET

Although Some Lists Have Been Issued to the Trade—Railroads are Making Purchases

Special to CANADIAN MACHINERY.

NEW YORK, June 10.—Business continues quiet in machine-tool and allied equipment, though some fairly large railroad orders have been placed and more railroad buying is in prospect. The Atlantic Coast Line has bought about $500,000 worth of shop equipment from its purchasing office at Wilmington, N.C., all of this business going to one company. Other roads which have purchased a few tools each are the New York Central and Long Island Railroad. The Chicago, Burlington & Quincy has placed orders for about $150,000 worth of tools at Chicago, and the Chicago, Milwaukee & St. Paul has an enquiry out for about a dozen machines. The Baldwin Locomotive Works, Philadelphia, is in the market for 18 cranes and a number of machines for locomotive repair work. A large part of the business pending is directly or indirectly due to the needs of the railroads for rolling stock.

The General Electric Co. has issued a new inquiry for abut 30 milling machines of various types, but otherwise there is not much demand for shop equipment from manufacturers. A good many manufacturers in the East have definitely decided to buy nothing but actual necessities for the present, at least. Some plans for expansion of plants will remain in status quo.

Shipping conditions are somewhat better, but many machine-tool plants still have quantities of unshipped tools. There have been a few cancellations of orders due to inability of sellers to deliver tools on schedule time. In some instances shipments are from one to two months overdue.

NOT ANXIOUS TO QUOTE PIG IRON

Dealers Place Toronto Prices Between $53 and $55, with an Indifferent Supply

Dealers in Canada are not anxious to give quotations on pig iron. Between $53 and $55 would be the price asked. As one dealer stated this week: "While we might name a price it is more or less nominal. As a matter of fact we are not all anxious to have you say anything about our business, as we find it hard to look after the business that we already have. Prospects for improvement in the future are not at all bright."

A New York report says that "a material improvement in demand has characterized the pig iron market in this district the past few days and sales which actually have been made, together with inquiries, which are on the point of being closed, aggregate a large total. Numerous large tonnages, making a total of more than 10,000 tons of foundry iron, have been sold, and there are inquiries out for 20,000 to 25,000 tons. Included in the sales were one or two large tonnages for prompt shipment, considerable for second half and a sizable portion for prompt export.

EXPLAIN DELAY IN WORK ON NEW PLANT

Pressed Metals, Ltd., Have New Place Under Way in States—Changes Made in Name

Some delays have taken place in the completion of the American plant of the Pressed Metals Company of Canada, and the situation is explained in the following circular to shareholders just issued:

"On account of the severe winter conditions, coal shortages, strikes, and transportation difficulties that have been prevalent for the greater part of the last six months in the United States, completion of our American plant has been delayed several months beyond calculations.

"Your directors, therefore, at a recent meeting thought it well to advise you of the situation.

"The buildings have been completed, and the machinery and power equipment are now being installed rapidly. Indications point to the commencement of manufacturing of bushings by July, and the operation of the plant to capacity within three months thereafter.

"The intention was to distribute the stock of the International Bushings, Ltd., and the preferred stock of the American Bushings Corporation, after the American plant was operating, but the distribution has consequently been delayed. However, your directors are now very optimistic regarding the operations of the company.

"The organization of the American company, with plant situated on the St. Clair River at Marysville, Michigan, has been completed and will operate under the name of American Bushings Corporation."

GERMAN TRADE NOT RESENTED

Sheffield Despatch Says Their Goods are Often Needed to Fill Out Orders

That British firms are glad enough to get certain lines of German-made goods is the information of one correspondent writing from Sheffield to a British paper. He states: "Importations are increasing, and there is more continuity about the supplies, but, comparatively speaking, the quantities are insignificant. Merchants and dealers, unable to obtain as much goods as their customers want, are eager to get the deficiency made good by any country, and the difficulties of the situation have done much to destroy the prejudice against our late enemy. Germany is at present sending us pen and pocket knives, scissors, manicure instruments, and hair clippers. There has been a big importation of German alarm and wood-case clocks, and these are particularly acceptable, as the home country does not make many such goods, and there is a very acute scarcity of them. Very little enamel and other domestic hollowware is coming from Germany. As this material is extremely dear, some of the large merchants have been visiting Germany for the purpose of getting cheaper supplies, but they found the production very limited. A revival seems to be taking place in the trade in Bohemian and German glassware. Vast quantities of bottles and glass vessels are used in the manufacture of electroplate, and users are doing their best to stimulate trade with Bohemia, which served them so admirably before the war. Deliveries from this source, although increasing, are quite inadequate, as the makers in Bohemia are short of raw materials and fuel."

STEEL TREATERS MEET

The good work of the Toronto Chapter of the American Steel Treaters Society was continued on Tuesday evening, June 1st, when they held their regular monthly meeting at the King Edward Hotel.

The speaker for this occasion was Professor T. R. Louden, of Toronto University. His subject was an extremely interesting one dealing with the Iron Carbon Diagram. He explained the dividing lines between steels and cast iron, the percentage of carbon in these classes of metals, the effects of overheating, how to overcome these effects, and many other phases of interest to anyone interested in the development of heat treatment.

After the lecture was completed, discussion was started, and many interesting points were brought out during this period of the meeting. Past experiences were retold to help others who might strike like difficulties. A motion was adopted to place before these meetings, problems which crop up in the daily heat-treatment work, so that some valuable data will no doubt be arrived at during such discussions.

To those who are not familiar with this society, we might say that the Toronto Chapter of the American Steel Treaters Society, is a body of men interested in heat treatment in all its phases. They meet once a month for educational purposes, and have a very capable speaker for every meeting. You need not be an actual heat treatment man to belong to this society, but if you are in any way interested in heat treatment, then you are welcome.

Mr. A. Lowry, Jr., 282 Lippincott Ave., who is secretary-treasurer of the society, will be pleased to give readers any information they so desire. Write him requesting the date of the next meeting and he will forward you all particulars.

FUEL RESEARCH IN GREAT BRITAIN

A large and well-equipped fuel research station has been established near London, England. It has been designed by the Fuel Research Board, formed under the Department of Scientific Industrial Research, and has been built out of funds provided by the Treasury. Its main object is to carry out large-scale experiments in the low-temperature carbonization of coal with a view to obtaining smokeless solid fuel for domestic and industrial use, gas for power purposes, oil fuel for the navy, and internal combustion engines, and a number of other by-products. Careful arrangements have been made for exact measurements in every step in the treatment. Plant has also been installed for research into the economies of pulverized coal, the utilization of peat, and the production of fuel alcohol. A detailed survey has been made of the qualities of coal available in Great Britain; and the analysis of the samples of coal used in the experiments has been placed on a scientific basis. Important results are expected in the near future.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$42 40
Lake Superior, charcoal, Chicago	57 00
Standard low phos., Philadelphia	50 00
Bessemer, Pittsburgh	43 00
Basic, Valley furnace	42 90
Toronto price:—	
Silicon, 2.25% to 2.75%	52 00
No. 2 Foundry, 1.75 to 2.25%	50 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 50
Steel bars, base, Toronto	5 50
Iron bars, base, Montreal	5 50
Steel bars, base, Montreal	5 50
Reinforcing bars, base	5 00
Steel hoops	7 00
Norway iron	11 00
Tire steel	5 75
Spring steel	10 00
Band steel, No. 10 gauge and 3-16 in. base	6 00
Chequered floor plate, 3-16 in.	8 40
Chequered floor plate, ¼ in.	8 00
Staybolt iron	9 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	4 00
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 67 to 5 50
Small shapes under 3"	3 62

FREIGHT RATES

	C.L.	L.C.L.
	Per 100 Pounds.	
Pittsburgh to Following Points		
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

	Gross. Montreal	Toronto
Lake copper	$25 00	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	66 00	65 00
Spelter	12 00	12 00
Lead	11 50	11 00
Antimony	14 50	14 00
Aluminum	34 00	36 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$ 7 25	$ 7 25
Plates, ¼ up	6 50	6 50

PIPE—WROUGHT

Price List No. 44—April, 1920.

STANDARD BUTTWELD S/C

	Steel Black	Steel Galv.	Gen. Wrot. Iron Black	Gen. Wrot. Iron Galv.
⅛ in.	$6 50	$ 8 50	....	....
¼ in.	5 13	7 26	$ 5 43	$ 7 56
⅜ in.	5 13	7 26	5 43	7 56
½ in.	6 84	8 42	7 27	8 84
¾ in.	8 45	10 58	9 03	11 16
1 in.	12 50	15 64	13 35	16 49
1¼ in.	16 91	21 16	18 06	22 31
1½ in.	20 21	25 30	21 59	26 68
2 in.	27 20	34 04	29 05	35 89
2½ in.	43 00	53 82	....	....
3 in.	56 23	70 38	....	....
3½ in.	71 30	88 32	....	....
4 in.	84 48	104 64	....	....

STANDARD LAPWELD S/C

	Steel Black	Steel Galv.	Gen. Wrot. Iron Black	Gen. Wrot. Iron Galv.
2 in.	$30 90	$37 74	$34 60	$41 44
2½ in.	45 34	56 16	51 19	62 01
3 in.	59 29	73 44	66 94	81 09
3½ in.	73 14	90 16	82 34	99 36
4 in.	86 66	106 82	97 56	117 72
4½ in.	0 98	1 23	1 24	1 49
5 in.	1 15	1 44	1 44	1 73
6½ in.	1 49	1 86	1 87	2 25
7 in.	1 94	2 43	2 42	2 90
8-L in.	2 04	2 55	2 54	3 05
8 in.	2 35	2 94	2 92	3 51
9 in.	2 81	3 52	3 50	4 21
10-L in.	2 61	3 26	3 25	3 90
10 in.	3 36	4 20	4 18	5 03

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.

4½" and larger 50%.

4" and under, running thread, 30%.

Standard couplings, 4-in. and under, 30%

Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds. Montreal	Toronto
Copper, light	$15 00	$14 00
Copper, crucible	18 00	18 00
Copper, heavy	18 00	18 00
Copper wire	18 00	18 00
No. 1 machine composition	16 00	17 00
New brass cuttings	11 00	11 75
Red brass cuttings	14 00	15 75
Yellow brass turnings	8 50	9 50
Light brass	6 50	7 00
Medium brass	8 00	7 75
Scrap zinc	6 50	6 00
Heavy lead	7 00	7 75
Tea lead	4 50	5 00
Aluminum	19 00	20 00
	Per Ton	Gross
Heavy melting steel	18 00	18 00
Boiler plate	15 50	15 00
Axles (wrought iron)	22 00	20 00
Rails (scrap)	18 00	18 00
Malleable scrap	25 00	25 00
No. 1 machine east iron	32 00	33 00
Pipe, wrought	12 00	12 00
Car wheel	26 00	26 00
Steel axles	22 00	20 00
Mach. shop turnings	11 00	11 00
Stove plate	26 50	25 00
Cast boring	12 00	12 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜-in. and less	10
Carriage bolts, 7-16 and up	Net
Coach and lag screws	25
Stove bolts	55
Wrought washers	45
Elevator bolts	Net
Machine bolts, 7/16 and over	Net
Machine bolts, ⅜-in. and less	15
Blank bolts	Net
Bolt ends	Net
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square, blank	add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 50
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	25 and 5
Sq. and hex. hd. cap screws	22½
Rd. and fil. hd. cap screws	plus 17½
Flat but. hd. cap screws	plus 30
Fin. and semi-fin. nuts up to 1-in.	20
Fin. and Semi-fin. nuts, over 1 in., up to 1½-in.	10
Fin. and Semi-fin. nuts over 1½ in., up to 2-in.	Net
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$60 00
Open-hearth billets	60 00
O.H. sheet bars	76 00
Forging billets	56 00-75 00
Wire rods	52 00-70 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 70
Cut nails	5 85
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 35½
British Manila rope	0 28
New Zealand hemp	0 28
Transmission rope, Manila	0 47
Cotton rope, ¼-in. and up	0 88

POLISHED DRILL ROD

Discount off list, Montreal and Toronto net

MISCELLANEOUS

Solder, strictly	$ 0 40
Solder, guaranteed	0 43
Babbitt metals	18 to 70
Soldering coppers, lb.	0 62
Lead wool, per lb	0 16
Putty, 100-lb. drums	8 30
White lead, pure, cwt.	20 00
Red dry lead, 100-lb. kegs, per cwt.	16 50
Glue, English	0 40
Tarred slater's paper, roll	1 30
Gasoline, per gal., bulk	0 35
Benzine, per gal., bulk	0 35
Pure turp., single bbls., gal.	3 60
Linseed oil, raw, single bbls.	3 00
Linseed oil, boiled, single bbls.	3 03
Sandpaper, B. & A.	List plus 43
Emery cloth	List plus 37½
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin, "D," per lb.	0 14
Borax crystal and granular	0 14
Wood alcohol, per gal.	2 70
Whiting, plain, per 100 lbs.	2 75

CARBON DRILLS AND REAMERS

S.S. drills, wire sizes	32½
Can. carbon cutters, plus	20
Standard drills, all sizes	32½
3-fluted drills, plus	10
Jobbers' and letter sizes	32½
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	net
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	20 to 40
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At warehouse]

Rounds and squares	$7 base
Hexagons and flats	$7.75 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	60	75
Class B	27	37
Class C	18	27

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 8 50	$ 9 50
Sheets, Blue ann., No. 10	8 50	9 00
Canada plates, dull, 52 sheets	8 50	10 00
Can. plates, all bright	8 60	9 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	11 00	....
Fleur-de-Lis, 28 B.W.G.	10 50	....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28.	....	....
Premier, No. 28, U.S.	11 50	10 50
Premier, 10¾-oz.	11 50	10 90
Zinc sheets	16 50	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	29 50
1¾ in.	31 50	30 00
2 in.	35 00	30 00
2¼ in.	35 00	29 00
2½ in.	42 00	37 00
3 in.	50 00	48 00
3¼ in.	.. ..	48 50
3½ in.	63 00	51 50
4 in.	85 00	65 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	24½
Palacine	27½
Machine oil, per gal.	43½
Black oil, per gal.	18½
Cylinder oil, Capital	82
Cylinder oil, Acme	70
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	$2 60
Union thread cutting oil, antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil, bbls., net	13½

BELTING—No 1 OAK TANNED

Extra heavy, single and double	10%
Standard	10%
Cut leather lacing, No. 1	2 75
Leather in side	2 40

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 60
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	09
Pumice, ground	06
Emery glue	30
Tripoli composition	09
Crocus composition	12
Emery composition	10
Rouge, silver	60
Rouge, powder, nickel	45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE

XXX Extra	24	Atlas	20
Peerless	22½	X Empire	19½
Grand	22½	Ideal	19
Superior	22½	X Press	17½
X L C R	21		

Colored

Lion	17	Popular	13
Standard	15	Keen	11
No. 1	15		

Wool Packing

Arrow	35	Anvil	22
Axle	28	Anchor	17

Washed Wipers

Select White	20	Dark colored	09
Mixed colored	10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades ... 15%

ANODES

Nickel	.58 to .65
Copper	.38 to .45
Tin	.70 to .70
Zinc	.18 to .18

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6 x 4 base	45 00	44 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 75	$14 50
Sheets, 3½ lbs. sq. ft.	10 50	14 00
Sheets, 4 to 6 lbs. sq. ft.	10 25	13 50

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .23
Acid, hydrochloric	.03¼
Acid, nitric	.10
Acid, sulphuric	.03¼
Ammonia, aqua	.15
Ammonium, carbonate	.20
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.14
Copper, carbonate, annhy.	.41
Copper, sulphate	.16
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.08
Nickel carbonate	.32
Nickel sulphate	.19
Potassium sulphide (substitute)	.42
Silver chloride (per oz.)	1.25
Silver nitrate (per oz.)	1.20
Sodium bisulphate	.11
Sodium carbonate crystals	.06
Sodium cyanide, 127-130%	.38
Sodium hyposulphite per 100 lbs	8.00
Sodium phosphate	.18
Tin chloride	1.00
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated

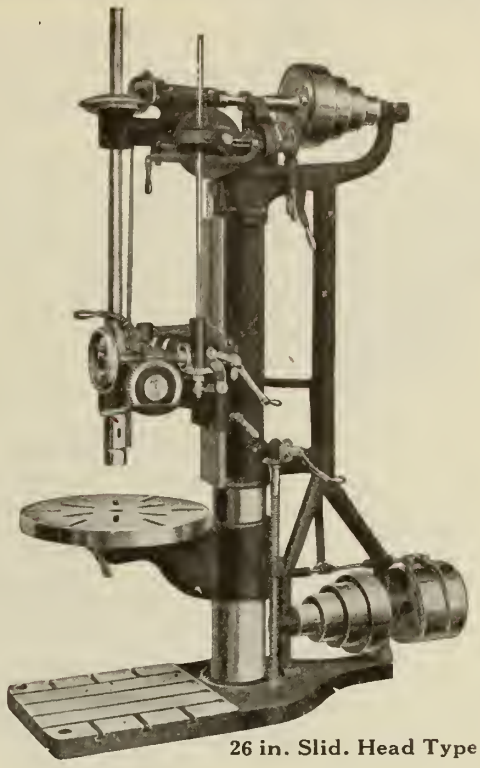
A Complete Line 8 in. to 50 in. Swing
with or without tapping attachment

BARNES

Upright Drills
Horizontal Drills
Gang Drills

Accuracy—Strength
Convenience of Operation

If it's machinery write "Williams"



26 in. Slid. Head Type

Carried in Stock by

THE A. R. WILLIAMS MACHINERY CO., Ltd., 64 FRONT ST. WEST TORONTO

MONTREAL ST. JOHN, N.B. WINNIPEG VANCOUVER HALIFAX BUFFALO, N.Y.

Gray Iron and Semi Steel Castings of all Descriptions

From 5 lbs. up to 4 tons

Foundry capacity, 15 tons per day.

Difficult castings our specialty.

Mixtures regulated by chemical analysis and all castings sandblasted.

Estimates from blue prints submitted promptly.

If desired, we can make patterns to your drawings.

G. W. MacFarlane Engineering, Limited
Paris, Ontario

TO-DAY

is not too early,
or too late,
to start
the use
of

P X H **P.H. or Imperial Files** IMPERIAL

"They cut faster and wear longer."

Be File-Wise

Ingersoll File Company, Limited
John Morrow Screw and Nut Co., Ltd.
Sole Distributors,
Ingersoll, Ontario

INGERSOLL

If interested tear out this page and place with letters to be answered.

Points Considered by the Purchasing Agent

Standing and Ability of the Vendors to Produce the Material Considered as Governing Factors—Equipment Has to Be the Best to Get the Desired Quality in the Product.

ALTHOUGH devoted to the purchase of gears, points equally applicable to the purchase of other materials were set forth in a paper on "Gears from a Purchaser's Standpoint" presented by G. D. Stanbrough, general superintendent Packard Motor Car Co., Detroit, at the recent convention of the American Gear Manufacturers' Association, Detroit. "When you undertake the purchase of any article from rough stock to finished parts," Mr. Stanbrough said, "the first question that comes to mind is the standing and ability of the vendors of the special commodities which you are purchasing. Your chances of selecting a satisfactory source of supply is governed by the following general conditions:

1. The personnel of the organization.
2. Their financial support.
3. Their general business reputation.
4. The location of the plant to sources of supply and transportation centres.
5. General business ability.
6. The labor market.
7. The general character of the plant buildings.
8. The character of their equipment.

"We cannot underestimate the value of weighing all these considerations. I will discuss them in the order named, briefly.

Plant Personnel and Reputation

1. It is a well-known fact that no firm nor the product that they make is any greater than the men that make up that business. An organization to machine and manufacture successfully should be made up of men who are good mechanics, whose reputations have stood the test of time for doing good work. Men who know the proper methods to be used and have courage enough to use them. The organization from a personnel standpoint should be well balanced— should include a good business man, good mechanical talent and a good engineer.

2 We cannot underestimate the value of ample financial resources. Such resources will relieve the men who are in charge of operations from worries and allow them to put their efforts on the production. Adequate finances permit the purchase of stock in different quantities to insure a steady flow of product, and this is particularly necessary in the manufacture of gears where many operations and much time is consumed. The firm that is handicapped for money to meet stock bills and to pay the payroll cannot be counted upon to produce with the same steadiness as can be expected under more propitious circumstances.

3. The only thing that we can tell about a firm or an individual, with any degree of certainty, is his record of past performances. Business ability is reflected in the stability of the organization. The prosperity of a company embraces its standing in a community and the reaction as apparent from personal contact with the representative of the firm in business traansactions. It is reflected in the measure of good judgment that is shown by a firm's past record in handling contracts under similar conditions.

4. I think the importance of this subject (location of the plant to sources of supply and transportation centres) is self-evident; other things being equal, it is much better for a firm to deal with one in its immediate vicinity in order to minimize the transportation difficulties of the present time. However, under various circumstances it may be more advantageous to deal with a firm that is close to a base of raw material. These are matters that have to be weighed and judged in each individual case.

5. A firm's business connections and contracts which it has established with vendors of raw material are an important consideration in these times when sources of supply are contracted for many months ahead.

Labor Conditions and Plant Equipment

6. We all realize that under present-day conditions the labor market has an important bearing upon a firm's ability to meet the promises as to production. The labor market has got to be viewed first from the standpoint of supply; (2) From the standpoint of the quality of the supply; (3) From the reputation of the people in the community on questions of strikes and other labor disturbances; (4) With reference to housing and general sociological conditions, affecting the welfare and happiness of the community.

7. This (the general character of the building) has particular reference to fire protection, fire underwriter's risk, plant lay-out to facilitate good manufacturing, arrangement of machinery for economical production, and satisfactory working conditions from a labor standpoint.

8. We have put this subject (character of equipment) last in order, but it is by no means last in importance. Good gears can only be produced by modern machinery properly installed, properly maintained and satisfactorily operated. An adequate supply of cutters, hobs, and high-speed steel for blading and the necessary assortment of small tools should be on hand. Machines should be placed to permit operation with a minimum amount of vibration. Wherever possible, grinding machinery should be placed on the ground floor. When we are manufacturing gears, we are working within narrow limits, and it is fruitless to suppose that satisfactory results can be obtained in the face of poor equipment and installations. It should be borne in mind that in these modern times heat treatments have a large part in the satisfactory finished product, and the plant that manufactures gears from carbon and alloy steels must contain modern heat treatment equipment, and a thoroughly experienced metallurgist in charge of its operation. We don't want to overlook the fact that the metallurgical end of the business is highly scientific and is based upon exact knowledge and cannot be satisfactorily performed by rule of thumb methods without the use of proper standards of comparison.

"Having settled to our satisfaction that the proposed source of supply fulfills a large number of the above requirements, we are next confronted by the fact that satisfactory gears from a purchaser's standpoint can only be produced as a result of conformity to good practice along the following lines: Design, materials, forgings and castings, heat treatment, machining, hardening and inspection."

After discussing these points in detail the speaker concluded that "satisfactory gears cannot be produced by any but the most painstaking efforts, and the higher requirements for the elimination of gear noises the more we are confronted by the fact that we have much to learn and from a purchaser's standpoint a knowledge of what is possible under present-day methods is necessary in order that purchasing requirements may be reduced or may be made to coincide with the present state of the art."

HERE ARE SOME RULINGS MADE

Many Points are Coming Up That Require Special Information for Dealers

Sales to Consumer by Manufacturer, Wholesaler or Jobber.—The Department of Inland Revenue has ruled that goods or material sold by a manufacturer, wholesaler or jobber to a consumer are subject to the sales tax of 1 per cent., and also to the tax set forth in Section 1 of the Resolutions, where the articles sold are subject to such excise tax.

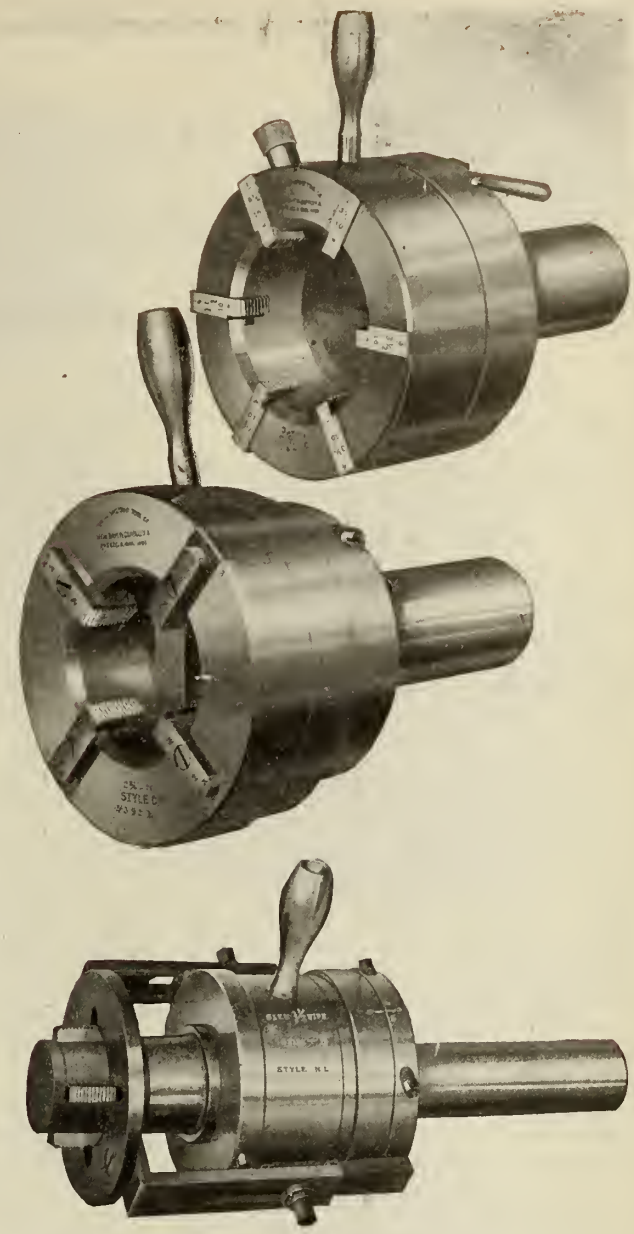
Manufacturers Who Purchase Goods for Resale.—The department has ruled that where a manufacturer purchases supplies and other articles as jobbers resale, the sales tax of 1 per cent. applies to such goods when sold.

Contracts Entered Into Prior to May 19th, 1920.—On contracts entered into prior to May 19th by manufacturers, wholesalers or jobbers, for the delivery of goods or material and which contracts had not on that date been completed by delivery, the sales tax of 1 per cent. will apply in respect of all shipments or deliveries made after May 18th. The sales tax of 1 per cent. should, according to the ruling of the department, be added to the invoices covering such shipments made after May 18th.

A GOOD BOON

"Geometric Tools are a good boon in our business. Always reliable and sure of turning out a class job; in fact, I don't know how we could secure a decent output without them."

This is what the Works Inspector of a London (England) shop says. He adds that they are making screw and small parts for air craft, and have quite a lot of Geometric Dies in constant use.



Because of the fact that Geometric threading tools are "a good boon" in the thread cutting business, the majority of screw machines and turret lathes are equipped with Geometrics.

THE GEOMETRIC TOOL CO.
NEW HAVEN, CONN.

Canadian Agents:

Williams & Wilson, Ltd., Montreal
The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg and St. John, N.B.
Canadian Fairbanks-Morse Co., Ltd., Manitoba, Saskatchewan, Alberta

For any thread, any size, any pitch,—there's a Geometric Collapsing Tap or Self-Opening Die Head. Be assured there is one to meet your particular threading need—whatever it may be. Ask us.

If interested tear out this page and place with letters to be answered.

INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS PERSONAL AND TRADE NOTES

TRADE GOSSIP

Two by-laws were emphatically endorsed by Brighton citizens. The vote for the Barnard Machinery Co. carried, with 275 voting for and 3 against it, and that of the Dominion Canners with 276 for and 7 against it.

Montreal.—Through the inability of the company to procure castings, the Canadian Vickers Co. have been compelled to lay off nearly five hundred men. The shortage is due to labor troubles at Warden King's and the Montreal Locomotive Works, which firms supply the Vickers Co. with their castings.

Advised to Cut Production.—The secretary of the United Mine Workers, after receiving word from the Minister of Labor refusing the request of the men for a collective board to consider grievances, suggested to the men that one way to bring the owners round was to decrease production 50 per cent. The suggestion was not acted upon, and several other proposed expedients were turned down.

To Build Viaduct.—The proposed railway viaduct along the Toronto waterfront will be proceeded with at an early date, if the civic authorities get their wish. A meeting between the Board of Control and the Harbor Commissioners will be held shortly, and an application made to the Railway Board to compel the railways to proceed with the work.

Dominion Briquette Research. — The Government's lignite briquetting plants established by the Research Council to produce lignite fit for consumption, will be producing by August. It is the opinion of Dr. A. B. Macallum that the new fuel will prove so much cheaper and more efficient than anthracite, that the market for the latter in Western Canada will be closed, and private capital attracted to the lignite fields.

Receiving Tenders.—The Toronto Electrical Commissioners will receive tenders until Wednesday, June 16, for building a sub-station on Ossington Avenue, near St. Clair Avenue, including excavation, masonry, structural steel, etc., roofing, plumbing, painting and such other work required for a completed building. Tenders must be accompanied by a marked cheque. Forms for tenders may be obtained from the purchasing agent, or the Engineering Department at Station D, corner of Duncan and Nelson Streets, Toronto.

Duluth.—Arguments in favor of the proposed deep waterway from the lakes to the sea were heard at the final hearing of the International Joint Waterways Commission. It was stated that a channel to the sea could be completed in shorter time than the Eastern Atlantic ports could improve their facilities. The commission will hold sessions at Superior, Wis.; Ashland, Wis.; Milwaukee, and finish up at Toledo.

Vocational Training in Manitoba.—The Manitoba Government are considering the establishment of vocational training centres for young men and women, for training in various branches of industry and home economics. The Government has decided to participate in the Federal Government's $10,000,000 fund for technical education, and to embark on a vigorous programme in that connection.

St. Catharines.—The Niagara, St. Catharines and Toronto Railway are proposing to put their new steamer Northumberland on the Toronto and Port Dalhousie route about the middle of June. The Northumberland, which is a steamer of 220 feet length, built in Newcastle-on-Tyne in 1894, will make the trip in about 1½ hours. She has been engaged in the North Atlantic Coast passenger traffic.

CANADIAN FAIR IS NOW OPEN IN LONDON

Many Firms From the Dominion Are There—Developing the Export Trade

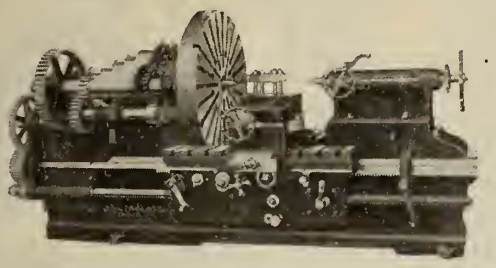
London.—The first Canadian Trade Exhibition ever held in Britain opened on Wednesday in the Agricultural Hall, London. A number of exhibits arrived late, and although the British customs authorities agreed to expedite the unloading, it has been found impossible to do so as the result of incorrect invoicing of some shipments. The exhibition, however, will afford an object lesson of wide range of present-day Canadian trade. It includes Canadian products varying all the way from a motion-picture projector to folding beds A Montreal ready-made clothing firm, apparently unimpressed by the competition of the world's woollen centre, Manchester, has an exhibit of ladies' and children's garments, and other firms are showing wall papers, tractors, spark plugs, washing machines, chemicals, tools, steels, enamelware, chocolates, and other products of divers kinds. The Dominion is now a larger exporting country than France and Japan, or Italy, Spain and Holland combined.

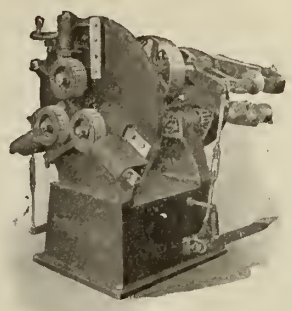
Brockville.—Catching fire at the wharf of the New York Central Railway, at Morristown, the steamer "H. P. Bigelow," owned by the Morristown-Brockville Transportation Co., was totally destroyed. The fire burned the steamer's mooring lines, and she drifted away from the wharf out of reach of the fire department's hose. She burned to the water's edge and then sank. Another vessel will be purchase to carry on the service.

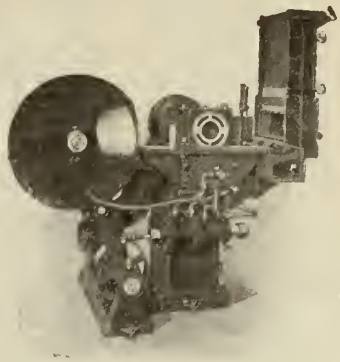
The MacKinnon Steel Co., Limited, Sherbrooke, Que., have recently received the following contracts: Oil storage tank, 8 ft. x 32 ft., for town of Moosomin, Sask.; steelwork for new Jewish Synagogue, Montreal Street, Sherbrooke, Que.; structural steel work for Weedon Power Station, City of Sherbrocke; steel superstructure for bridge over Tartigou River, Gaspe Co. H. Lepage & Freres are the general contractors.

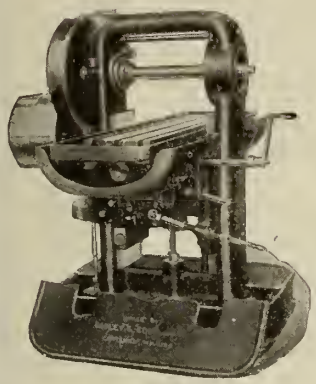
Secures Coal for Gas.—The Fuel Commissioner, Mr. H. A. Harrington, has returned from a trip to the U.S. coal mine areas, where he has been successful in arranging for some deliveries. At the same time companies are urged to practise conservation. The firms for whom deliveries were secured include the Ottawa Gas Company, the Hamilton Gas Company, and the Consumers' Gas Co. of Toronto. A train-load was also secured for the Chatham-Windsor district, and also barge loads for Toronto and Sarnia, as well as 2,000 tons of anthracite.

The Canadian Fairbanks-Morse Co., at their Toronto office, have installed an ingenious "in" and "out" directory, covering all department managers i nthe building. It is situated conveniently just outside the front door on the main floor, the offices for the most part being upstairs. Yellow and blue lights are used. When a member of the staff comes in he shoves a button and his name will show up in yellow. When he goes out he shoves again and a blue light appears under his name. The meaning of the colors is explained at the top of the directory. A glance at the board will

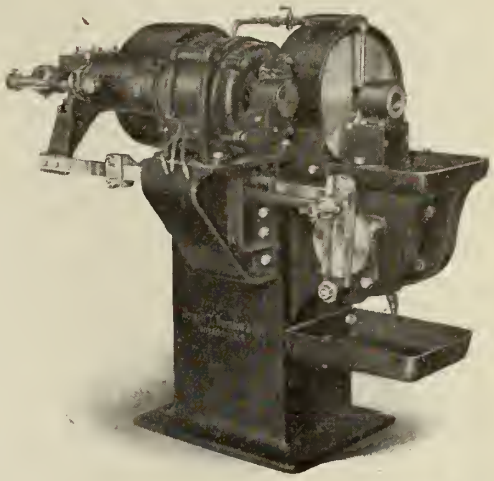








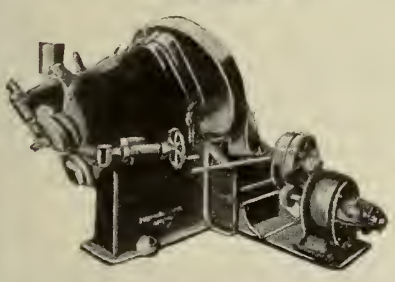
PARTIAL LIST OF MACHINERY IN TORONTO STOCK

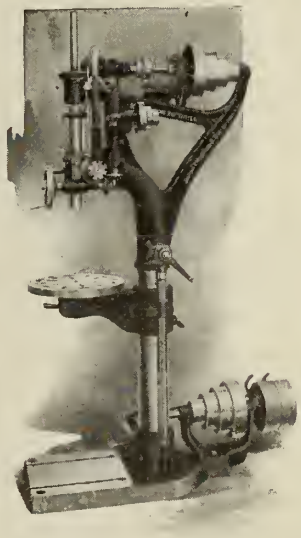


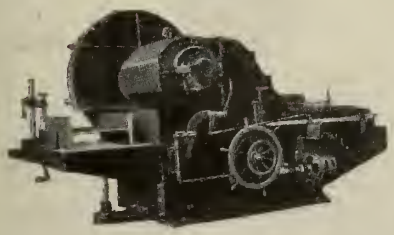
- 2 7 "A & B" Cataract Precision lathes.
- 1 18x8 Roe, D.B.G. & G.C.G., engine lathe.
- 1 18x8 Milwaukee, D.B.G. & G.C.F., engine lathe.
- 1 24x10 Milwaukee, D.G.B., G.C.F., engine lathe.
- 1 36x18 Putnam engine lathe.
- 1 20x38x12 C.M.C., Exp. engine lathe.
- 1 16" Edlund H.S. drill.
- 1 20" Barnes drill press.
- 2 20" Champion drill press.
- 1 No. 314 Baker, 3" capacity.
- 3 4-spindle Woodward H.S. drills.
- 1 16" Queen City shaper.
- 1 24" McGregor or Gourlay shaper.
- 1 24" Steptoe single pulley drive shaper.
- 1 30x36x12 London planer.
- 1 8x36 Fitchburg Plain Cylindrical grinder.
- 1 No. 3 Ryerson Owen Universal grinder.
- 2 No. 3 Ford Smith plain miller.
- 4 Briggs Millers, 20 to 42" traverse.
- 1 Ryerson No. 3 Rotary Bevel Shear 1" capacity.

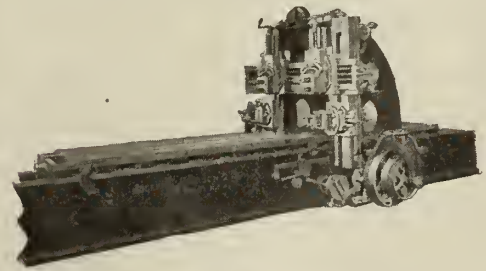
Cleveland, National, Acme & Brown & Sharpe Automatic and other machines for all purposes.

May we have your enquiries?









Garlock-Walker Machinery Company, Limited

32 Front Street West

TORONTO

MONTREAL **WINNIPEG**

"Everything in Woodworking and Metal Working Machinery"

If interested tear out this page and place with letters to be answered.

show at once if the party you desire to see is in or out.

Changes at Galt.—Wells Bros. Company of Canada, Limited, are about to change their name to the Greenfield Tap and Die Corporation of Canada, Limited, this being the same name as the parent concern at Greenfield, Mass. At the same time, they are increasing their capital from $40,000 to $250,000 and will very shortly increase their manufacturing space by more than double the present capacity. This is necessitated by the ever-increasing business.

Brantford Shop Extends.—Dominion Steel Products, Brantford, are building a large steel and brick pattern shop to take care of the additional demand for patterns brought on by the recent completion of their grey iron and brass foundry. Their foundry is equipped with a 20-ton air furnace, used especially for the manufacture of all classes of chilled cast iron rolls, and other high-grades of close-grained iron castings. In addition to the air furnace, the foundry is equipped with two cupolas of an hourly capacity of 12 tons, and an electric brass furnace of 1,000 pounds capacity. This company at present is engaged in the manufacture of rolling mill equipment, the heavier rubber working machinery, all classes of drive, line and propeller shafting, and are the manufacturers of the Dominion Herringbonegear, cut under the Fawcus patents. The company has recently developed, and has now ready for the market, a heavy oil engine of the Diesel type of 120-horse power, which may be used independently or directly connected with a generator.

PERSONAL

Mr. Beverley H. Neill, sales manager and secretary-treasurer of the Canada Machinery Corporation, Ltd., Galt, is at present en route for Vancouver on the special C. M. A. train, to attend the Canadian Manufacturers' Annual Convention.

CATALOGUES

TECHNICAL BOOK CATALOGUE

The D. Van Nostrand Company, 8 Warren St., New York, have now issued their 1920 catalogue on technical, industrial, engineering and scientific publications. The book is very complete, and as stated by this company, the list therein contains, in their judgment, only books from standard authorities on the respective subjects. They even go so far as to state that money will be refunded, if after ten days the purchaser is not satisfied.

To go into all the subjects in this short space is impossible, as the catalogue contains 256 pages, but enough to state that the chemical, paint, paper, textile, electrical, mechanical, structural, machine shop and other varied fields have been covered very completely.

As we understand it, a copy of this catalogue can be obtained free by mentioning this announcement, and to all interested in technical literature, we can safely recommend its use.

NEW CATALOGUE

The L. Best Company, 28-30 West Broadway, New York, have issued their 1920 catalogue on grinding machines, wheels and supplies. In addition to a description of their lines they give various tables and data of considerable importance.

BRANTFORD FIRM SOLD THE BUSINESS

Brantford Emery Wheel Co. Has Been Bought Out by the Waltham Grinding Wheel Co.

Brantford.—Recent transaction places the control of the Brantford Emery Wheel Company, Limited, in the hands of those whose interests are identical with the Waltham Grinding Wheel Company of Waltham, Massachusetts. The Brantford Company has been operating for the past ten years in the manufacturing of grinding wheels and it is felt that the new interests will enlarge immediately production facilities and be a factor of service to the grinding wheel users of Brantford and other parts of Canada.

Colonel Frank A. Howard is to continue as managing director.

The Waltham Grinding Wheel Company is one of the oldest and largest companies of the United States, the originators of the so-called elastic wheel process and have a record of 50 years of service and quality.

The new owners expect to greatly enlarge their production at Brantford.

BRITAIN TRADES WITH RUSSIA NOW

Working Agreement Reported to Have Been Arrived At in London

London.—An agreement for the resumption of trade between Great Britain and Russia was concluded at a meeting to-day between Premier Lloyd George and other Ministers, and Gregory Krassin, Russian Soviet Minister of Trade and Commerce. While no official report was issued after the two-hour meeting, it is said on good authority that an agreement was definitely concluded.

Under the terms of the agreement individual commercial concerns will immediately begin dealing with Russia, which, it is said, would draw to England $300,000,000 in gold now in Moscow. The only control over the transactions which will be held by the Government, will be the granting of permits to companies wishing to trade with Russia, it was said.

The consummation of the agreement was regarded in business circles as the most notable commercial and financial victory since the end of the war.

—Kirby in the New York "World."

POINTING THE WAY

ATKINS
METAL CUTTING SAWS

Solve your Metal Cutting problems, easily, quickly and economically, by adopting the products made by

ATKINS

We make Kwik-Kut Power Hack Saw Machines which use practically the full cutting edge of the Hack Saw Blade at each stroke; Metal Cutting Band Saw Machines for general shop work, cutting all classes of metal up to 12 x 14 inches.

Your requirements for Metal Cutting Circular Saws can be supplied promptly and we solicit a trial of our "AAA" Non-Breakable and Power Hack Saw Blades and Frames.

"A Better Saw for Every Use"

E. C. Atkins & Co.

Established 1857

"The Sterling Quality Saw People"

Factory: HAMILTON, ONT

Branch: VANCOUVER, B C.

THE FINEST ON EARTH

If interested tear out this page and place with letters to be answered.

The Week's Events in Montreal Industry

The Hyde Engineering Works of Montreal are open to take on some good manufacturing line. They have a well-equipped plant and have a long experience in engineering activities.

Robt. Dawson, for the past two years with Peacock Bros., of Montreal, in charge of the instrument repair department, has accepted a position with McGill University, and will have charge of maintenance of all scientific instruments.

Owing to the irregular delivery of steel plates and shapes, the shipbuilding plant of the Canadian Vickers Company has been operating below capacity, and curtailment of activities has necessitated the temporary suspension of some of the workmen. These men will be taken on again immediately the accumulation of material warrants it.

Owing to the general scarcity of soft coal in this district, which has become additionally pronounced during the past week, the National Brick Company of Laprarie has had to suspend operations. Other materials are plentiful, but the delivery of coal in operating quantities has fallen off tremendously during the past several weeks.

Hans Renold, of Canada, Ltd., have opened their offices in the Marconi Building, 11 St. Sacrament Street, Montreal. This company was recently organized to be the sole Canadian representatives of the Hans Renold Ltd., of Manchester, England, so that dating from June 1, all enquiries regarding Renold steel driving chains and wheels should be made to the above address. Mr. H. George, formerly with Jones and Glassco, will be the managing director.

Negotiations have been going on for some time, whereby the Canadian Explosives, Ltd., will absorb the Dominion Copper Products, and it is expected that the deal will be closed this week, at a special meeting of the Copper Company's shareholders. The Dominion Copper Products Co. was created during the war for the manufacture of brass for cartridge cases, and copper for rifling bands. Since the close of the war the plant has been actively engaged in meeting the demands for domestic copper and brass products.

The City of Montreal has just closed a contract with the Montreal Light, Heat, and Power Company for power to operate the electric units that will be used for the pumping of water at the Low Level Pumping Station. The contract is for a minimum amount of 4,000 horse-power at a maximum rate of $25, the period of the agreement to be 25 years. This is the result of negotiations that have been carried on for some time in connection with the installation of motor-driven pumps in place of the steam ones now in use. Two of the new five 30 million-gallon pumps that will eventually be provided are expected to be in operation this summer.

The fortieth annual convention of the American Federation of Labor, which is being held this week in Montreal, at the St Denis Theatre, is now in full swing, and additional delegates are arriving daily. It is expected that upwards of 1,000 labor representatives from all parts of Canada and the United States will be in attendance. President Samuel Gompers arrived in the city last Friday to prepare for the week's activities. In commenting on the work before the convention, Mr. Gompers said: "We have great economic questions to deal with in the United States, problems that require constant study and wise handling. These include the bettering of the conditions of the toilers, the reduction of the alarming cost of living, the crushing of profiteering. You have the same problems in Canada, so, much as our presence is needed in the United States, we could not refuse your invitation to come here and help to solve your difficulties and to lend a hand in trying to arrange a basis of common action that would help to improve the conditions of Canadian workers be of benefit to them all round, and at the same time not inflict grievances or hardships on the employers of this and the sister country."

The effects of the shortage of coal are already becoming painfully evident in various Montreal industries, a number of which are closed down for want of fuel, while many others are only able to keep going by exercising the greatest economy. Complaints were heard last week-end in the hardware trade that manufacturing firms had ceased operations for this reason. Now comes the report that the National Brick Company, of Laprairie, has ceased burning. Coal, they say, is being received in small quantities, but not enough to make any impression on the accumulation of orders they have on hand. For some weeks now they have been fulfilling orders from stock only, but this is rapidly coming to an end. Ample materials are on hand, otherwise, and everything is ready to resume burning on a large scale as soon as the supply of coal becomes available.

SCRAP RECOVERING AROUND CHICAGO

But It May Be Some Time Yet Before Buying Will Be Done in Any Quantity

Chicago.—Efforts to clean up congestion in railroad terminals and to speed up the movement of freight all along the line are begining to produce results. Scrap is moving a little more freely and trade is hopeful that the transportation problem will soon cease to be the deterrent factor in business that it has been for several weeks past. At the same time it is understand that much work is yet to be done before the jam is loosened at every point and a prompt and orderly freight service restored. The important thing, however, is that progress to that end is being made under definite plans and co-operative effort, which, barring further arbitrary action on the part of the railroad brotherhoods, can be counted on to set the traffic system in motion again.

Consumers of melting steel are at last beginning to show some interest in the market, and although no buying of importance has yet been reported, a few minor transactions serve to give some line on prices, which for heavy melting steel range from $22 to $22.50 and $21.50 to $22 for shovelling steel. Prices in wrought and other grades show little change and no indication of further decline, except in stove plate and machine shop turnings, which are off about a dollar a ton from last quotation.

Dealers complain that on the basis of present labor costs for working and handling scrap, the higher freight rates, there is no money in scrap at present prices. If that is the case, any further decline can only come as a result of forced sales to realize on stock in hand.

Stocks in dealers' yards have been accumulating for some time and a larger proportion than usual is sorted and worked up for shipment, so that the probabilities are that when demand opens up, it will be met by plentiful offerings.

APPROVE IDEA OF PREFERENCE TARIFFS

What the C.M.A. in Its Annual Meeting Has to Say Regarding This Matter

The Canadian Manufacturers' Association, at its meeting in Vancouver, in the annual report, made the following reference to the tariff:

"The position of this association in regard to the Canadian customs tariff was clearly defined at the last anual meeting, where a resolution was passed advocat- capacity to the Government. We see no reason why this resolution should of experts who would act in an advisory capacity to the Government do not see any reason why this resolution should not be reaffirmed at this meeting. The objects of the fiscal system of Canada should be to diminish, as far as possible, the buying of goods from other countries which can be produced here; to facilitate the importation of raw materials which cannot be produced at home; to export our own materials in the shape of finished products, and to make Canada as self-contained as possible by developing and encouraging activities which will give occupation to our citizens. The association last year also went strongly on record in favor of tariff preference among the various countries constituting the British Empire. The war strengthened the ties which bind the Empire together, and we believe these ties would be further strengthened by the extension of imperial preferential tariffs."

Morrow
The best advertising solicitors and best salesmen are those who get business on business grounds, through their knowledge of their business, rather than through ability to tell stories, order dinners and drink liquors.

"These drills are made of good steel and are forged; they do better work; make them standard all through your shop."

MORROW DRILLS

will give you maximum production in your drilling. Always specify "Morrow" drills.

TRY YOUR JOBBER FIRST
No reliable jobber will substitute

John Morrow Screw and Nut Co., Limited

INGERSOLL, CANADA

MONTREAL
St. Paul St.

WINNIPEG
Confederation Life Building
LONDON, ENGLAND: 7 Hop Exchange, Southwark St.

VANCOUVER
1290 Homer St.

The

Blashill Wire Machine Co.

Limited

ANNOUNCEMENT!

We Beg to Announce the Opening of Our Machinery Salesroom and Offices at 307 ST. JAMES STREET, MONTREAL

(Just West of Victoria Square)

We will specialize in the better classes of used machine tools, and in machines rebuilt with exceptional care in our own machine shops. Sales will be made subject to a liberal guarantee. Large stock of lathes ranging from 14" to 36" swing, also grinders, millers, turret lathes, drills, etc., also—

SPECIAL!

50 K.W. 120-125 Volt D.C. Bullock 300 r.p.m. Engine (12x12)—Generator set—direct connected and mounted on heavy cast base, marble switchboard instruments and rheostat complete—A 1 condition

5 ft. Cincinnati Bickford Radial Drill a Fine Machine.

THE BLASHILL WIRE MACHINERY CO.

LIMITED

Sales Rooms and Offices:
307 St. James St.
MONTREAL

Machine Shops:
182 Shearer St.
MONTREAL

TRADE GOSSIP

Halifax.—The strike at the Halifax shipyards shows no signs of an early settlement. The men were all paid off on leaving work recently, and were requested to remove their tools from the yards. The strike is for higher wages, and it may be prolonged.

Chatham.—A further attempt was made recently to raise a seven-ton propellor, lost overboard some time ago from the car ferry Marquette and Bessemer No. 1, and located by divers on the bottom of the channel connecting Rondeau Bay with the Lake. The attempt was unsuccessful, owing to there being insufficient power, and a derrick will be brought over the spot. The propellor is worth $3,000, and will not be abandoned till a fair trial has been made to recover it.

CATALOGUE ON DIAMONDS

The Joyce-Koebel Co., Inc., 39 West 32nd St., New York, have published a catalogue on diamond tools as used in the manufacturing industry. A short history of the diamond is given, and the style as used by mechanics is discussed. Various styles of mounting are also described, and their particular line of feralium holders are given, together with prices and particulars. Tools for truing, grinding wheels, and turning tools for fibre, hard rubber, paper rolls, ivory, brass, bronze, aluminum, etc., etc., are also illustrated. A copy of the catalogue can be obtained by mentioning this notice.

DESIGN OF FLY WHEELS

(Continued from page 551)

In designing split fly wheels, it is common practice to make the joint come half way between two arms. This is most decidedly the wrong place, as the rim being loaded by the centrifugal force, in the same manner as a beam uniformly loaded and supported at each end by the arms, the case is analogous to that of a beam having a joint in the centre of its span.

The split should come through the centre of an arm, the arm itself being half on each side of the joint, and bolted together, to make a complete arm of the same or slightly heavier section as the other arms. The rim is then equally as strong as though it was solid, provided that the bolts in the joint are equal in textile strength to the solid rim, which it is not at all difficult to arrange for under these conditions.

FOR SALE

One 10" x 10" centre crank "Gosselin" steam engine, but slightly used and in first-class condition.

THE CANADIAN H. W. GOSSARD CO., LIMITED
DRUMMONDVILLE, P. Q.

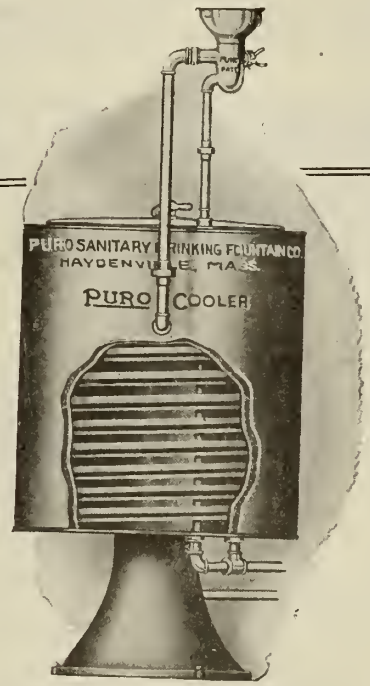
A Drinking Water Service that will last a LIFETIME

What you pay for a few ordinary drinking cups will meet the cost of the

PURO SANITARY DRINKING FOUNTAIN
(MADE IN CANADA)

DRINKING CUPS ARE UNSANITARY but the "PURO" delivers clean, fresh water at a reduction of 15 per cent. to 35 per cent. in water bill.
"PURO" WILL SAFEGUARD THE HEALTH OF YOUR EMPLOYEES and protect your staff against disorganization by sickness.
Easily attached. Simply unscrew the ordinary faucet and put on the "Puro."
Write us to-day for full information regarding the cost of installation of the "PURO" Sanitary Drinking Fountain Service.

Puro Sanitary Drinking Fountain Co.
Canadian Agents:
McKENZIE BROS.
18 St. Alexis St., Montreal, P.Q.



Eclipse Interchangeable Counterbores, Core Drills, Connecting Rod Cutters, Countersinks, Inverted Counterbores, Spot Facers, Adjustable Length Holders
See first issue of each month.
Eclipse Counterbore Co., Ltd.
Walkerville, Ont.

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BLACK DIAMOND OVENS
OVENS
Japanning and Varnishing Ovens heated by Gas, Electricity, Steam or Coal. Kernchen Siphonage Ventilators, Bakers' Ovens, trucks, casters, etc. Write for Booklet.
Brantford Oven & Rack Co. Ltd.
Brantford, Canada

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PROCURED IN ALL COUNTRIES
Special Attention Given to Patent Litigation
Pamphlet sent free on application.
RIDOUT & MAYBEE Kent Bldg., Yonge St.
TORONTO, CANADA

DROP FORGE DIES
Send us your blueprints and specifications. Entrust your requirements to experienced workmen and up-to-date equipment. Have your dies made in Canada. First-class workmanship guaranteed.
THE KIMBER & HILLIER MFG. CO.,
Thorold Road, St. Catharines, Ont.

PATENTS
Fetherstonhaugh & Co.,
The old established firm. Patents everywhere. Head office, Royal Bank Bldg., Toronto. Ottawa office, 5 Elgin St. Offices throughout Canada.
Booklet Free.

PATENTS PROMPTLY SECURED
In all countries. Ask for our Investor's Adviser which will be sent free.
MARION & MARION 364 University St
Merchants Bank Building, corner St. Catherine St., MONTREAL, Phone Up. 64[illegible]
and Washington, D.C., U.S.A.

BETTS
HEAVY DUTY MACHINE TOOLS
Planers, Engine and Axle Lathes, Slotters, Boring and Turning Mills, Horizontal Boring and Drilling Machines.
BETTS MACHINE CO
406 BLOSSOM ROAD, ROCHESTER, N.Y.

HIGH CLASS *Machine Tools*
FOR SHIPYARDS AND CONSTRUCTIONAL WORKS
BERTRAMS LIMITED
SCIENNES EDINBURGH

Classified Opportunities

HELP WANTED

WANTED — MAN TO SET UP AND TAKE charge of Gleason straight tooth gear cutters. Must be able to handle men. Salary commensurate with ability and experience. Apply Employment Manager, McKinnon Industries Ltd., St. Catharines, Ont. (c26m)

DIE SINKER WANTED—FIRST-CLASS MAN only. Best working conditions and top wages. Apply Employment Manager, McKinnon Industries Limited, St. Catharines, Ont. (c24m)

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1000	6600		Westinghouse	1000	
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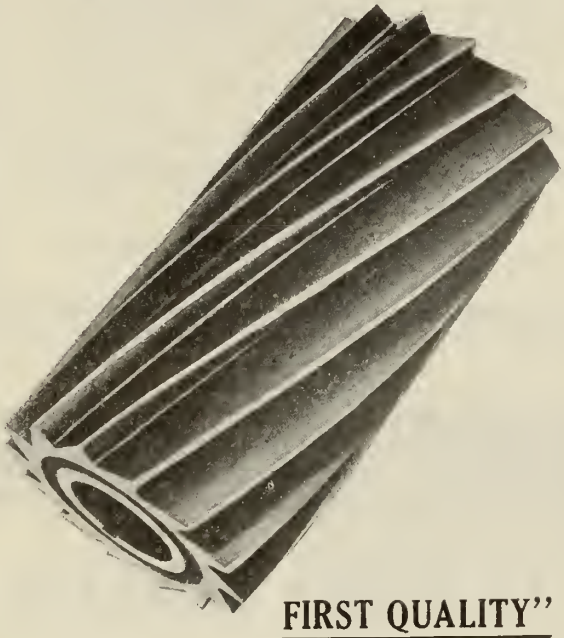

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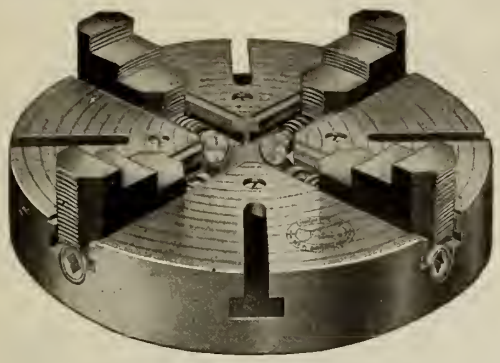

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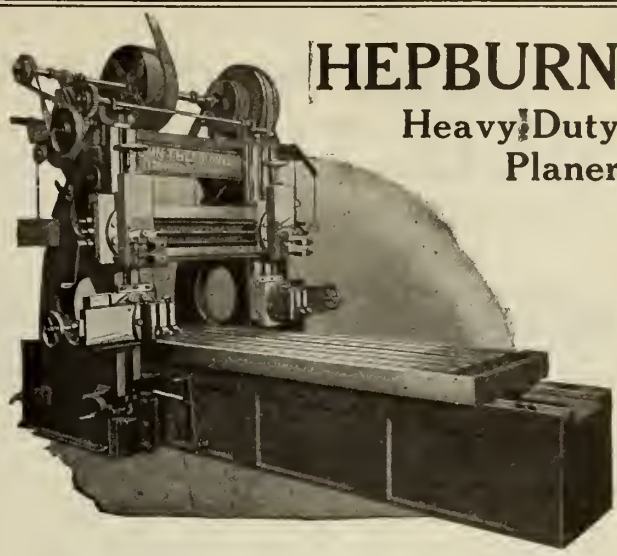

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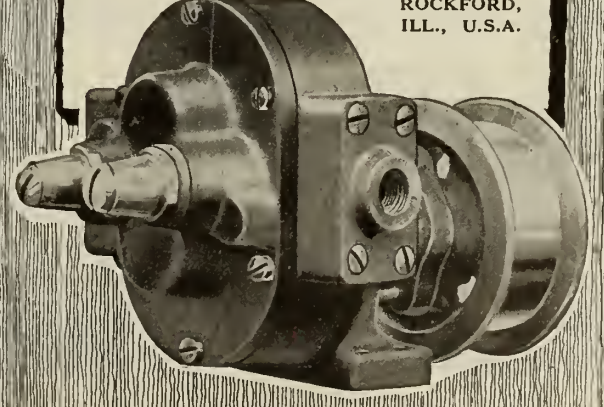

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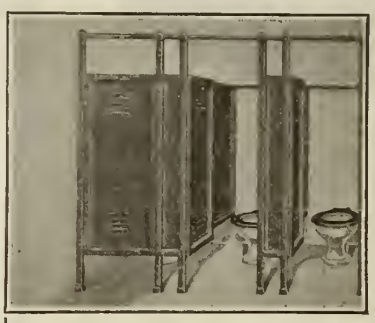

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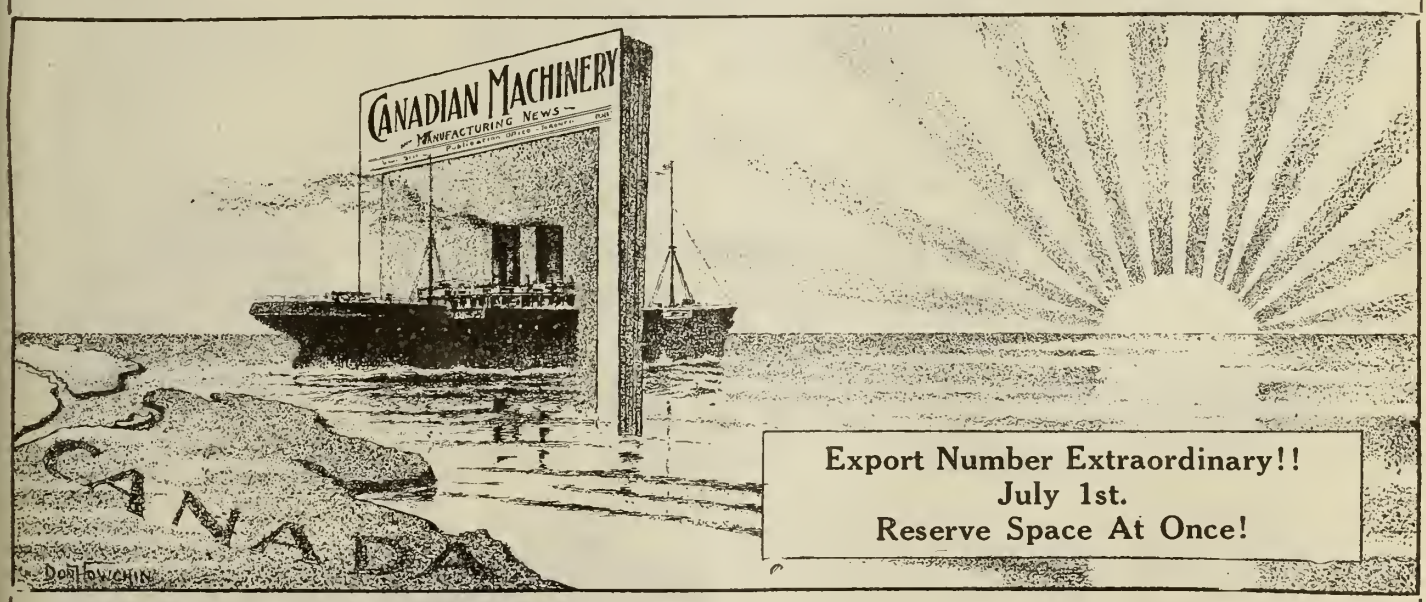

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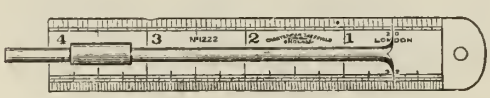

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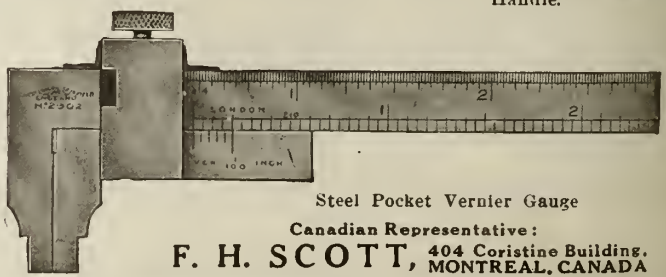

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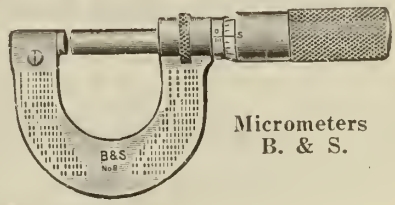

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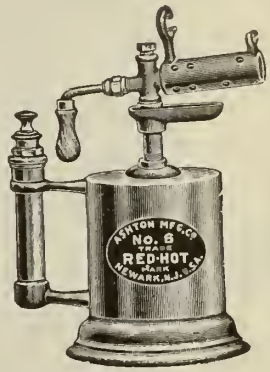

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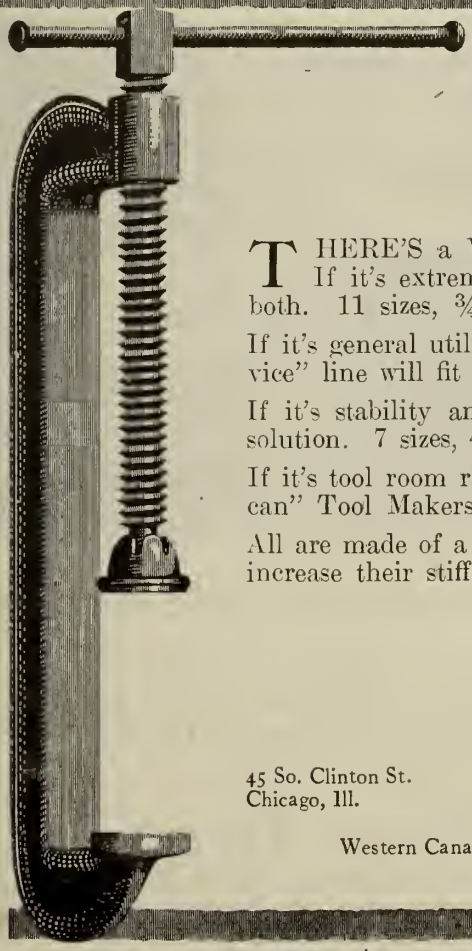

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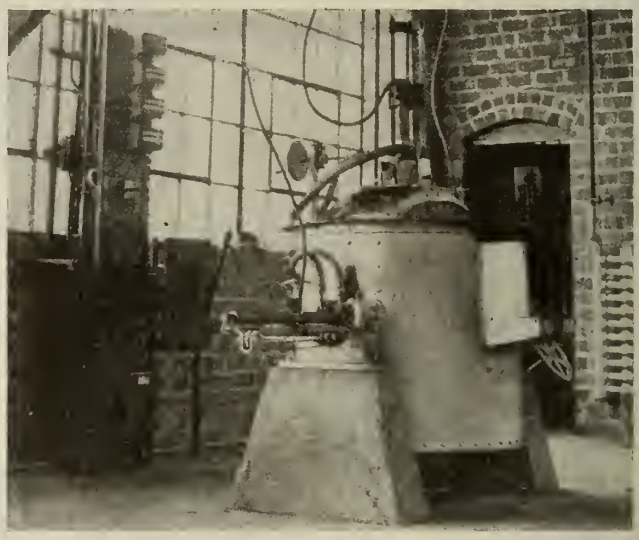

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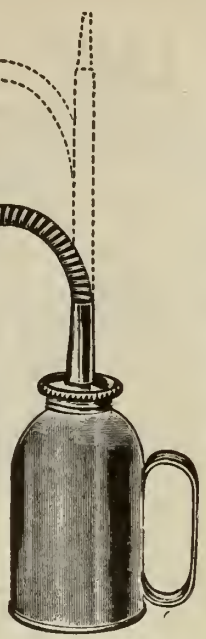

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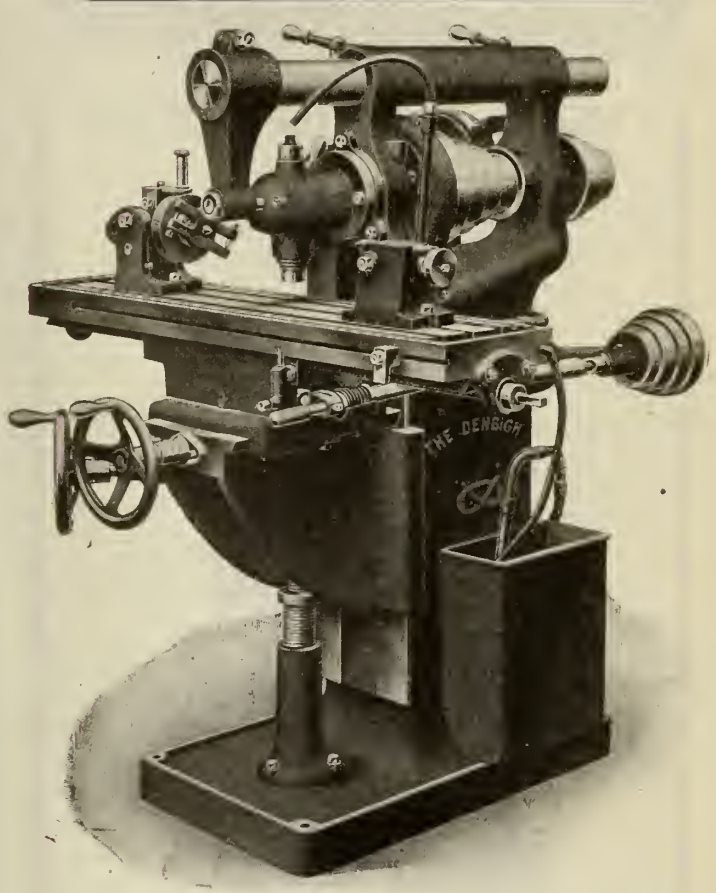

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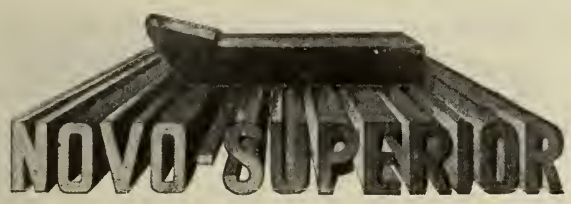

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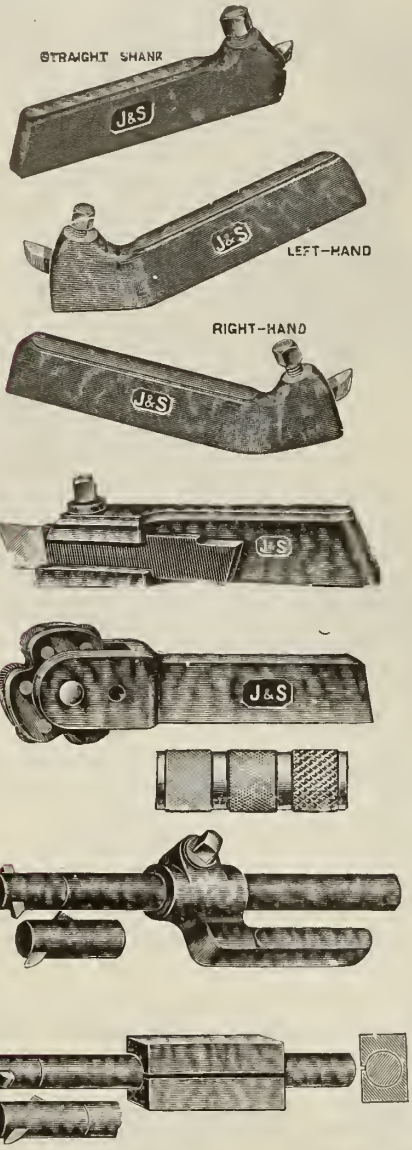

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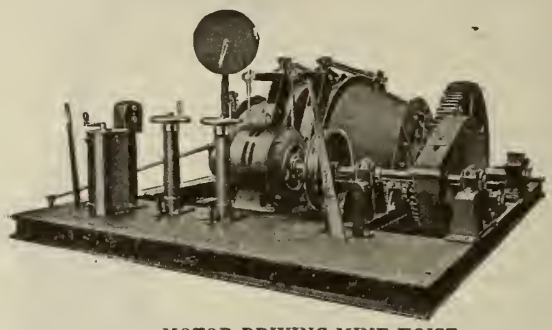

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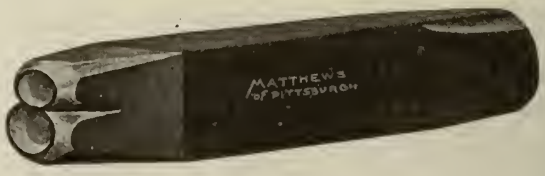

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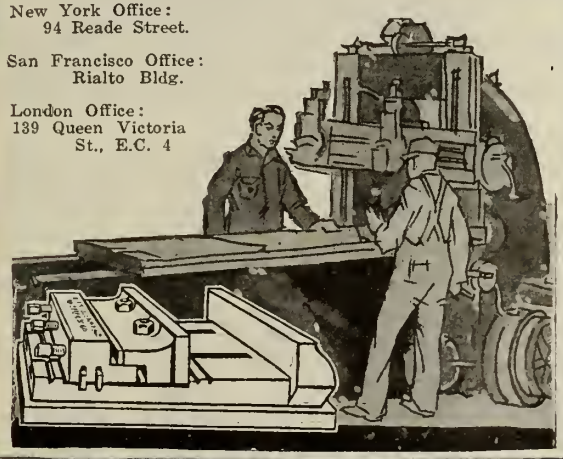

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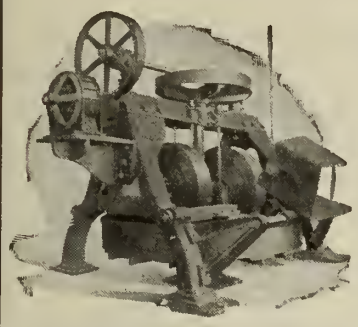

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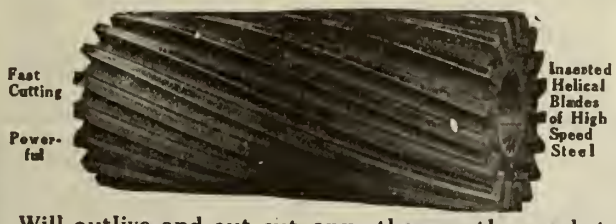

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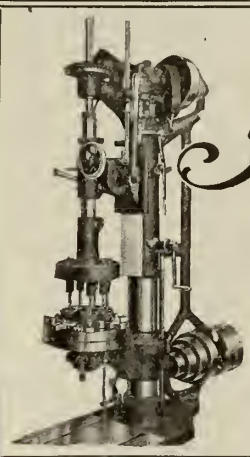

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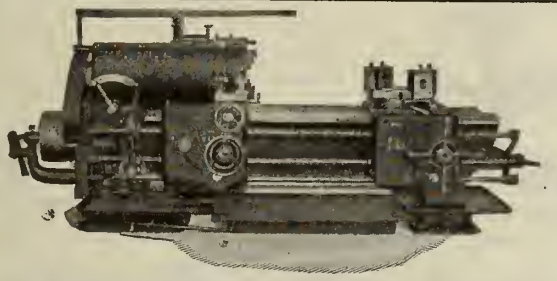

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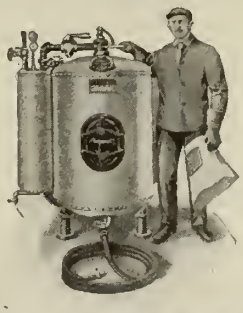

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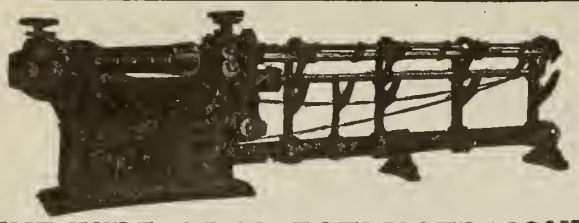

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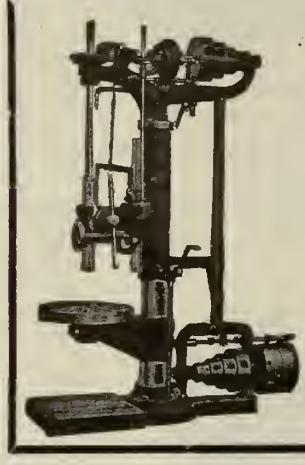

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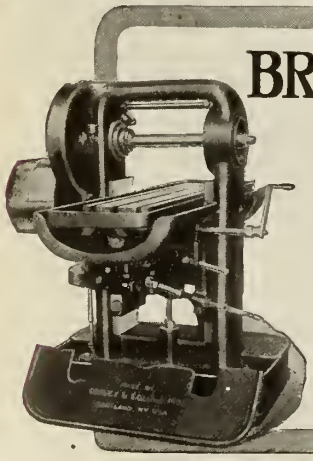

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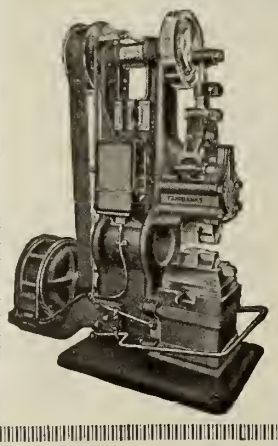

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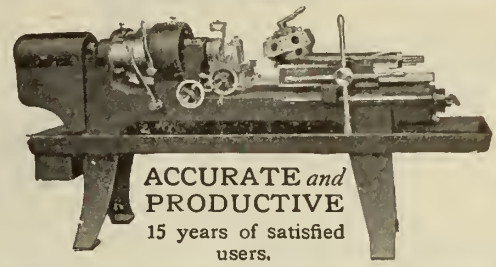

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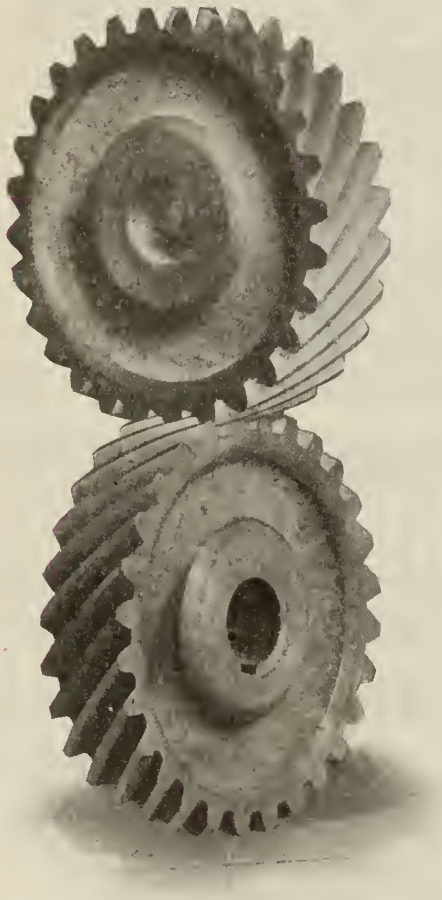

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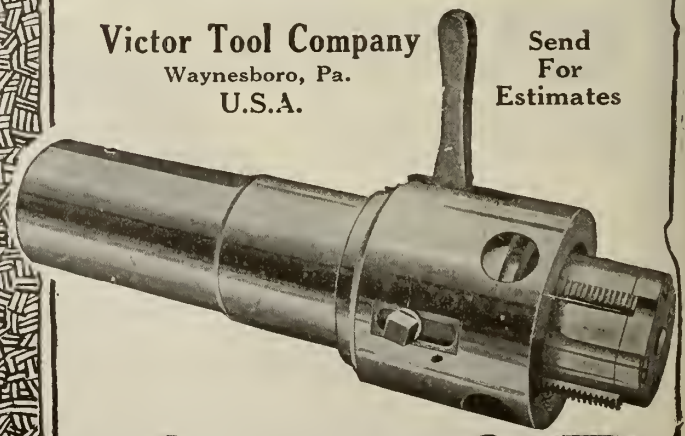

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Roelofson Machine & Tool Co., Toronto.
Williams Machy. Co., A. R., Toronto.

AUTOMATIC METAL CUTTING-OFF MACHINES
Atkins & Co., E. C., Hamilton, Ont.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros., of Can., Galt, Ont.
Aikenhead Hardware Co., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal
Canada Metal Co., Toronto.
G. F. Foss Mchy. & Sply. Co., Montreal.

AUTO SHEET METAL MACHINERY
Quickwork Co., St. Marys, Ohio.

AUXILIARY HEADS
Hoefer Mfg. Co., Freeport, Ill.

BABBITT METAL
British Smelting & Refining Co., Ltd., Montreal.
Canada Metal Co., Ltd., Toronto, Ont.
Burniss, Clarke & Co., Montreal, Que.
G. F. Foss Mch. & Sply. Co., Montreal.
Hoyt Metal Co., Ltd., Toronto.
Magnolia Metal Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Tallman Brass & Metal Co., Hamilton.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

BAND SAWS
Atkins & Co., E. C., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

BALL BEARINGS
Canadian Fairbanks-Morse Co., Montreal
Can. S K F Co., Toronto, Ont.
Chapman Double Ball Bearing Company, Toronto
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., John, Ingersoll
Williams Mchy Co., A. R., Toronto, Ont.

BALLS, STEEL
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Chapman Double Ball Bearing Co., Toronto
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Gray Ball Bearing Co., Ltd., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

BAROMETERS
Taylor Instrument Co., Rochester, N.Y.

BARRELS, SAND-BLAST
Pangborn Corp., Hagerstown, Md.

BARRELS, STEEL SHOP
Baird Machine Co., Bridgeport, Conn.
Cleveland Wire Spring Co., Cleveland.

BARRELS, TUMBLING
Baird Machine Co., Bridgeport, Conn.
Katie Foundry, Galt, Ont.
Northern Crane Works, Walkerville, Ont.
Petrie, Ltd., H. W., Toronto.

BARS, BORING
Gisholt Machine Co., Madison, Wis.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Williams & Co., J. H., Brooklyn, N.Y.

BARS, CONCRETE REINFORCING
Algoma Steel Corp., Sault Ste. Marie

BARS, MERCHANT
Algoma Steel Corp., Sault Ste. Marie.
Peckovers, Ltd., Toronto, Ont.

BASE FACING MACHINES
Victoria Foundry Co., Ottawa, Ont.

BATTERIES
Northern Electric Co., Ltd., Montreal Que

BEADING MACHINES
Quickwork Co., St. Marys, Ohio.

BELT CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Summer & Co., New York, N.Y.
Williams Mchy Co., A. R., Toronto, Ont.

BEARINGS, DIE CAST
Franklin Mfg. Co., Syracuse, N.Y.

BEARINGS, GRAPHITE BRONZE
Lyman Tube & Supply Co., Montreal, Que.

BEARINGS, ROLLER
Lyman Tube & Supply Co., Montreal, Que.

BELT-LACING MACHINES, HOOKS AND PINS
Clipper Belt Lacer Co., Grand Rapids

BELT LACING LEATHER
Aikenhead Hardware Co., Toronto, Ont.
G. F. Foss Mchy. & Sply. Co., Montreal.
Graton & Knight Mfg., Worcester, Mass.
Rice Lewis & Son, Toronto, Ont.

BELTING, BALATA
Federal Engineering Co., Toronto, Ont.

BELT HOOKS, WIRE
Clipper Belt Lacer Co., Grand Rapids

BELTING, RUBBER
Can. Consolidated Rubber Co., Montreal.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.
Goodyear Tire & Rubber Co., of Canada, Ltd., Toronto.
Gutta Percha & Rubber Ltd., Toronto, Canada.

BELTING, CHAIN
Can. Fairbanks-Morse Co., Montreal.
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Whitney Mfg. Co., Hartford, Conn.
Williams Mchy Co., A. R., Toronto, Ont.

BELTING, CONVEYOR
Can. Consolidated Rubber Co., Montreal.
Can. Link-Belt Co., Ltd., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal
Federal Engineering Co., Ltd., Toronto.
Gutta Percha & Rubber, Ltd., Toronto, Canada.
Graton & Knight Mfg., Worcester, Mass.
International Mchy. Spls., Ltd., Montreal.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
McLaren Belting Co., J. C., Montreal.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Quaker City Rubber Co, Philadelphia, Pa.
Rice, Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Sumner & Co., New York, N. Y.
Williams Mchy Co., A. R., Toronto, Ont.

BELTING, FRICTION AND SURFACE
Can. Con. Rubber Co., Ltd., Montreal.
Gutta Percha & Rubber, Ltd., Toronto.

BELTING, HAIR
Summer & Co., New York, N.Y.

BELTING, LEATHER
Can. Graton & Knight Mfg. Co., Montreal
Gutta Percha & Rubber, Ltd., Toronto, Canada.
Sumner & Co., New York, N. Y.
John Tullis & Son, Glasgow, Scotland.

BELTING, RUBBER
International Mchy. Spls., Ltd., Montreal.
Quaker City Rubber Co, Philadelphia, Pa.

BELTING, STITCHED COTTON DUCK
Dominion Belting Co., Hamilton, Ont.
Gutta Percha & Rubber, Ltd., Toronto.

BELTING, WOVEN
Federal Engineering Co., Ltd., Toronto
Summer & Co., New York, N.Y.

BENDING MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.
Bertram & Sons Co., John, Dundas
Brown-Boggs Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Kitchener.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Mach. Co., Toronto.
Petrie, Ltd., H. W., Toronto.

BLAST GATES
W. S. Rockwell Co., New York, N.Y.

BLASTING MACHINES, SAND
Garlock-Walker Machinery Co., Toronto.
Jardine, A. B., & Co., Hespeler, Ont.
National Mach. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

BILLET MARKERS
Matthews & Co., Jas. H., Pittsburgh, Pa.

BILLETS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Swedish Steel & Importing Co., Ltd., Montreal.
Algoma Steel Corp., Sault Ste. Marie.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto
United States Steel Corp., Canton, Ohio.

BILLETS, FORGING
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.

BINS, STEEL
Dennis Wire & Iron Works, London, Ont.
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Toronto Iron Works, Ltd., Toronto, Ont.
Wilkes Hamilton Co., Peterboro, Ont.

BLACKSMITH WORK
The Thos. Pink Co., Ltd., Pembroke.

BLOCKS, CHAIN
Oliver Engineering Co., Montreal.

BLOOMS AND SLABS
Algoma Steel Corp., Sault Ste. Marie.
United States Steel Corp., Canton, Ohio.

BLOWERS
Can. Blower & Forge Co., Kitchener, Ont.
Garlock-Walker Machinery Co., Toronto.
MacGovern & Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
U.S. Ordnance, Toronto, Ont.

BLOWING ENGINES
General Combustion Co., Ltd., Montreal, Que.

BLOW PIPES AND REGULATORS
Carter Welding Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

BLUE PRINTING MACHINERY
Commercial Camera Co., Providence, R.I.

BLUE PRINT PAPER
Hughes, Owens Co., Ltd., Montreal, Que.

BOARDS, GLASS CUTTING
Lufkin Rule Co., of Can., Windsor, Ont.

BOARTZ
Joyce, Koebel & Co., Inc., New York.

BOLT CUTTERS
Greenfield Tap & Die Corp., Greenfield Mass

BOILER TUBES
Lyman Tube & Supply Co., Montreal, Que.

BOILER BREECHINGS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
St Lawrence Welding Co, Ltd., Montreal
William Hamilton Co., Peterboro, Ont.

BOLT CUTTERS
Fellows Gear Shaper Co., Springfield, Vt.
Greenfield Tap & Die Corp., Greenfield Mass.
Wells Bros., of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.

BOILERS, RANGE
Can. John Wood Mfg. Co., Ltd., Toronto, Ont.

BOILERS
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.

BOLT CUTTERS AND NUT TAPERS
Aikenhead Hardware Co., Toronto, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Landis Machine Co., Waynesboro, Pa.
A.B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Wells Bros. Co. of Canada, Galt, Ont.
Petrie, Ltd., H. W., Toronto.

BOLTS
Aikenhead Hardware Co, Toronto, Ont.
London Bolt & Hinge Wks., London, Ont.
Morrow Screw & Nut Co., John, Ingersoll.
Rice, Lewis & Son, Toronto, Ont.
Steel Co., of Canada, Ltd, Hamilton.
Wilkinson & Kompass, Hamilton, Ont.
Williams & Co., J. H. Brooklyn, N.Y.

BOLTS, COUPLING
Gast Machine Screw Co., Ltd., Galt, Ont.

BOLTS, STAY
Morrow Screw & Nut Co., John, Ingersoll.

BOLTS, SPRING SHAKLE
Can. Winkley Co., Ltd., Windsor, Ont.
Morrow Screw & Nut Co., John, Ingersoll

BOLTS, PATCH
Morrow Screw & Nut Co., John, Ingersoll.

BOLT AND NUT MACHINERY
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto
Gardner & Son, Robt., Montreal.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Universal Mach. Co., Bowling Green, O.
Williams Machinery Co., A. R., Toronto

BOLT THREADING MACHINERY
Jardine & Co., Ltd., B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
Victor Tool Co., Waynesboro, Pa.

BONDING MACHINES (Electric Railway)
The Lincoln Electric Co., Toronto, Ont.

BORING MACHINES, PNEUMATIC CYLINDER
Cleveland Pneumatic Tool Co., Toronto.
Canadian Fairbanks-Morse Co., Montreal
Can. Ingersoll-Rand Co., Sherbrooke Que
Garlock-Walker Mach. Co., Toronto.

BORING MACHINES, UPRIGHT AND HORIZONTAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto
Oliver Mach'y Co., Grand Rapids, Mich.
Gisholt Machine Co., Madison, Wis.
Hoefer Mfg. Co., Freeport, Ill.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Rockford Drilling Mchs. Co, Rockford, Ill.

BORING AND TURNING MILLS
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Foss Mch. & S'ply Co., Geo. F., Montreal
Knight Metal Products, Toronto.
Oliver Mach. Co., Grand Rapids, Mich.
Niles-Bement-Pond Co., New York.

BOXES, CAST IRON
Brown & Sharpe Mfg. Co., Providence, R.I.

BOXES, STEEL SHOP AND TOTE
Cleveland Wire Spring Co., Cleveland.

BRAKES
Brown, Boggs & Co., Hamilton, Can.
Electric Steel & Metals, Ltd., Welland.

BRASS—SHEETS, ROLLS, PLATES, and RODS
Brown's Copper and Brass Rolling Mills, New Toronto.

BRASS ALLOYS
British Smelting & Refining Co., Ltd., Montreal, Que.

BRASS AND COPPER TUBING
Lyman Tube & Supply Co., Montreal, Que.

BRASS FOUNDERS
Canada Metal Co., Toronto.
St. Lawrence Welding Co., Montreal.
Tallman Brass & Metal Co., Hamilton.

BRASS GOODS
Crane, Ltd., Montreal, Que.

BRASS PIPE AND TUBE
Crane, Ltd., Montreal, Que.

BRASS WORKING MACHINERY
Barber Mchy. Co., Ltd., Toronto, Ont.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machinery Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Frank-O-Lite Co., Inc., Toronto, Ont.
Wood Turret Machine Co., Brazil, Ind.
Williams Machy. Co., A. R., Toronto.
Brown's Copper and Brass Rolling Mills, New Toronto.

BRAZING EQUIPMENT
Chicago Flexible Shaft Co., Chicago, Ill.

BRICKS, FIRE
Elk Fire Brick Co., Can., Ltd., Hamilton, Ont.

BRIDGES, RLY. AND HIGHWAY
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.

BRONZE—SHEETS, ROLLS, PLATES, and RODS
Brown's Copper and Brass Rolling Mills, New Toronto.

BRONZE, NAVAL
Canada Metal Co., Toronto.
Tallman Brass and Metal Co., Hamilton.

BRONZE COPPER
Canada Metal Co., Toronto.

BRUSHES, CARBON
Lyman Tube & Supply Co., Montreal, Que.

BUFFING AND POLISHING MACHINERY
Ford-Smith Mach. Co., Hamilton.
Foss Mchy. & S'ply Co., Geo. F. Montreal
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.

BUCKETS, DUMP
MacKinnon Steel Co., Sherbroooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
St Lawrence Welding Co, Ltd , Montreal

BUCKETS, ELEVATOR
Can. Link-Belt Co., Toronto, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
[illegible]nce Welding Co. Ltd., Mont[illegible]

BUCKETS, CLAM SHELL, CRAB, DUMP
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Ltd, Walkerville.

BULLDOZERS
Bertram & Sons Co., John, Dundas.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

BURNERS, OIL AND NATURAL GAS
Northern Crane Works, Ltd., Walkerville.
W. S. Rockwell Co., New York, N.Y.

BURRS, IRON AND COPPER
Parmenter & Bulloch Co., Gananoque,.

BUSHINGS, BRONZE
Morrow Screw & Nut Co., John, Ingersoll.
St Lawrence Welding Co, Ltd., Montreal

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R.I.
Pangborn Corporation, Hagerstown, Md.

CABINETS, SAND BLAST
Pangborn Corporation, Hagerstown, Md.

CABLE, ELECTRIC
International Machinery & Supply Co., Ltd., Montreal, Que.

CABLES, TRANSMISSION AND TELEPHONES
Northern Electric Co., Ltd., Montreal.

CALKS, BOOT
Lufkin Rule Co., of Can., Windsor, Ont.

CANNERS' MACHINERY
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Can.

CANNERS' CONVEYORS
Can. Link-Belt Co., Toronto, Ont.

CARBIDE
Carter Welding Co., Ltd., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.
Union Carbide Co., of Canada, Limited, Weland, nt.

CARBONIZING BOXES
Can. Driver-Harris Co., Ltd., Walkerville
Katie Foundry, Galt, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
Swedish Crucible Steel Co., Windsor.

CARRIERS, PNEUMATIC TUBE
James & Glassco, Montreal.

CARS, INDUSTRIAL
Can. Blower & Forge Co., Kitchener, Ont
Can. Fairbanks-Morse Co., Ltd, Montreal
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

CASES, FILING
Economy Drawing Table Co., Adrian, Mich.

CASTINGS, ALUMINUM, BRASS BRONZE, COPPER, AND GUN METAL
Algoma Steel Corp., Sault Ste. Marie.
Franklin Mfg. Co., Syracuse, N.Y.
Canada Metal Co., Ltd., Toronto, Ont.

CASTINGS, DIE CAST
Canada Metal Co., Ltd., Toronto, Ont.
Franklin Mfg. Co., Syracuse, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Tallman Brass & Metals Ltd., Hamilton, Ont.

CASTINGS, STEEL—ALL KINDS
Canada Electric Castings, Ltd., Orillia, Ont.
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Electric Steel & Metals Co., Welland.
Meeta Machine Co., Pittsburgh, Pa.

CASTINGS, ELECTRIC AND ALLOY STEEL
Can. Elec. Castings Co. Ltd., Orillia, Ont
Dominion Foundries & Steel Ltd., Hamilton, Ont.

CARRIERS COUPLING BOLTS
John Morrow Screw & Nut Co., Ingersoll
Alexander Fleck Ltd., Ottawa.
Tallman Brass & Metal Co., Hamilton.

CASTINGS, BENCH LEG,
Brown & Sharpe Mfg. Co., Providence, R.I.

CASTINGS, BRASS AND IRON
Algoma Steel Corp., Sault Ste. Marie.
International Machinery and Supply Co., Ltd., Montreal, Que.

CASTINGS, BUILDING
Katie Foundry, Galt, Ont.

CASTINGS, GRAY IRON
Bernard Industrial Co., A., Fortierville, Q.
Brown & Sharpe Mfg. Co., Providence, R.I.
Brown, Boggs Co., Ltd., Hamilton.
Can. Elec. Castings Co, Ltd., Orillia, Ont
Alexander Fleck, Ltd., Ottawa.
Gardner & Son, Robt., Montreal.
Hull Iron & Steel Foundries, Ltd., Hull
International Malleable Iron Co., Guelph
Kennedy & Sons, Ltd., Wm., Owen Sound.
Katie Foundry, Ltd., Galt, Ont.
Hamilton Co., Wm., Peterboro.
McFarlane Engineering Ltd., G. W., Paris, Ont.

CASTINGS, PLUMBERS'
Katie Foundry, Galt, Ont.

CASTINGS, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville

CASTINGS, HARDWARE
Katie Foundry, Galt, Ont.

CASTINGS, STEEL CHROME AND MANGANESE STEEL
Thos. Davidson Mfg. Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hull Iron & Steel Foundries, Ltd., Hull.
Kennedy & Sons, Ltd, Owen Sound.

CASTINGS, MALLEABLE
International Malleable Iron Co., Guelph

CASTINGS, NICKEL STEEL
Hull Iron & Steel Foundries, Ltd., Hull.

CEMENT MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gardner, Robt., & Son, Montreal.

CEMENT HANDLING MACHINERY
Can. Link-Belt Co., Toronto, Ont.

CEMENT TOOLS
Atkins & Co., E. C., Hamilton, Ont.

CENTERING MACHINES
Victoria Foundry Co., Ottawa, Ont.

CENTRE REAMERS
Bertram & Sons Co., John, Dundas.
Butterfield & Co., Inc., Rock Island, Que.
Gardner, Robt. & Son, Montreal.
Hurlburt, Rogers Mch. Co., South Sudbury, Mass.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co., of Canada, Galt, Ont.

CHAIN, WELDED COIL
Morris Crane & Hoist Co., Herbert; Niagara Falls, Ont.

CHAIN BLOCKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford Chain Block & Mfg. Co., Phila., Pa.
Garlock-Walker Machy. Co., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & HoistCo., Herbert, Niagara Falls, Ont.
Oliver Engineering Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Jones & Glassco, Montreal, Que.

CHAINS, AGRICULTURAL
Canadian Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.

CHAINS, AUTOMOBILE ENGINE
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.

CHAINS, BICYCLE, DRIVE AND BLOCK
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAINS, FOR ELEVATORS AND CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAIN, MALLEABLE, DETACHABLE AND RIVETED
Can. Link-Belt Co., Toronto, Ont.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAINS, POWER TRANSMISSION
Canadian Link-Belt Co., Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, New York.
Glasgow, N.S.

CHAINS, SPROCKET WHEEL
Can. Link-Belt Co., Ltd., Toronto, Ont.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAIN DRIVES
Can. Link-Belt Co., Toronto, Ont.
Coventry Chain Co., Coventry, England.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHASERS
National Acme Co., Cleveland, Ohio.
Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont.

CHEMISTS
Toronto Testing Lab'tory, Ltd., Toronto

CHUCKS, AERO, AUTOMATIC
Garvin Machine Co., New York.

CHUCKS, CENTERING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKS, COLLET, AIR
Elliott & Whitehall Mach. & Tool Co. Galt, Ont.
Smalley-General Co., Inc., Bay City, Mich.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, LATHE AND UNIVERSAL
Aikenhead Hardware Co., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt., & Son, Montreal.
Garlock-Walker Mach'y Co., Toronto.
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Chicago, Ill.
Jacobs Mfg. Co., Hartford, Conn.
Ker & Goodwin Machine Co., Ltd., Knight Metal Products, Toronto.
Modern Tool Co., Erie, Pa.
Rice Lewis & Son, Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, AUTOMATIC AND KEYLESS
Aikenhead Hardware Co., Toronto, Ont
Can. Blower & Forge Co., Kitchener.
McCrosky Tool Corp., Meadville, Pa., U. S. A.

CHUCKS, FRICTION AND TAP
Victor Tool Co., Waynesboro, Pa.

CHUCKS, MAGNETIC
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

CHUCKS, RING WHEEL
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.

CHUCKS, WHEEL, CAR
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKING MACHINES
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Windsor, Vt.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Wood Turret Mach. Co., Brazil, Ind.
Williams Mchy Co., A. R., Toronto, Ont.

CIRCULATING SYSTEMS FOR LUBRICATING OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

CLAY FIRE
Elk Fire Brick Co., Can., Ltd., Hamilton, Ont.

CLEANERS, METER, WASTE, GENERAL
Oakley Chemical Co., New York, N.Y.

CLEANING COMPOUND
Oakley Chemical Co., New York.

CLOCK SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

CLOCKS, WATCHMAN, PORTABLE
Gisholt Machine Co., Madison, Wis.

CLOSETS
Crane, Ltd., Montreal, Que.

CLUTCHES, CHAIN
Wright Mfg. Co., Lisbon, Ohio.

CLUTCHES, FRICTION AND PULLEY
Bernard Industrial Co., A., Fortierville, Q.
Can. Link-Belt Co., Toronto, Ont.
Carlyle Johnson Mach. Co., Manchester, Conn.
Positive Clutch & Pulley Wks., Aurora, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.

COAL CRUSHERS
Canadian Link-Belt Co., Ltd., Toronto, Ont.
Canadian Mead-Morrison Co., Limited, Montreal, Que.

COAL HANDLING MACHINERY
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
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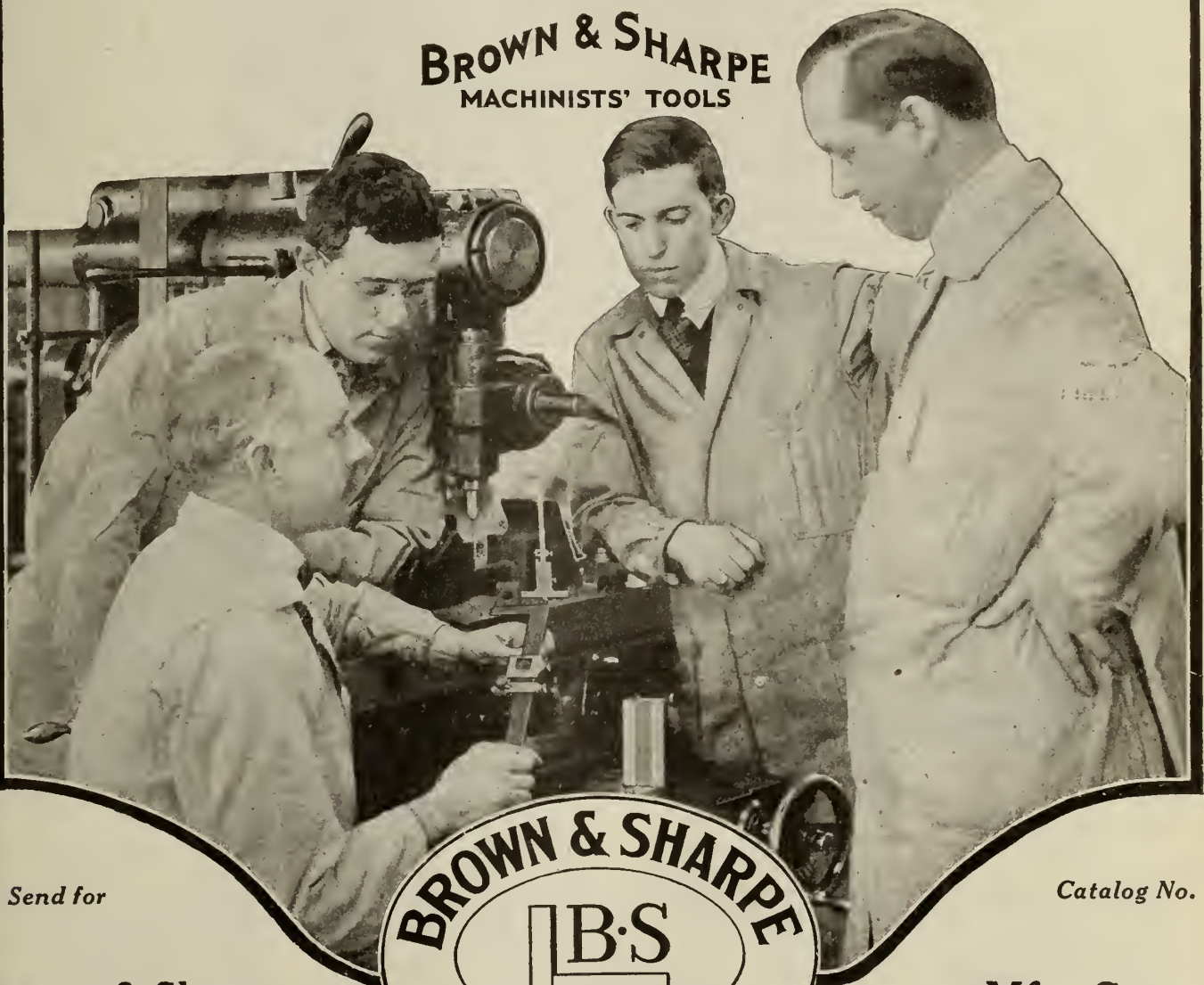

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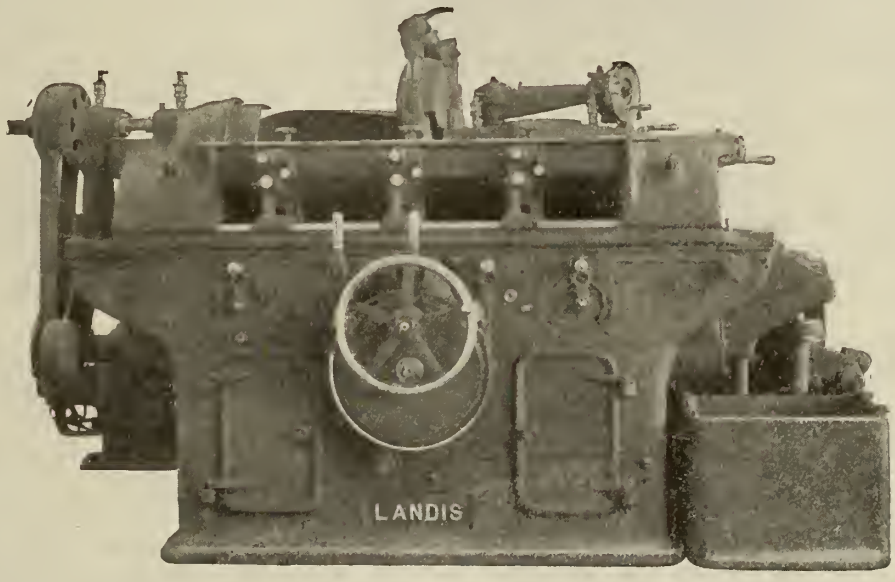

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Standard Machy. & Supplies, Montreal.
Taylor J. A. M., Stair Bldg., Toronto.
Wilt Twist Drill Co. of Can., Walkerville
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

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Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

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Cleveland Pneumatic Tool Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Williams Mchy Co, Ltd., A. R., Montreal
Greenfield Tap & Die Corp., Greenfield, Mass.

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Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.

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Armstrong Bros. Tool Co., Chicago, Ill.
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Canadian Fairbanks-Morse Co., Montreal.
Cincinnati Electrical Tool Co., Cincinnati.
Cleveland Twist Drill Co., Cleveland.
Garlock-Walker Mchy. Co., Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilt Twist Drill Co. of Can., Walkerville.

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Cleveland Pneumatic Tool Co., Toronto.
The Foss Mchy. & Supply Co., Montreal.
Samuel Osborne Ltd., Montreal, P.Q.
A. R. Williams Machy. Co., Toronto.

DRILLS, SQUARE & HEXAGON
Globe Engineering Co.

DRILLS, TRACK
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Cleveland Twist Drill Co., Cleveland.
The Foss Mchy. & Supply Co., Montreal.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Wilt Twist Drill Co. of Can., Walkerville.

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Sturtevant Co., B. F., Galt, Ont.
W. S. Rockwell Co., New York, N.Y.

DRUM CONTROLS
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DUMP CARS
Canadian Fairbanks-Morse Co., Montreal.
MacKinnon Steel Co., Sherbrooke, Que.

DUST EXHAUSTER. ARRESTER SYSTEM
Pangborn Corporation, Hagerstown, Md.

DUST HANDLING EQUIPMENT
Pangborn Corporation, Hagerstown, Md.
Sturtevant Co., B. F., Galt, Ont.

DUST SEPARATORS
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Sturtevant Co., B. F., Galt, Ont.

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Lancashire Dynamo & Motor Co., Ltd., Toronto.
MacGovern & Co., Montreal, Que.
A. R. Williams Machy. Co., Toronto.

ELECTRICAL SUPPLIES
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Lyman Tube & Supply Co., Montreal, Que.
Northern Electric Co., Ltd., Montreal Que

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Hamilton & Hansell, Inc., New York City
Volta Manufacturing Co., Welland, Ont.

ELECTRIC FURNACE REGULATORS, WINCHES, ROOF COOLERS AND ELECTRODE HOLDERS
Volta Manufacturing Co., Welland, Ont.

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Can. Driver-Harris Co., Walkerville, Ont.

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Canadian Mead-Morrison Co., Limited, Montreal, Que.
Volta Manufacturing Co., Welland, Ont.

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Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
Sturtevant Co., B. F., Galt, Ont.
Volta Manufacturing Co., Welland, Ont.

ELECTRIC TRUCKS
Cowan Truck Co., Holyoke, Mass.
Goad Engineering Co., Toronto, Ont.

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Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
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Oliver Machinery Co., Grand Rapids, Mich

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Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.

EMERY CLOTH
Atkins & Co., E. C., Hamilton, Ont.

EMERY PAPER
Atkins & Co., E. C., Hamilton, Ont.

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Ford-Smith Mach. Co., Hamilton, Ont.
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Petrie, Ltd., H. W., Toronto.
A. R. Williams Machy. Co., Toronto.

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Can. Foundries & Forgings, Ltd., Welland, Ont.

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Page Steel & Wire Co., Adrian, Mich.

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FACTORY SITES
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Sturtevant Co., B. F., Galt, Ont.

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Morrow Screw & Nut Co., J., Ingersoll, Ont
Marshall, Son & Bunney, Toronto, Ont.
Nicholson File Co., Port Hope, Ont.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
Whitman & Barnes Mfg. Co., Akron, O.
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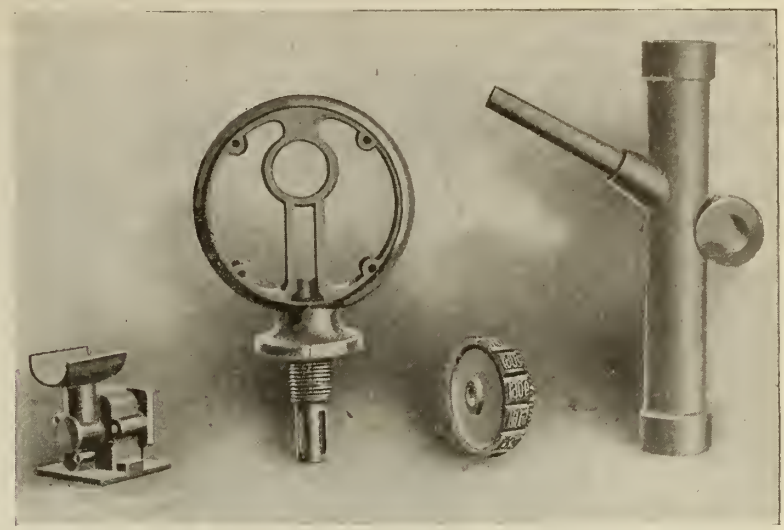

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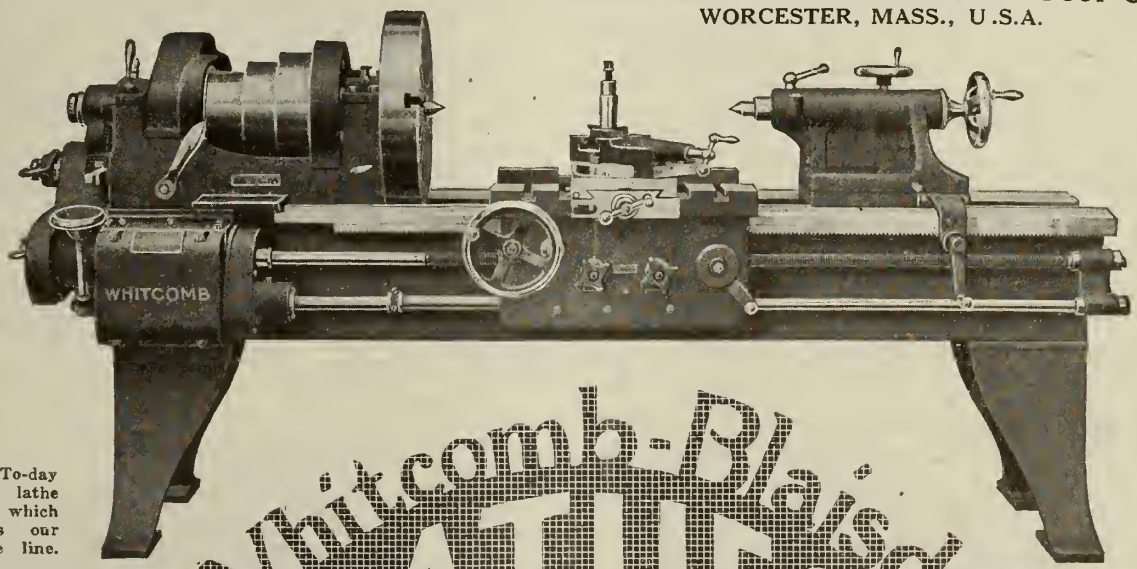

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Dominion Bridge Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Elliott & Whitehall, Galt, Ont.
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Williams Mchy Co., A. R., Toronto, Ont.

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Wells Bros. of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

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Heald Machine Co., Worcester, Mass.
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Grant Mfg. & Mach. Co., Bridgeport, Con
Garlock-Walker Machinery Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Independent Pneumatic Tool Co., Chicago
Petrie, Ltd., H. W., Toronto.
United States Elec. Tool Co., Cincinnati
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Cleveland Pneumatic Tool Co., Toronto.
Garlock-Walker Machinery Co., Toronto.
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Independent Pneumatic Tool Co., Chicago
MacGovern & Co., Montreal, Que.

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Bristol Machine Tool Co., Bristol, Conn.
Manhattan Machine & Tool Co., Grand Rapids, Mich.

GRINDERS, TOOL AND HOLDER
Armstrong Bros. Tool Co., Chicago.
W. F. & John Barnes Co., Rockford, Ill.
Blount & Co., J. G., Everet, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I
Ford-Smith Machine Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield.
National-Acme Co., Cleveland, Ohio.
Tabor Mfg. Co., Philadelphia, Pa.
Wells Bros. of Canada, Galt, Ont.

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Norton Co., Worcester, Mass.
Williams Mchy Co, Ltd., A. R., Montreal

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Gisholt Machine Co., Madison, Wis.
Norton Co., Worcester, Mass.
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Gardner & Son, Robt., Montreal.
Garvin Machine Co., New York.
Garlock-Walker Machy. Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Haskins & Co., R. C., Chicago, Ill.
Hall & Sons, John H., Brantford, Ont.
Niles-Bement-Pond Co., New York, N.Y.
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Wisconsin Electric Co., Racine, Wis.
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Atkins & Co., E. C., Hamilton, Ont.
Brantford Emery Wheel Co., Brantford.
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Carborundum Co., Niagara Falls, N.Y.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Mchy. & S'ply Co. G. F., Montreal.
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Canada Wire & Iron Goods Co., Hamilton
Dennis Wire & Iron Works, London, Ont.
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Atkins & Co., E. C., Hamilton, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Wks., Buffalo.
Ford-Smith Machine Co., Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Plewes, Ltd., Winnipeg, Man.
Pilot Steel & Tool Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Racine Tool & Machine Co., Racine, Wis.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
L. S. Starrett Co., Athol, Mass.
Standard Machy. & Supplies, Montreal.
Victor Saw Works, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.
Williams Mchy Co., A. R., Toronto, Ont.

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Atkins & Co., E. C., Hamilton, Ont.
Can. Fairbanks-Morse Co., Montreal.
Ford-Smith Machine Co., Hamilton, Ont.
Garvin Machine Co., New York City.
Victor Saw Works, Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.

HACK SAWS, POWER
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Atkins & Co., E. C., Hamilton, Ont.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Wks., Buffalo.
Foss Mchy. & S'ply Co., G. F., Montreal.
Ford-Smith Machine Co., Hamilton.
Perfect Machine Co., Galt, Ont.
Starrett Co., L. S., Athol, Mass.
Victor Saw Works, Hamilton, Ont.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Forged Chrome Vanadium Gear Blanks and Pinions

Immediate Delivery, Rough turned, Sizes up to 12" diameter.

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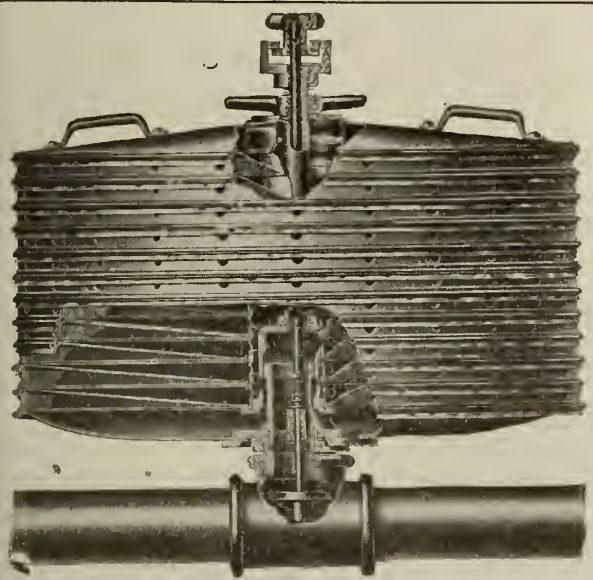
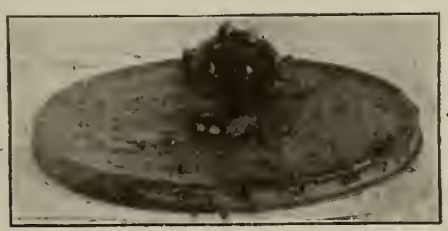


No. 1—Sectional View of Bowser Filter Section Assembled



No. 2—Filter Disc with dirt filtered from oil

It Gets The Dirt It's A BOWSER Oil Filter

The pictures shown illustrate the Bowser Filter Section as used in the Bowser Oil Filter.

No. 1 shows the Filter Section assembled, ready for use. No. 2 shows one of the Filter discs with dirt that the Filter has collected from used oil. This pile of dirt is about 6 in. in diameter and from 2 in. to 3 in. high.

There are twelve of these filter discs and cloths in a Bowser filter section, each as effective as the one you see pictured. As many complete Filter Sections as needed are furnished in the Bowser System.

Bowser Systems are applicable to any size and type of power producing and transmitting machinery.

We will be glad to send literature and explain to you how the Bowser principle of Oil Filtration can be applied to your power plant.

S. F. BOWSER COMPANY, Limited
66-68 FRASER AVE., TORONTO, CANADA
Offices in Principal Cities of the World

If interested tear out this page and place with letters to be answered.

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Bliss Co., E. W., Brooklyn, N.Y.
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Can. Billings & Spencer, Ltd., Welland.
Canada Machinery Corp., Galt, Ont.
High Speed Hammer Co., Rochester, N.Y.
Jardine & Co., A. B., Hespeler, Ont.
Niles-Bement-Pond Co., New York, N.Y.
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
United Hammer Co., Boston, Mass.
Williams Mchy Co, Ltd., A. R., Montreal

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Petrie, Ltd., H. W., Toronto.
West Tire Setter Co., Rochester, N.Y.
Williams Mchy Co, Ltd., A. R., Montreal

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Nazel Eng. & Mach. Wks., Philadelphia.

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United Hammer Co., Boston, Mass.

HAMMERS, POWER
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Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.
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Williams Mchy Co, Ltd., A. R., Montreal

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A. Beatty & Sons, Ltd., Welland, Can.
Oliver Engineering Co., Montreal.
Volta Mfg. Co., Welland, Ont.

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Dominion Bridge Co., Montreal, Que.
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Kennedy & Sons, Owen Sound, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
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Williams Mchy Co, Ltd., A. R., Montreal

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Matthews & Co., Jas. H., Pittsburgh, Pa.

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Electric Steels & Metals, Ltd., Welland

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Clipper Belt Lacer Co., Grand Rapids.

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Dominion Bridge Co., Montreal, Que.
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Garvin Machine Co., New York.
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Globe Engineering Co., Ltd., Hamilton.
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Toronto Tool Co., Toronto, Ont.

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Garlock-Walker Machinery Co, Toronto.
Garvin Machine Co., New York.
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Niles-Bement-Pond Co., New York.
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Rae Mach. Tool Co., Hamilton.
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Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.
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MACHINE TOOLS
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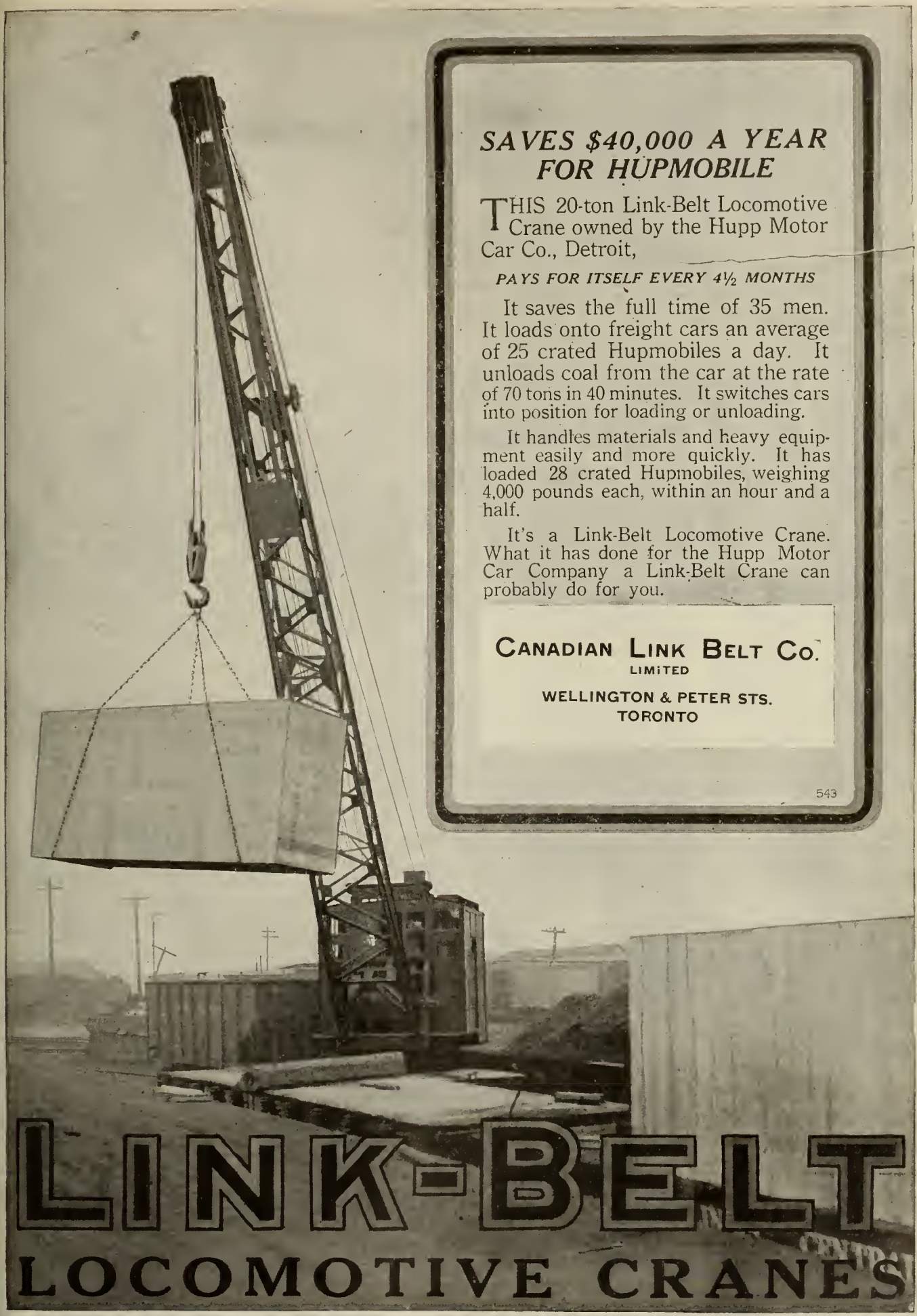
Knight Metal Products, Toronto.
Rae Mach. Tool Co., Hamilton.



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It saves the full time of 35 men. It loads onto freight cars an average of 25 crated Hupmobiles a day. It unloads coal from the car at the rate of 70 tons in 40 minutes. It switches cars into position for loading or unloading.

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It's a Link-Belt Locomotive Crane. What it has done for the Hupp Motor Car Company a Link-Belt Crane can probably do for you.

CANADIAN LINK BELT CO.
LIMITED
WELLINGTON & PETER STS.
TORONTO

543

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Can. Fairbanks-Morse Co., Montreal.
Elliott & Whitehall, Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Williams Machy. Co., A. R., Toronto.

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Globe Engineering Wks., Hamilton, Ont.
Knight Metal Products, Toronto.

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Crescent Machine Co., Ltd., Montreal, Que.
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Cleveland Twist Drill Co., Cleveland.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Pratt & Whitney Co., Dundas, Ont.

MARKING DEVICES

Matthews & Co., Jas. H., Pittsburgh, Pa

MARKING MACHINERY

Brown, Boggs Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Perrin, Wm. R., Toronto.
Petrie, Ltd., H. W., Toronto.

MATERIALS, HANDLING PLANTS

Canadian Mead-Morrison Co., Limited, Montreal, Que.

MATS, RUBBER MATTING

Quaker City Rubber Co., Philadelphia, Pa
International Mchy. Sply., Ltd., Montreal

MEASURING MACHINES

Pratt & Whitney Co., Dundas, Ont.

MEASURES, REGISTERING

Bowser Co., Ltd., S. F., Toronto, Ont.

MEASURING TAPES AND RULES

Chesterman & Co., Jas., Sheffield, Eng.

MERCHANTS, IRON AND STEEL

Samuel Osborne (Can.), Ltd., Montreal.

METALLURGISTS

See Chemists.

METAL CLEANERS

Oakley Chemical Co., New York, N.Y.

METAL CUTTING MACHINES

Atkins & Co., E. C., Hamilton, Ont.
Lyman Tube & Supply Co., Montreal, Que.

METAL SAWS

See Saws.

METAL, ANTI-FRICTION

Thos. Moore & Son, Montreal.

METAL SAWS, POWER

E. C. Atkins & Co., Inc., Indianapolis.
Hoefer Mfg. Co., Freeport, Ill.
Lyman Tube & Supply Co., Montreal, Que.

METALS

British Smelting & Refining Co., Ltd., Montreal, Que.
Brown's Copper & Brass Rolling Mills, New Toronto, Ont.
Canada Metal Co., Toronto, Ont.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.

METAL, STAMPINGS, SMALL

Can. Winkley Co., Ltd., Windsor, Ont.

METERS, OIL, GASOLINE, KEROSENE, ETC.

Bowser Co., Ltd., S. F., Toronto, Ont.
General Combustion Co., Ltd., Montreal, Que.

MICROMETERS

Taylor, J. A. M., 518 Stair Bldg., Toronto.
Petrie, Ltd., H. W., Toronto.

MILLS, BRACE AND TUBE

Elec. Steel & Metals, Welland, Ont.

MILL SPECIALTIES

Atkins & Co., E. C., Hamilton, Ont.

MILLS, SAND

Frost Mfg. Co., Chicago, Ill.

MILL MACHINERY

Alexander Fleck, Ltd., Ottawa.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

MILLING ARBORS

Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.

MILLING ATTACHMENTS

Barber Mchy. Co., Ltd., Toronto, Ont.
Becker Milling Machine Co., Boston, Mass.
Bertram & Sons Co., John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence.
Canada Machinery Corp., Galt, Ont.
Cincinnati Milling Machine Co., Cincinnati
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Hardinge Bros., Inc., Chicago, Ill.
Hendey Mach. Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Taft-Peirce Mfg. Co., Woonsocket, R.I.

MILLING MACHINES, AUTOMATIC

Bilton Mach. Tool Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Betts Machine Co., Rochester, N.Y.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.

MILLING CUTTERS

Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Milling Machine Co., Cleveland.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Marshall, Son & Bunney, Toronto.
Petrie, Ltd., H. W., Toronto.
Wilt Twist Drill Co., Walkerville, Ont.

MILLING MACHINES, HAND

Bristol Machine Tool Co., Bristol, Conn.

MILLING MACHINES, THREAD

Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Inc., Chicago, Ill.
Gray Ball Bearing Co., Ltd., Toronto.
United States Mach. Tool Co., Cincinnati.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Smalley Gen. Co., Inc., Bay City, U.S.A.
Standard Equipment & Tool Wks., Montreal, P.Q.

MILLING MACHINES, HORIZONTAL AND VERTICAL

Barber Mchy. Co., Ltd., Toronto, Ont.
Becker Milling Machine Co., Boston, Mass
Bristol Machine Tool Co., Bristol, Conn.
Brown & Sharpe Mfg. Co., Providence.
Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Knight Metal Products, Toronto.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Rockford Milling Mach. Co., Rockford, Ill
United States Mach. Tool Co., Cincinnati.
Whitney Mfg. Co., Hartford, Conn.
Williams Machy. Co., A. R., Toronto.

MILLING MACHINES, PLAIN, BENCH AND UNIVERSAL

Barber Mchy. Co., Ltd., Toronto, Ont.
Becker Milling Machine Co, Boston, Mass.
Bilton Mach. Tool Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence.
Canada Machinery Corp., Galt, Ont.
Cleveland Milling Machine Co., Cleveland.
Cincinnati Milling Machine Co., Cincinnati
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
National Machy. Co., Tiffin, Ohio.
Gooley & Eduud. Inc., Cortland, N.Y.
Hardinge Bros., Inc., Chicago, Ill.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Knight Metal Products, Toronto.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.

MILLING MACHINES, PROFILE

Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

MILLING TOOLS

Aikenhead Hardware Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence.
Ford-Smith Mach. Co., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

MINE CARS

Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dominion Bridge Co., Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.

MINING MACHINERY

Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Elec. Steel & Metals, Welland, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

MIXERS, SAND

Frost Mfg. Co., Chicago, Ill.

MORTISING MACHINES

Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
Gray Ball Bearing Co., Ltd., Toronto.

MOTORS, ELECTRIC

Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
MacGovern & Co., Montreal, Que.
Northern Elec. Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
U. S. Ordnance, Toronto, Ont.
Volta Mfg. Co., Welland, Ont.
Williams Mach'y Co., A. R., Toronto.

MOTOR SPRINGS

The Dunbar Brothers Co., Bristol, Conn.

MOTORCYCLE FRAME AND FORK

The Dunbar Brothers Co., Bristol, Conn.

MOTORS, PNEUMATIC

Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto.

MOULDS, RUBBER

Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

MULTIPLE INDEX CENTRES

Garvin Machine Co., New York.
Graton & Knight Mfg. Co., Worcester, M.

MULTI-DRILLING, MULTI-BORING, MULTI-TAPPING MACHINERY.

Nat. Automatic Tool Co., Richmond, Ind.

MUNICIPALITIES

City of St. John, Quebec.

NAIL SETS

Morrow Screw & Nut Co., J., Ingersoll, Ont

NAME PLATES, BRONZE, ETCHED AND STAMPED

Matthews & Co., Jas. H., Pittsburgh, Pa.
Turner Brass Works, Sycamore, Ill.

NICHROME CASTINGS

Can. Driver-Harris Co., Ltd., Walkerville.

NICKEL

Pilot Steel & Tool Co., Montreal, Que.

NICKEL STEEL

See Steel.

NICKEL SILVER—SHEETS, ROLLS, PLATES and RODS

Brown's Copper and Brass Rolling Mills, New Toronto.

NIPPLE THREADING MACHINES

Hall & Sons Ltd., John H., Brantford.
Landis Machine Co., Waynesboro, Pa.

NITROGEN

Carter Welding Co., Toronto, Ont.

NUTS, STEEL, CASTELLATED AND COLD PRESSED

Galt Machine Screw Co., Ltd., Galt, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Williams & Co., J. H., Brooklyn, N.Y.

NUTS, SEMI-FINISH AND FINISHED

Galt Machine Screw Co., Galt, Ont.
National-Acme Co., Cleveland, Ohio.
Wilkinson & Kompass, Hamilton.

NUT LOCKS

Edw. W. Robinson Co., Ltd., Montreal.

NUT BURRING AND NUT MACHINES (HOT)

National Machy. Co., Tiffin, Ohio.

NUT FACING AND BOLT SHAVING MACHINES

Garvin Machine Co., New York.
National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
Victor Tool Co., Waynesboro, Pa.

NUT TAPPERS

Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
Hall & Son, J. H., Brantford, Ont.
Jardine & Co., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.

OILERS

All-Way Oiler Mfg. Co., Toronto, Ont.

OIL SEPARATORS

Can. Fairbanks-Morse Co., Montreal.

OIL STONES

Aikenhead Hardware Co., Toronto, Ont.
Carborundum Co., Niagara Falls, N.Y.
Norton Co., Worcester, Mass.
Rice Lewis & Son, Toronto, Ont.

OIL STONE GRINDERS

Oliver Machy. Co., Grand Rapids, Mich

OIL STORAGE SYSTEMS

Bowser Co., Ltd, S. F., Toronto, Ont.
St. Lawrence Welding Co., Ltd., Montreal.

OPENING DIE HEADS

Greenfield Tap & Die Corp, Greenfield.
Wells Bros. of Canada, Galt, Ont.

OPTICAL SUPPLIES

Consolidated Optical Co., Toronto, Ont.

ORE HANDLING EQUIPMENT

Brown Hoisting Machinery Co., Cleveland, Ohio.
Canadian Link-Belt Co., Ltd., Toronto, Ont.
Canadian Mead-Morrison Co., Limited, Montreal, Que.

OSCILLATING VALVE GRINDERS (PNEUMATIC)

Cleveland Pneumatic Tool Co. of Canada, Toronto

OVENS FOR BAKING, BLUING, DRYING, ENAMELING, JAPANNING AND LACQUERING

Brantford Oven & Rack Co., Brantford

OVEN TRUCKS, STEEL

Brantford Oven & Rack Co., Brantford
MacKinnon Steel Co., Sherbrooke, Que.

OVENS FOR DRYING, TEMPER AND OXYGEN, ELECTROLYTIC CELLS UNDER TRUCKS

Welding & Supplies Co., Montreal, Que
Brantford Oven & Rack Co., Brantford

OXY-ACETYLENE WELDING AND CUTTING AND OUTFITS

Carter Welding Co., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.
Prest-o-Lite Co., Inc. Toronto, Ont.
Davis-Bournonville Co., Toronto, Ont.

OXYGEN

Carter Welding Co., Ltd., Toronto, Ont
Dominion Oxygen Co., Ltd., Toronto Ont.
Nat. Electro Products Ltd., Toronto, Ont
L'Air Liquide Society, Toronto, Ont.

OXYGEN PLANTS (ELECTROLYTIC)

Davis-Bournonville Co., Toronto, Ont.

PACKINGS, ASBESTOS

Cleveland Wire Spring Co., Cleveland.

PACKING, ROD AND SHEET

Dunlop Tire & Rubber Goods Co., Ltd. Toronto.
Goodyear Tire & Rubber Co., Can., Ltd. Toronto
Gutta Percha & Rubber, Ltd., Toronto
International Mach. Spls., Ltd., Montreal
Petrie, Ltd., H. W., Toronto.
Quaker City Rubber Co., Philadelphia, Pa

PANS, WET AND DRY

Frost Mfg. Co., Chicago, Ill.

PAPER MILL CONVEYORS AND DRIVES

Bertrams, Ltd., Edinburgh, Scotland.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Can. Link-Belt Co., Toronto, Ont.
Gutta Percha & Rubber, Ltd., Toronto
MacKinnon Steel Co., Sherbrooke, Que.

PARTITIONS, WIRE

See Guards

PAPER MILL MACHINERY

Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Garlock-Walker Machinery Co., Toronto
Hamilton Co., Ltd., Wm., Peterborough Ont.
MacKinnon Steel Co., Sherbrooke, Que.

PATTERN SHOP EQUIPMENT

Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto
Oliver Machy. Co., Grand Rapids, Mich
Petrie, Ltd., H. W., Toronto.

PATTERN MAKERS' LATHES

See Lathes.

PATENT SOLICITORS

Budden, Hanbury A., Montreal.
Fetherstonhaugh & Co., Ottawa.
Marion & Marion, Montreal.
Ridout & Maybee, Toronto.

PECK CARRIERS FOR POWER PLANTS

Can. Link-Belt Co., Toronto, Ont.

PENSTOCKS

William Hamilton Co., Peterboro, Ont.

PERFORATED METALS AND ORNAMENTAL IRON GOODS

Canada Wire & Iron Goods Co., Hamilton

PHOSPHOR TIN, COPPER AND BRONZE

British Smelting & Refining Co., Ltd. Montreal, Que.

PHOTOSTATS

Commercial Camera Co., Providence, R.I.

PIG IRON

Hanna & Co., M. A., Cleveland, O.
Steel Co. of Canada, Ltd., Hamilton, Ont

PINS, TAPER

Morrow Screw & Nut Co., J., Ingersoll, Ont

PINS, BELT-LACING

Clipper Belt Lacer Co., Grand Rapids.

PIPE, BLACK & GALVANIZED

Crane, Ltd., Montreal, Que.

PIPE FITTINGS, MALLEABLE AND CAST IRON

International Malleable Iron Co., Guelph

PIPE CUTTING AND THREADING MACHINES

Barber Mchy. Co., Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Curtis & Curtis Co., Bridgeport, Conn.
Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield
Hall & Sons, John H., Brantford.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
McDougall Co., R., Galt.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt, Ont.
Williams Tool Co., Erie, Pa.
Williams Machy. Co., A. R., Toronto.

PIPE, JOINT COMPOUNDS

Crane, Ltd., Montreal, Que.

PIPE RIVETED STEEL

Toronto Iron Works, Ltd., Toronto.
William Hamilton Co., Peterboro, Ont.

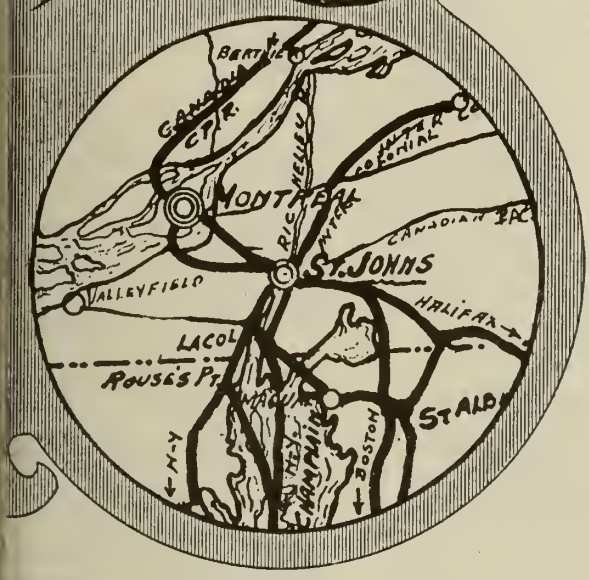
PIERCING

Oliver Machy. Co., Grand Rapids, Mich

PIPE CUTTERS, ROLLING

Curtis & Curtis Co., Bridgeport, Conn.
Greenfield Tap & Die Corp., Greenfield.
Hall & Sons, Ltd., John H., Brantford.
Wells Bros. Co. of Canada, Galt, Ont.

The City of ST. JOHNS, QUEBEC



The location of an industrial plant has a vital effect on its prosperity.

For every industry there is a logical location. It may be decided by labour conditions, by the location of raw materials and market, by demands for power or by special factors peculiar to the business.

It is therefore of utmost importance in selecting a location for your new factory that the relative advantages of the different sites be weighed carefully with keen appreciation for future demands and development.

St. Johns possesses such unusual advantages of great economic importance such as its commanding geographical location, unequalled transportation facilities, adequate fuel and power and labour supply that it should always be included in investigations before definitely deciding on the location of a new industry.

You will do well to get into direct touch with us and let us show you in detail the sites we have available, the actual advantages of St. Johns as a location for your particular industry and the inducements you are offered to locate with us.

No other locality can offer these combined advantages

—Seven railroads, including Canada's great transcontinental lines.

—Finest ocean shipping facilities.

—Canal connections with New York, the Eastern States, and the Great Lakes.

—Cheapest labour market in Canada.

—Plentiful supply of skilled and unskilled labour.

—Cheap and abundant electric power.

—Cheap coal and lower freight rates.

—Desirable factory sites with all public conveniences immediately available.

—Extraordinary inducements to new industries.

For more specific information write

The Secretary of the City Council

ST. JOHNS, QUEBEC, CANADA

If interested tear out this page and place with letters to be answered.

PIPE TOOLS AND DIES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE CUTTERS AND REAMERS
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE STOCKS AND THREADERS
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE TAPS AND VISES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE WRENCHES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PISTON AND PISTON RING MACHINES
National Acme Co., Windsor, Vt.

PLANER BOLTS
Atkins & Co., E. C., Hamilton, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont.

PLANER JACKS
Armstrong Bros. Tool Co., Chicago.

PLANERS, STANDARD AND ROTARY
Butts Machine Co., Rochester, N.Y.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Oliver Machy. Co., Grand Rapids, Mich.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal
Gardner & Son, Robt., Montreal.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Morton Mfg. Co., Muskegon Heights, Mich
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.

PLANING AND SHAPING MACHINERY
Barber Mchy. Co., Ltd., Toronto, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Niles-Bement-Pond Co., New York.
Ohio Mach. Tool Co., Kenton, Ohio.
Perrin, Ltd., William, Toronto.
Williams Mchy Co. Ltd., A. R., Montreal

PLANER-SHAPER, COMBINED OPEN SIDE
Lynd-Farquhar Co., Boston.
Petrie, Ltd., H. W., Toronto.

POWER HAMMERS
Quickwork Co., St. Marys, Ohio.

PLANING MILL EXHAUSTERS
Can. Blower & Forge Co., Kitchener, Ont.
MacGovern & Co., Montreal, Que.
Niles-Bement-Pond Co., New York.
Sturtevant Co., B. F., Galt, Ont.

PLATES, Q.M., SHEARED AND CHEQUERED
Pedlovers, Ltd., Toronto, Ont.

PLATING, PLANTS & SUPPLIES
Can. Hanson Van Winkle Co., Ltd., Toronto, Ont.

PLIERS
Aikenhead Hardware Co., Toronto.
Can. Billings & Spencer, Ltd., Welland.
Rice Lewis & Son, Toronto, Ont.

PNEUMATIC TOOLS
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Can., Toronto.
Curtis Pneumatic Machy. Co., St. Louis.
Garlock-Walker Machy. Co., Toronto.
Int. Mach. & Supply Co., Ltd., Montreal.
Independent Pneumatic Tool Co., Chicago.

POWER CRANES, HAND
MacKinnon Steel Co., Sherbrooke, Que.

POLISHING MACHINES
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto.

POLISHING PLATES
Greenfield Tap & Die Corp., Greenfield.
Petrie, Ltd., H. W., Toronto.
Wells Bros. of Canada, Galt, Ont.

POLISHING PAPER
H. H. Barton & Son Co., Philadelphia.

POTS AND KETTLES, CAST STEEL
Elec. Steel & Metals, Welland, Ont.

POWER HOUSE CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

PORTABLE MACHINERY
Haskins & Co., R. C., Chicago, Ill.

POWER TRANSMISSION MCHY.
Canadian Link-Belt Co., Ltd., Toronto, Hamilton Co., Ltd., Wm., Peterborough, Ont.
Petrie, Ltd., H. W., Toronto.

PRESSED STEEL PARTS
Gray Ball Bearing Co., Ltd., Toronto.

PRESSERS, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Metalwood Mfg. Co., Detroit, Mich.
Petrie, Ltd., H. W., Toronto.

PRESSES, BROACHING, FORGING AND FLANGING
Atlass Press Co., Kalamazoo, Mich.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Dom. Steel Products Co., Ltd., Brantford
Metalwood Mfg. Co., Detroit, Mich
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
Stoll Co., D. H., Buffalo, N.Y.
Williams Mchy Co., Ltd., A. R., Montreal

PRESSES, CAM, TOGGLE, EYELET
Baird Machine Co., Bridgeport, Conn.
Bliss Co., E. W., Brooklyn N.Y.
Toledo Machine & Tool Co., Toledo.
Stoll Co., D. H., Buffalo, N.Y.

PRESSES, FILTER
Perrin, Ltd., William R., Toronto.
Smalley-General Co., Inc., Bay City, Mich.

PRESSES, PNEUMATIC
Barber Mchy. Co., Ltd., Toronto, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Metalwood Mfg. Co., Detroit, Mich.
Toledo Machine & Tool Co., Toledo.

PRESSES, DROP AND FORGING
Barber Mchy. Co., Ltd., Toronto, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton.
Can. Fairbanks-Morse Co., Montreal.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co, Toledo.

PRESSES, HYDRAULIC
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Dom. Steel Products Co., Ltd., Brantford.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
Stoll Co., Inc., D. H., Buffalo, N.Y.
Williams Machy. Co., A. R., Toronto.

PRESSES, HYDRO-PNEUMATIC
Eastern Production Co., Detroit, Mich.

PRESSES, BALING
Perrin, Ltd., William R., Toronto.

PRESSES, POWER
Baird Machine Co., Bridgeport, Conn.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo.
Williams Machy. Co., A. R., Toronto.

PRESSES, SPRING FOOT
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Ont.
Toledo Machine & Tool Co., Toledo.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal

PRESSES, SCREW
Barnes & Co., W. F. & Jno., Rockford, Ill
Bliss Co., E. W., Brooklyn, N.Y.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.

PRESSES, TIRE
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,

PRESSES, TRIMMING
Bliss Co., E. W., Brooklyn, N.Y.
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.

PROJECTORS, FLOOD LIGHTING
Lyman Tube & Supply Co., Montreal, Que

PROPELLERS
Kennedy & Sons, Wm., Owen Sound.

PROTECTIVE COATINGS
H. H. Robertson, Ltd., Sarnia, Ont.

PSYCROMETERS, SLING
Taylor Instrument Co., Rochester, N.Y.

PULLEYS
Algoma Steel Corp., Sault Ste. Marie, Ont
American Pulley Co., Philadelphia.
Baird Machine Co., Bridgeport, Conn.
Bernard Industrial Co., Fortierville, Que.
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Diamond State Fibre Co., Bridgeport, Pa.
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Kennedy & Sons, Ltd., W., Owen Sound.
Positive Clutch & Pulley Works Ltd., Toronto.
Petrie, Ltd., H. W., Toronto.

PULLEYS, STEEL SASH, STEEL BELT
American Pulley Co., Philadelphia, Pa.

PULLEYS, FRICTION, CLUTCH
American Pulley Co., Philadelphia, Pa.
Baird Machine Co., Bridgeport, Conn.
Bernard Industrial Co., A., Fortierville, Q.
Can. Link-Belt Co., Toronto, Ont.
Carlyle Johnson Mch. Co., Manchester, Ct.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Jones & Glassco, Montreal.
Positive Clutch & Pulley Works, Toronto.
Petrie, Ltd., H. W., Toronto.

PULP MILL MACHINERY
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Hamilton Co., Ltd., Wm., Peterborough, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

PUMPS, AIR LIFT
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,

PUMPS, BOILER FEED
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,

PUMPS, CENTRIFUGAL
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Ingersoll-Rand Co., Montreal, Que.
Darling Bros., Ltd., Montreal, Que.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

PUMPS, FUEL OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Darling Bros., Ltd., Montreal, Que.
Trahern Pump Co., Rockford, Ill.

PUMPS, GEARED
Darling Bros., Ltd., Montreal, Que.
Globe Engineering Co., Hamilton, Ont.

PUMPS, HIGH PRESSURE
Perrin, Ltd., William R., Toronto.

PUMPS, HYDRAULIC
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Clarke & Co., Furniss, Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Darling Bros., Ltd., Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
Metalwood Mfg. Co., Detroit, Mich.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

PUMPS, LUBRICATING, OIL STORAGE
Bowser Co., Ltd., S. F. Toronto, Ont.

PUMPS, RETURN AIR
Can. Ingersoll-Rand Co. Ltd., Sherbrooke,

PUMPS, SPECIAL
Elec. Steel & Metals, Welland, Ont.

PUMPS, RUBBER CEMENT
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, KEROSENE, OIL, SELF-MEASURING
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, LUBRICANT, OIL, WATER
Darling Bros., Ltd., Montreal, Que.
Trahern Pump Co., Rockford, Ill.

PUMPS — ROTARY
General Combustion Co., Ltd., Montreal, Que.

PUMP LEATHERS
Graton & Knight Mfg. Co., Worcester.

PUNCHES AND DIES
Atkins & Co., Ltd., Wm., Sheffield, Eng.
E. W. Bliss Co, Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Can.
Can. Blower & Forge Co., Kitchener, Ont.
Crescent Mach. Co., Ltd., Montreal, P.Q.
Can. Fairbanks-Morse Co., Montreal.
Elliott & Whitehall Machine and Tool Co., Galt, Ont.
Gardner & Son, Robert, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Marshall, Son & Blunney, Toronto.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Williams Mchy Co., A. R., Toronto, Ont.

PUNCHES, POWER
John Bertram & Sons Co., Dundas, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd, Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
A. B. Jardine & Co., Hespeler, Ont.
Long & Allstatter, Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
D. H. Stoll Co., Buffalo, N.Y.
Williams Mchy Co., A. R., Toronto, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertrams, Ltd., Edinburgh, Scotland.
Bertrams & Sons, John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton, Ont.
Garlock-Walker Mach'y. Co., Toronto.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

PYROMETERS
Bristol Co., Waterbury, Conn.
Shore Instrument & Mfg. Co., New York
Taylor Instrument Co., Rochester, N.Y.

QUARTERING MACHINES
Bertram & Sons, John, Dundas, Ont.
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Niles-Bement-Pond Co., New York.

QUARRY HOISTS
Canadian Mead-Morrison Co., Limited, Montreal, Que.

RAIL BENDERS
Algoma Steel Corp., Sault Ste. Marie, Ont.

PUNCHES, HAND
Niles-Bement-Pond Co., New York.

RAILROAD TOOLS
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Petrie Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

RASPS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.

RAWHIDE PINIONS (See Gears)

REAMERS
Butterfield & Co., Inc., Rock Island, Que.

REAMERS, ADJUSTABLE
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Elliott & Whitehall Machine and Tool Co., Galt, Ont.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Machy. Co., Ingersoll, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Plewes, Ltd., Winnipeg, Man.
Pratt & Whitney Co., Dundas, Ont.
The Kelly Reamer Co., Cleveland, O.
J. A. M. Taylor, 318 Stair Bldg., Toronto
Wells Bros. of Can., Galt, Ont

REAMERS, BRIDGE, EXPANDING AND HIGH SPEED
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Aikenhead Hardware Co., Toronto.
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Elliott & Whitehall Machine and Tool Co., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Lyman Tube & Supply Co., Montreal, Que
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Samuel Osborne, Ltd., Montreal, P.Q.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, STEEL TAPER AND SELF-FEEDING
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
A. B. Jardine & Co., Hespeler, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, CHUCKING
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que
Elliott & Whitehall Machine and Tool Co., Galt, Ont.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Machy. Co., Ingersoll, Ont.
Marshall, Son & Bunney, Toronto.
J. Morrow Screw & Nut Co., Ingersoll, Ont
Wells Bros. of Canada, Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, HAND
Butterfield & Co., Inc., Rock Island, Que
Elliott & Whitehall, Galt, Ont.
Greenfield Tap & Die Corp., Greenfield.
J. Morrow Screw & Nut Co., Ingersoll, Ont
Wells Bros. of Can., Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, PIN
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Greenfield.
Morrow Screw & Nut Co., John, Ingersoll
Wells Bros. of Can., Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMER FLUTING MACHINES
Garvin Machine Co., New York.

REAMING MACHINES, PNEUMATIC
Cleveland Pneumatic Co. of Can., Toronto
Garlock-Walker Machinery Co., Toronto.

RECORDING INTRUMENTS
Bristol Co., Waterbury, Conn.
Gisholt Machine Co., Madison, Wis.
Taylor Instrument Co., Rochester, N.Y.

REELS, WIRE AND TEXTILE MFG
American Pulley Co., Philadelphia, Pa.

REGULATORS, AUTOMATIC
Electric Steels & Metals, Ltd., Welland

REGULATORS, PRESSURE, TEMPERATURE
Can. Fairbanks-Morse Co., Montreal.
Taylor Instrument Co., Rochester, N.Y.

REPAIR WORK — SAWS
Atkins & Co., E. C., Hamilton, Ont.

REPAIR WORK, ALL KINDS
Elec. Steel & Metals, Welland, Ont.

RIVETS,
Aikenhead Hardware Co., Toronto, Ont.
Parmenter & Bulloch Co., Ganonoque.
Rice, Lewis & Son, Toronto.
Steel Co. of Canada, Ltd., Hamilton.

RIVETERS, PNEUMATIC, HYDRAULIC, HAMMER, COMPRESSION
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Montreal.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago
Niles-Bement-Pond Co., New York.

RIVETING MACHINES, ELASTIC, ROTARY BLOW
Grant Mfg. & Machine Co., Bridgeport
High-Speed Hammer Co., Rochester.
Petrie, Ltd., H. W., Toronto.
F. B. Shuster Co., New Haven, Conn.

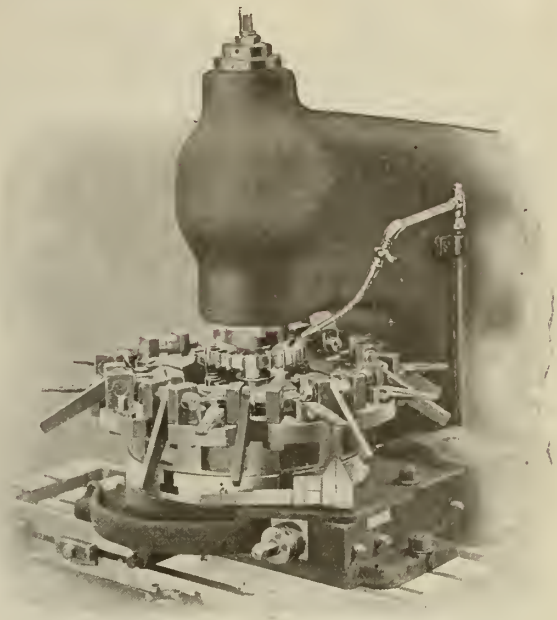
ROAD BUILDING EQUIPMENT
Can. Ingersoll-Rand Co., Ltd., Sherbrooke

ROAD-MAKING MACHINERY
G. F. Foss Mchy & Sply. Co., Montreal

RODS, ROPE AND SPRING
Page Steel & Wire Co., Adrian, Mich.

RODS, PURE NICKEL, MONEL METAL, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville

MILWAUKEE MILLING MACHINES



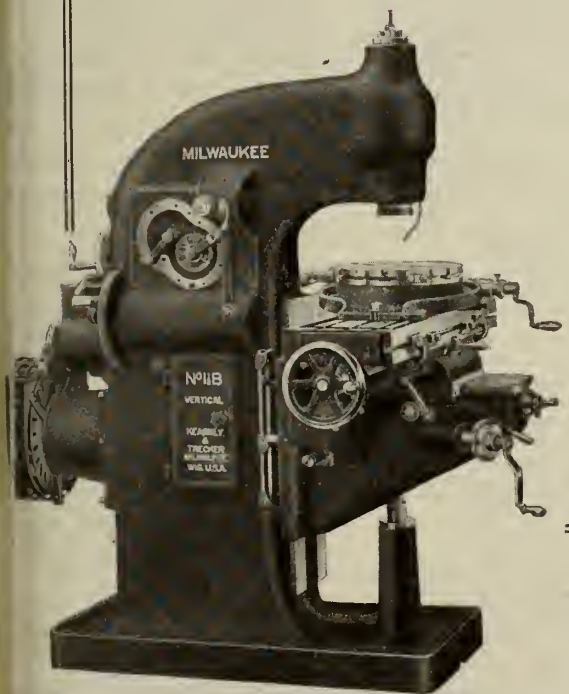
Continuous milling of 10-inch adjustable wrenches on a Milwaukee Vertical Milling Machine. These parts are turned out at the rate of 3,000 a day and the finished surface bears a constant and accurate relation to other selected points on the part.

Rapid Milling

Manufacturing milling by the continuous process is an advanced step in milling machine practice and is worthy of the serious consideration of the management of any plant. The motion in this milling process is continuous. It is reasonable, therefore, that in this way maximum production is secured. This sort of milling is most desirable in the machining of parts in large quantities. The rotary table with chucking fixture holding the work, revolves and the cutter is in operation and in work at all times. The operator removes the finished piece and puts another unmilled one in its place.

Milwaukee Vertical Milling Machines are particularly well adapted to continuous milling. The spindle is adjustable for wear only as sufficient adjustment can be obtained by the adjustment of the knee alone, the same as it is in the horizontal type milling machines.

Have you any milling that would be well adapted to continuous milling? Let us help you.



KEARNEY & TRECKER CO.

Milwaukee, Wis., U.S.A.

If interested tear out this page and place with letters to be answered.

ROLLER CHAINS
Can. Link-Belt Co., Toronto.
Jones & Glasco, Montreal.
Lyman Tube & Supply Co., Montreal, Que

ROLLS, BENDING, STRAIGHTENING
John Bertram & Sons Co., Dundas.
Brown, Boggs Co., Ltd., Hamilton.
Can. Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Petrie Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo, O.

ROLLS CRUSHING
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

ROLLS AND TABLES
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Elec. Steel & Metals, Welland, Ont.

ROOFING
H. H. Robertson, Ltd., Sarnia, Ont.

ROPE, GALX, MONEL METAL, BRONZE, TILLER AND SASH CORD
Can. Driver-Harris Co., Ltd., Walkerville

ROTARY SHEARS
The Quickwork Co., St. Mary's, Ohio.

ROOF COOLERS
Electric Steels & Metals, Ltd., Welland

ROLLING MACHINES, SHEET METAL
Manhattan Machine & Tool Co., Grand Rapids, Mich.

ROLLING MILL MACHINERY
Dom. Steel Products Co., Ltd., Brantford.
Mesta Machine Co., Pittsburgh, Pa.

ROLL LATHES
Mesta Machine Co., Pittsburgh, Pa.

ROLLS, BENDING, STRAIGHTENING
Manhattan Machine & Tool Co., Grand Rapids, Mich.

ROLLS, CRUSHING
Can. Link-Belt Co., Toronto.

RUBBER MOULDS AND CORES
Elliott & Whitehall, Galt, Ont.

RUBBER MILL DRIVES
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dom. Steel Products Co., Ltd., Brantford.
Can. Link-Belt Co., Toronto.

RUBBER MILL MACHINERY
Bertrams Ltd., Edinburgh, Scotland.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que
Dom. Steel Products Co., Ltd., Brantford.

RUBBER MOULDS & CORES
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

RUBBER PRODUCTS, MECHANICAL
Dunlop Tire & Rubber Goods Co., Ltd., Montreal.

RUBBING BRICKS
Dominion Abrasive Co., Mimico, Ont.

RULES
Brown & Sharpe Mfg. Co., Providence.
James Chesterman & Co., Ltd., Sheffield.
Lees, Lewis & Son, Toronto.
L. S. Starrett Co., Athol, Mass.

RULES, STEEL, STRAIGHT, AND FOLDING
Lufkin Rule Co. of Can., Windsor.

RULES, BOXWOOD, FOLDING
Lufkin Rule Co. of Can., Windsor.

RULES, BOARD AND LONG
Lufkin Rule Co. of Can., Windsor.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N.Y.

SAW MILL CONVEYORS
Can. Link-Belt Co., Toronto.
Petrie, Ltd., H. W., Toronto.

SAND MILLS
Frost Mfg. Co., Chicago, Ill.

SAND-BLAST EQUIPMENT SAND BLAST SUPPLIES AND ACCESSORIES
Pangborn Corporation, Hagerstown, Md.

SAND BLAST ABRASIVES
Pangborn Corporation, Hagerstown, Md.

SAND MIXING MACHINERY
Frost Mfg. Co., Chicago, Ill.

SANITARY DRINKING FOUNTAINS
Puro Sanitary Drinking Fountain Co., Haydenville.

SANDING MACHINES
Canada Machinery Corp., Galt.

SAW MILL MACHINERY
Can. Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt.
Robert Gardner & Son, Montreal.
Curtis Pneumatic Machy Co., St. Louis.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
A. R. Williams Machy Co., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

SASH SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

SAWS FOR EVERY USE
Atkins & Co., E. C., Hamilton, Ont.

SAWS, CIRCULAR METAL
Atkins & Co., E. C., Hamilton, Ont.
Wm. Atkins & Co., Ltd., Sheffield, Eng.
Marshal, Son & Bunney, Toronto.
Plewes Ltd., Winnipeg, Man.
Simonds Mfg. Co., Fitchburgh, Mass.
Tabor Mfg. Co., Philadelphia, Pa.

SAWS, HACK (See Hack Saws)

SAW GUARDS
Atkins & Co., E. C., Hamilton, Ont.

SAWS, METAL, HACK AND BAND
Atkins & Co., E. C., Hamilton, Ont.

SAWS, SILVER STEEL
E. C. Atkins & Co., Inc., Indianapolis

SAW SHARPENERS
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Can., Galt, Ont.

SAWS, SLITTING
J. A. M. Taylor, Stair Bldg., Toronto.
Atkins & Co., E. C., Hamilton, Ont.
Elliott & Whitehall Machine and Tool Co., Galt, Ont.

SAWS — HIGH-SPEED FRICTION
Atkins & Co., E. C., Hamilton, Ont

SAWS — PATTERN SHOP
Atkins & Co., E. C., Hamilton, Ont.

SAWS — SWING
Atkins & Co., E. C., Hamilton, Ont

SCALES
Can. Kron Scale Co., Montreal, P.Q.

SCALES, MECHANICS'
Lufkin Rule Co. of Can., Windsor.

SCLEROSCOPES
Shore Instrument & Mfg. Co., New York.

SCREENING MACHINERY
Can. Link-Belt Co., Toronto.

SCREW EXTRACTORS
Cleveland Twist Drill Co., Cleveland.

SCREW MACHINES, HAND, AUTOMATIC
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Ltd., Toronto
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield.
A. B. Jardine & Co., Hespeler.
National Acme Co. Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Warner & Swasey Co., Cleveland, O.
Wells Bros. of Can., Galt, Ont.
Wood Turret Mach. Co., Brazil, Ind.

SCREWS, MACHINE, SET, CAP AND SPECIAL
Galt Machine Screw Co., Galt.
John Morrow Screw & Nut Co., Ingersoll.
National Acme Co. Montreal.
Rice Lewis & Son, Toronto.
Steel Co. of Canada, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.

SCREW COLLARS
Galt Machine Screw Co., Ltd., Galt, Ont.
John Morrow Screw & Nut Co., Ingersoll.

SCREW MACHINES, PLAIN WIRE FEED
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.

SCREW PLATES
Butterfield & Co., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
A. B. Jardine & Co., Hespeler.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto.
J. A. M. Taylor, Stair Bldg., Toronto.
Wells Bros. of Can., Galt.
Wilkinson & Kompass, Hamilton.

SCREWS, SAFETY SET
Galt Machine Screw Co., Ltd., Galt, Ont.

SCREW SLOTTERS
Butterfield & Co., Inc., Rock Island, Que.
Garvin Machine Co., New York.
National Acme Co., Cleveland, O.
Pratt & Whitney Co., Dundas, Ont.

SEPARATORS, MOISTENERS AND OIL FOR COMPRESSED AIR
Pangborn Corporation, Hagerstown, Md.

SELF-OPENING DIES
See Dies.

SEPARATORS, SAND
Pangborn Corporation, Hagerstown, Md.

SET SCREWS, SAFETY
Aikenhead Hardware Co., Toronto.
Bristol Co., Waterbury, Conn.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wilkinson & Kompass, Hamilton.

SHANKS, STRAIGHT AND TAPER
Jacobs Mfg. Co., Hartford, Conn.

SHAPERS
Barber Mchy. Co., Ltd., Toronto, Ont.
John Bertram & Sons Co., Dundas.
Can. Fairbanks-Morse Co., Montreal.
Canadian Machinery Corp., Galt.
Geo. F. Foss Mchy. & Sply. Co., Montreal
Robt. Gardner & Son, Montreal.
Garlock-Walker Mach'y. Co., Toronto.
Hendey Machine Co., Torrington, Conn.
Milwaukee Shaper Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto.
Rae Mach. Tool Co., Hamilton.
Standard Equipment & Tool Wks., Montreal.
Walcott Lathe Co., Jackson, Mich.
Williams Mchy Co., A. R., Toronto, Ont.

SHAPERS, GEAR
Fellows Gear & Shaper Co., Springfield, V.
Knigh Metal Products, Toronto.

SHAFTING
Algoma Steel Corp., Sault Ste. Marie, O.
Can. Fairbanks-Morse Co., Montreal.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Jones & Glasco, Montreal.
Niles-Bement-Pond Co., New York.
Can. Drawn Steel Co., Hamilton.
Peckovers, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas.
Rice, Lewis & Son, Toronto.
A. R. Williams Machy. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

SHARPENING STONES
Norton Co, Worcester, Mass.
Rice, Lewis & Son, Toronto.

SHEARING MACHINES, ANGLE IRON, BAR AND GATE
John Bertram & Sons Co., Dundas.
Bertrams Ltd., Edinburgh, Scotland.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
A. B. Jardine & Co., Hespeler, Ont.
Long & Allstatter Co., Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo, O.

SHEARS, POWER
John Bertram & Sons Co., Dundas.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton.
Can Blower & Forge Co, Kitchener.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Long & Allstatler, Hamilton, Ohio.
A. B. Jardine & Co., Hespeler, Ont.
National Machy. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
H. D. Stoll Co., Inc., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Williams, White & Co., Moline, Ill.
Williams Mchy Co., A. R., Toronto, Ont.

SHEARS, ROTARY
The Quickwork Co., St Mary's, Ohio.

SHEARS, PNEUMATIC
Toledo Machine & Tool Co., Toledo, Ohio

SHEARS, PLATE CUTTING, SLITTING
Dom. Steel Products Co., Ltd., Brantford.
Quickwork Co., St. Mary's, Ohio.

SHEARS, SPLITTING
Dom. Steel Products Co., Ltd., Brantford.

SHEARS, IRREGULAR AND CIRCLE CUTTING
The Quickwork Co., St. Mary's, Ohio.
D. H. Stoll Co., Inc., Buffalo, N.Y

SHEARS, SERPENTINE
The Quickwork Co., St. Mary's, Ohio.

SHEARS, SQUARING
Brown, Boggs & Co., Hamilton, Ont.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEET METAL WORKING MACHINERY
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEET METAL WORKING TOOLS
Baird Machine Co., Bridgeport, Conn.
Barber Mchy. Co., Ltd., Toronto, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton.
Peck, Stow & Wilcox Co., Southington, C.
Petrie, Ltd., H. W., Toronto.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEETS, CRUCIBLE, CAST
British Smelting & Refining Co., Ltd., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.

SHEETS, BLACK AUTO AND GALVANIZED
Peckovers, Ltd., Toronto, Ont.

SHEETS, NICKEL, RESIST, ALLOY
Can. Driver-Harris Co., Ltd., Walkerville.

SHELVING, STEEL
Dennis Wire & Iron Works, London.

SHIPYARD MACHINERY, SHOP FURNITURE
Dennis Wire & Iron Works, London.

SIDE TOOLS
Armstrong Bros. Tool Co., Chicago.
J. H. Williams & Co., Brooklyn, N.Y.

SILENT CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glasco, Montreal.

SLEDGES
Aikenhead Hardware Co., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont

SLEDGES, CAST IRON
Katie Foundry, Galt, Ont.

SLICING CLAMPS
Peck, Stow & Wilcox Co., Southington Conn.

SLINGS, CHAINS
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

SLOTTERS
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
National-Acme Co., Cleveland, Ohio.
Niles-Bement-Pond Co., New York.

SMOKESTACKS
William Hamilton Co., Peterboro, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

SNIPS, TINNERS AND SHEET METAL WORKERS
Kearney & Trecker Co., Milwaukee, Wis.
J. Morrow Screw & Nut Co., Ingersoll, Ont

SOCKETS
Brown & Sharpe Mfg. Co., Providence.
Butterfield & Co., Inc., Rock Island, Que
Cleveland Twist Drill Co., Cleveland.
Keystone Mfg. Co., Buffalo, N.Y.
Modern Tool Co., Erie, Pa.
J. Morrow Screw & Nut Co., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

SOIL PIPE FITTINGS, CAST IRON
Katie Foundry, Galt, Ont.

SOLDERING IRONS
Aikenhead Hardware Co., Toronto, Ont.
Brown, Boggs & Co., Hamilton, Ont.
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Rice Lewis & Son, Toronto, Ont.

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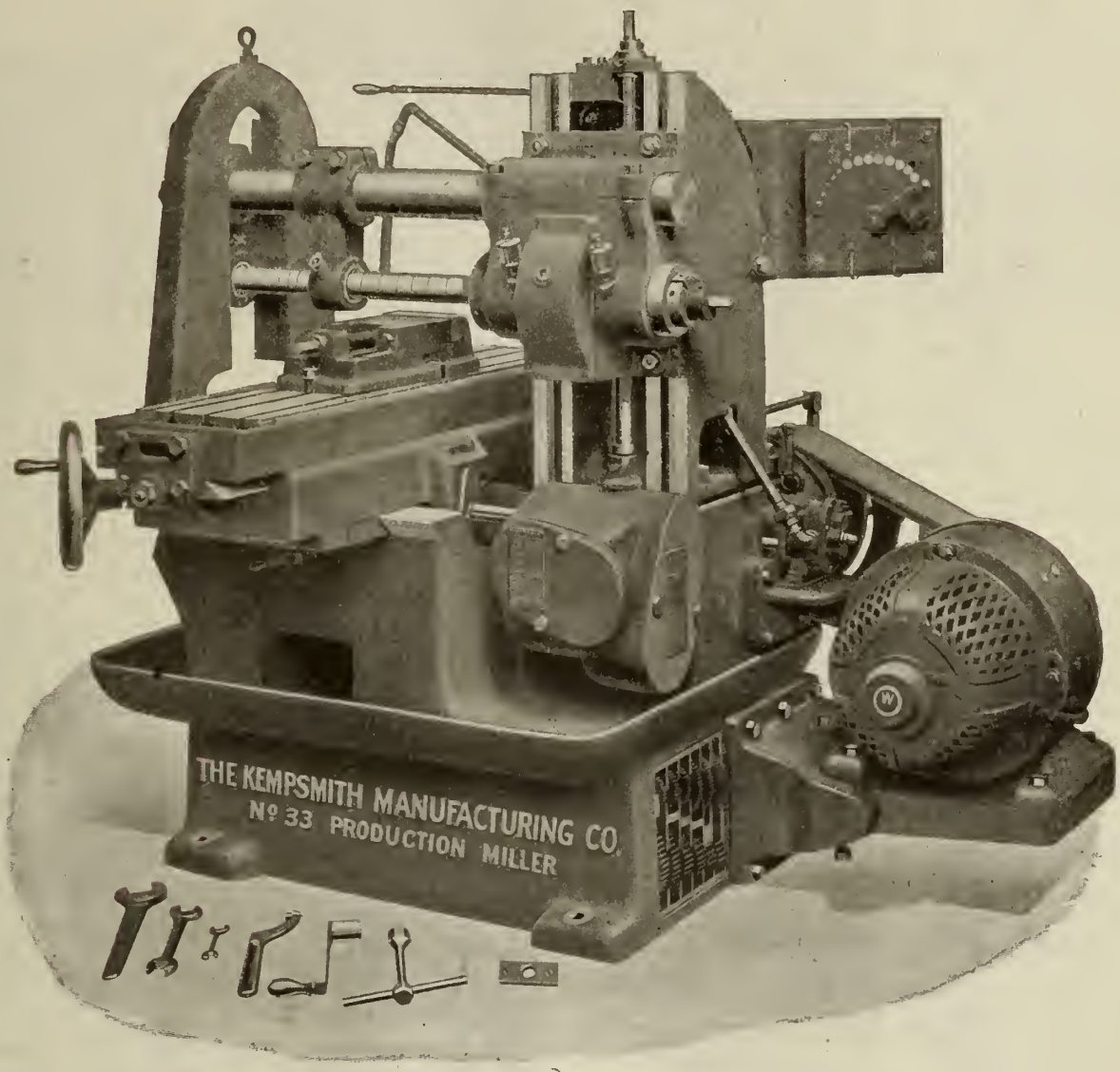

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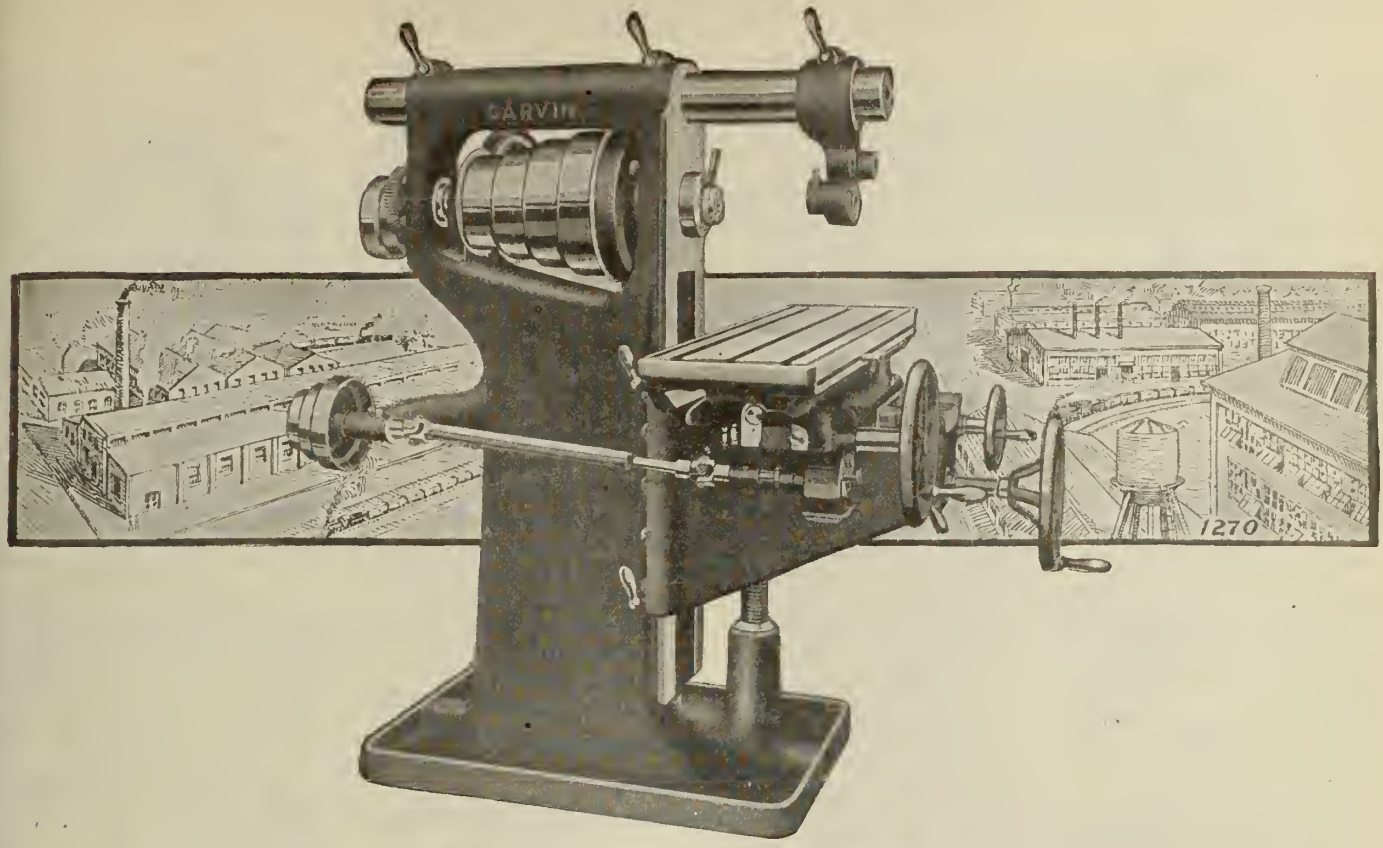

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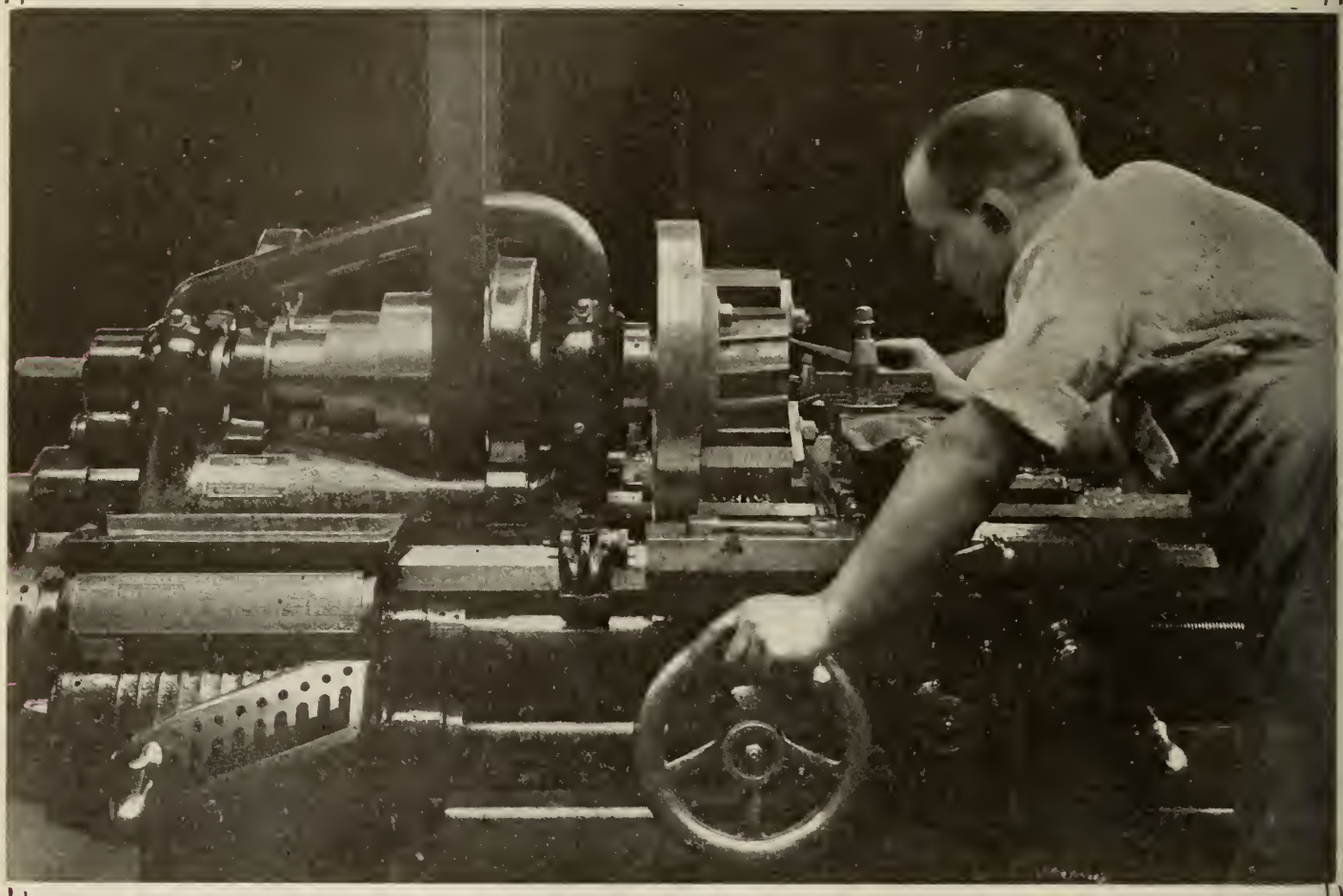

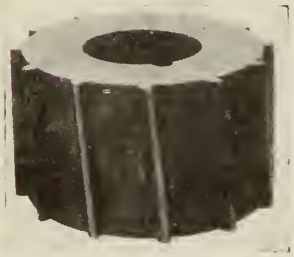

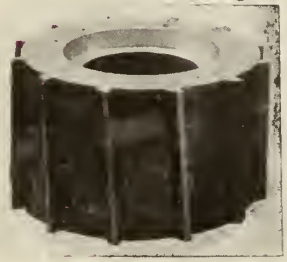

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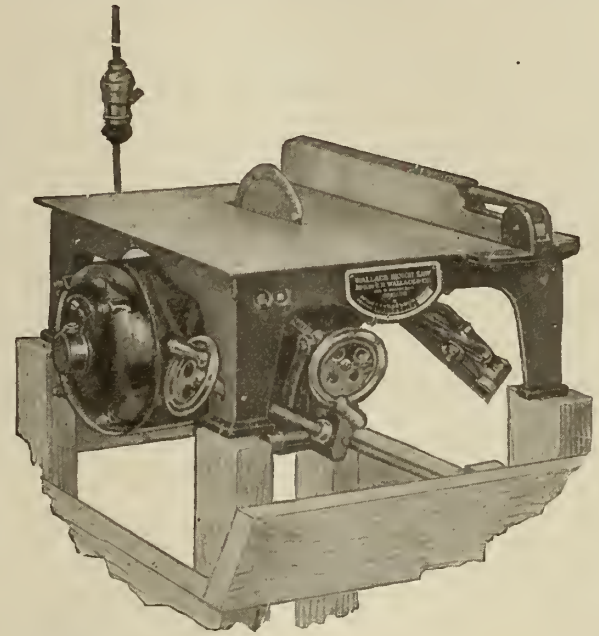

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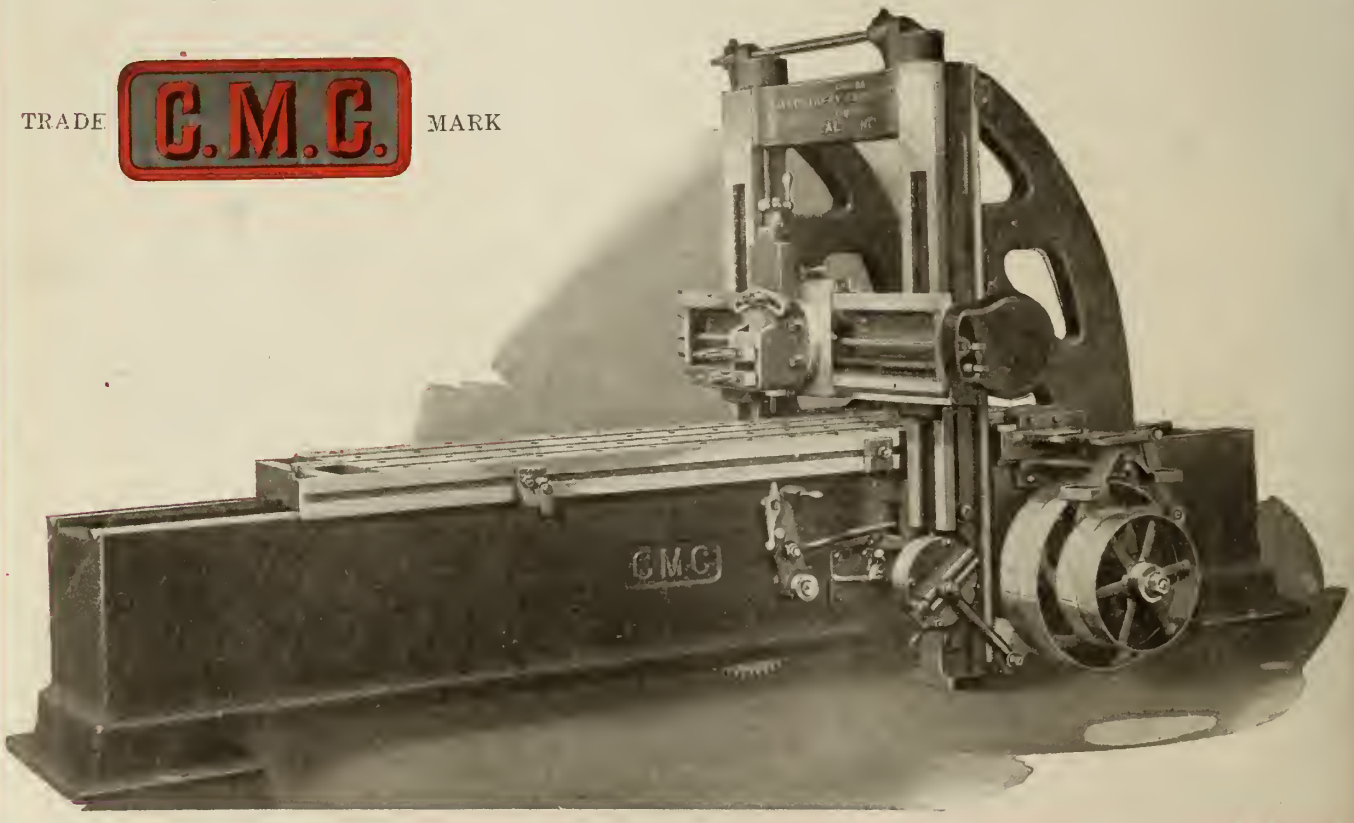

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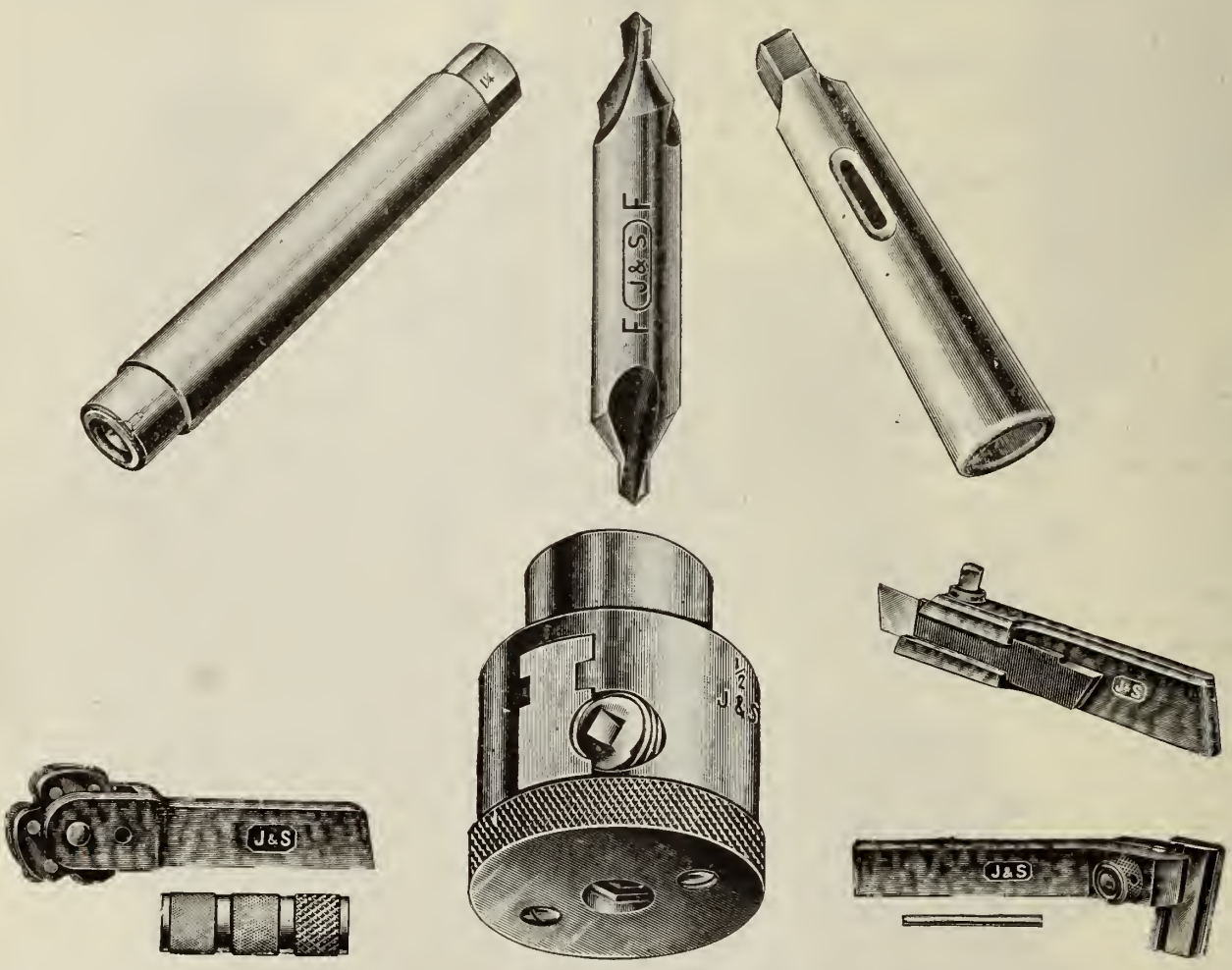

Every man who loves a good tool is invited to call or write for literature

A.A. Jones & Shipman LIMITED
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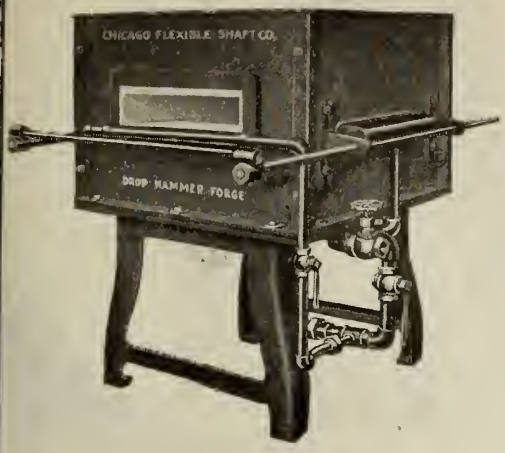

Stewart Drop Hammer Forges

This line of forges is especially adapted to heating bolt and bar stock prior to heading or upsetting.

Wide opening permits a quantity of work being heated at once for supplying continuous stocks to upsetting or heading machines.

Eight stock sizes, ranging from 5 in. x 15 in. x 15 in. to 5 in. x 18 in. x 24 in. For gas or oil fuel.

Stewart No. 13 Crucible Furnace

For Lead or Cyanide Hardening

Pressed steel pot—10 in. diam., 13½ in. depth. Floor space, 30 in. x 30 in.
Gas connections, 1¼ in.; air connections, 1½ in. Shipping weight, 1,000 lbs. For gas or oil fuel.

Quality in Furnace Building Assures Heat Treating Quality

Quality production in heat treating operations is absolutely essential in these days of continually rising costs. Heat treating of expensive gears, dies, tools and machine parts must be accurate—the heavy investment already made in material and labor must be protected.

Quality production is possible only in quality furnaces—furnaces practically constructed for the exacting demands of modern tool rooms and industrial plants—furnaces guaranteeing uniformity and accuracy under severest tests.

Stewart Furnaces **guarantee** quality production. Their scientific construction makes certain uniform temperature as long as necessary in every part of the heating chamber. Combustion takes place beneath the hearth, the flame surging over it and into the arch of the furnace, with maximum fuel efficiency. Burner placement is such that heat is uniformly distributed, under instant and absolute control.

Stewarts have helped many a manufacturer establish and maintain a reputation for high quality production. The experience and thorough satisfaction of these users can be duplicated in your plant.

Stewart Furnaces cover a wide range of heat treating—there's a Stewart for every heat treating requirement.

Stewart Cylindrical Furnaces for High Speed Steel

For hardening broaches, heat treating cam shafts, coupling rods or any long pieces apt to be distorted when laid horizontally on oven floor. Pieces are suspended in heating chamber, and are thoroughly heat penetrated, but flame does not strike them direct.

Specifications of No. 5

Inside diam., 10 in.; inside depth, 44 in.
Ht. from floor to top of cover, 54 in.
Floor space, 26 x 21 in.
Gas and air connections, 1½ in.
Shipping weight, 1,000 lbs.
For gas fuel only.
Four other stock sizes.

Chicago Flexible Shaft Company

1148 South Central Ave., Chicago, Ill.

350 Broadway
New York City

Railway Exchange Bldg.
St. Louis, Mo.

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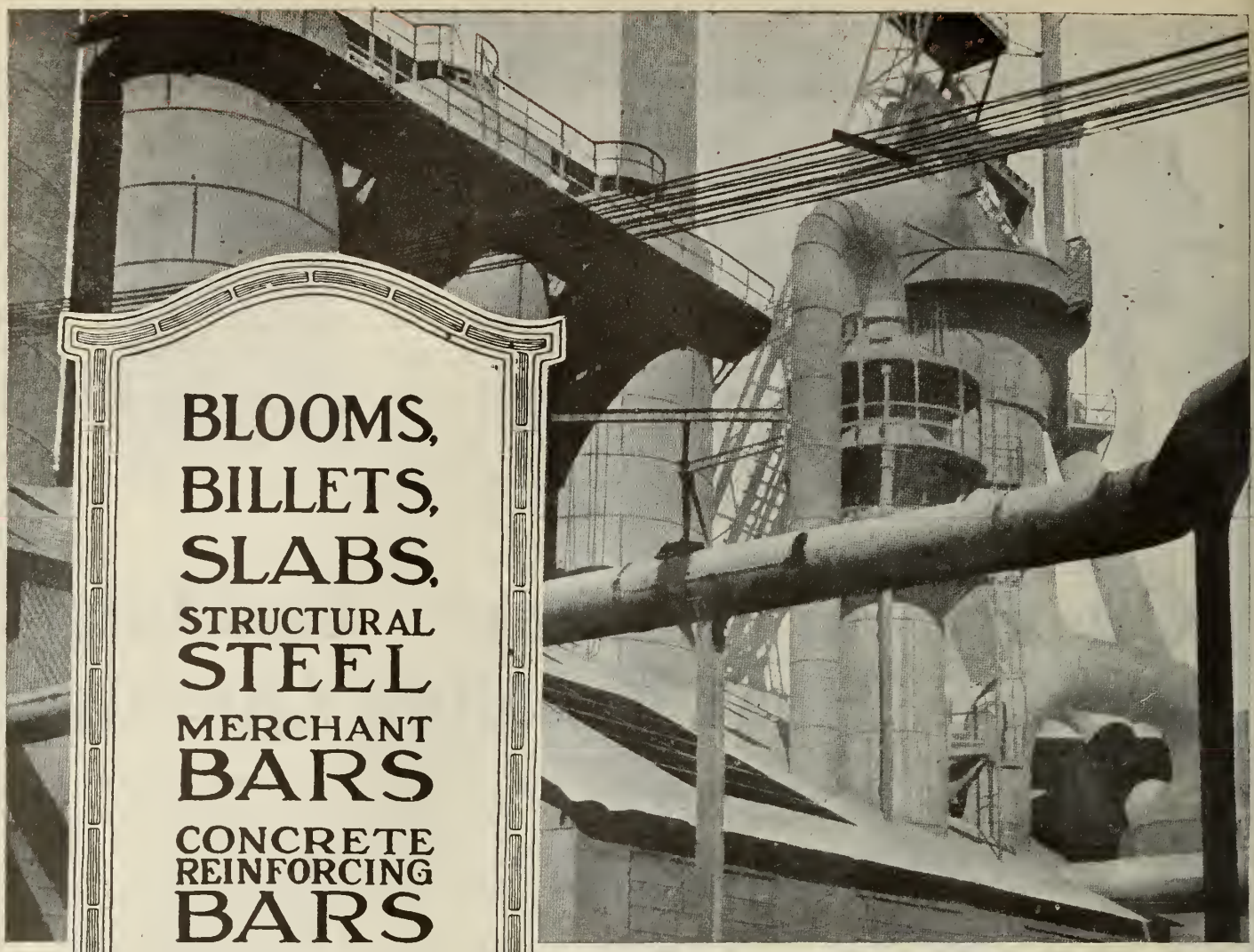

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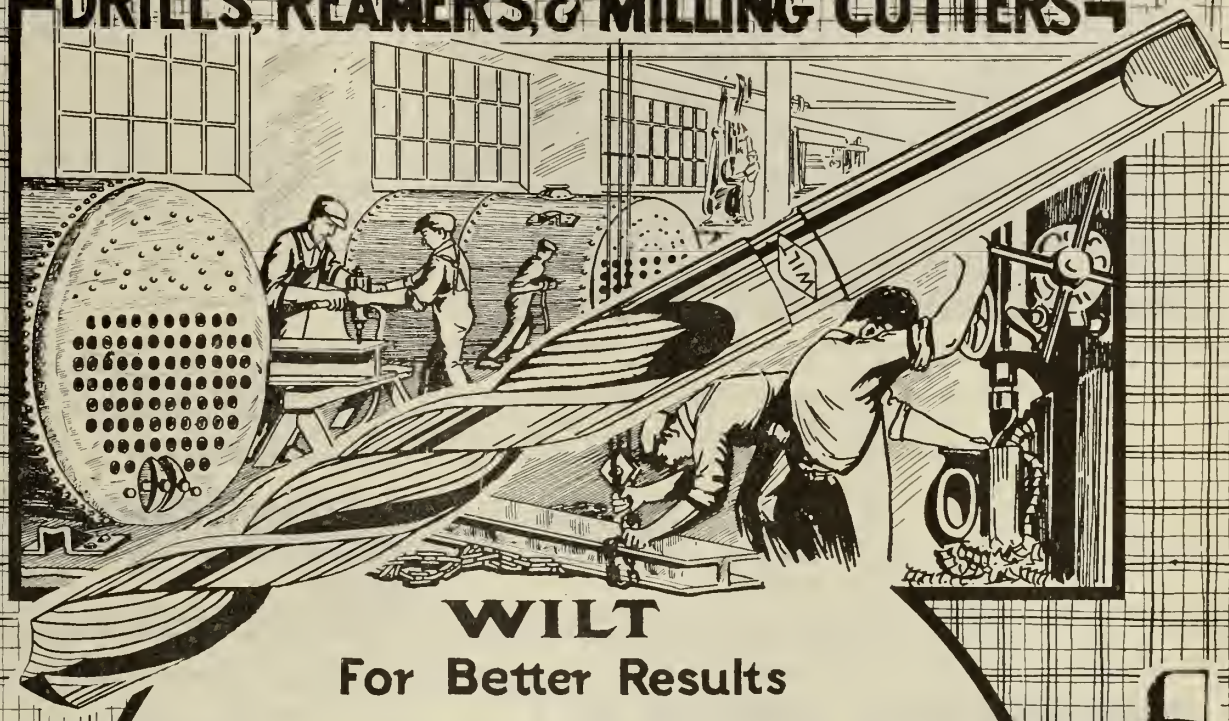
DRILLS, REAMERS, & MILLING CUTTERS



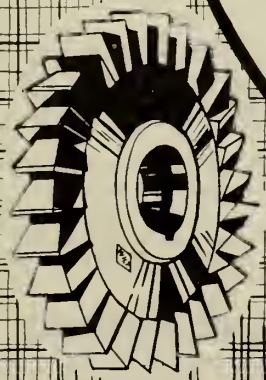
WILT
For Better Results

Made in Canada·

Manufacturers who have switched from the use of ordinary tools to WILT TOOLS realize the benefit of the change. They are getting better results from their operations.

Wilt High Speed and Carbon Twist Drills, Reamers and Milling Cutters give longer service, do more work without regrinding and cost no more than ordinary tools.

For a steady volume of work that is satisfactory from the standpoint of both **quantity** and **quality** there are no better tools than the WILT line.



WILT TWIST DRILL COMPANY
OF CANADA LIMITED·
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TRADE WILT MARK

"Where there's a WILT – There's the Way"

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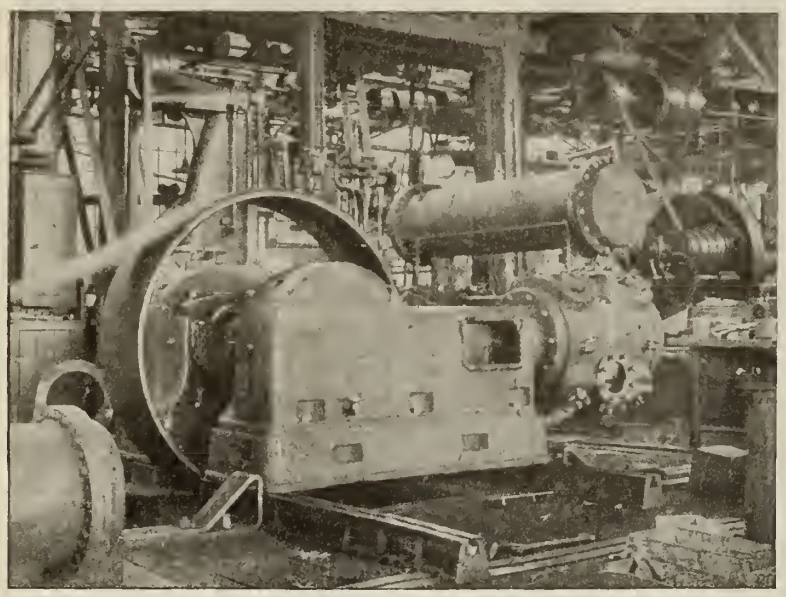

On The Test Floor

This half-tone was made from an untouched photograph of one of our PLB-2 Compressors on its test run. Note the rigidity and remarkable steadiness of these machines even on a temporary foundation. Bolts, nuts and other details are just as sharp and as clean-cut as on the machine tools in the background despite the fact that the camera shutter was opened for almost a minute while the compressor was running at top speed.

Every steam, electric or belt driven compressor of our manufacture undergoes a long test run and no machine goes to the stock room until our inspectors (paid to find flaws), are satisfied that its mechanical and compression efficiency are as high as they can be in any man made machine.

Ask for a set of compressor bulletins.

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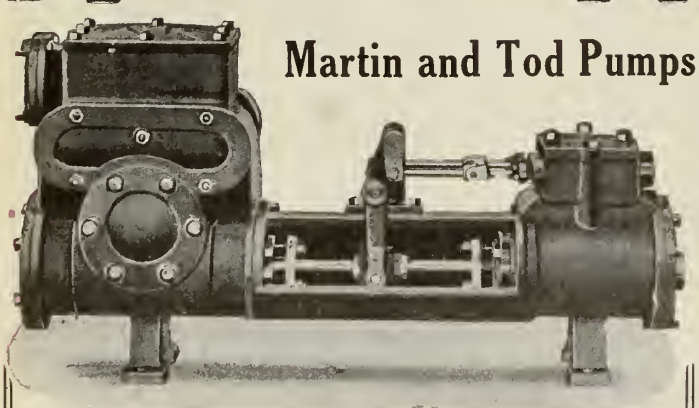

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We are now the exclusive manufacturers of the well-known Martin and Tod Pumps.

Standard Simplex and Duplex Pumps for Boiler Feeding, Fire and general service. Vacuum Pumps for heating systems. Condensers, and Vacuum Fans. We have many combinations of sizes for both high and low pressures. Your enquiries will be carefully and promptly attended to.

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High-class Drills with IRRESISTIBLE PIERCING FUNCTIONS that stand the WEAR and TEAR — in other words, the DRILLS that are EFFICIENT and ECONOMICAL — are the DRILLS with the "DORMER" Brand.

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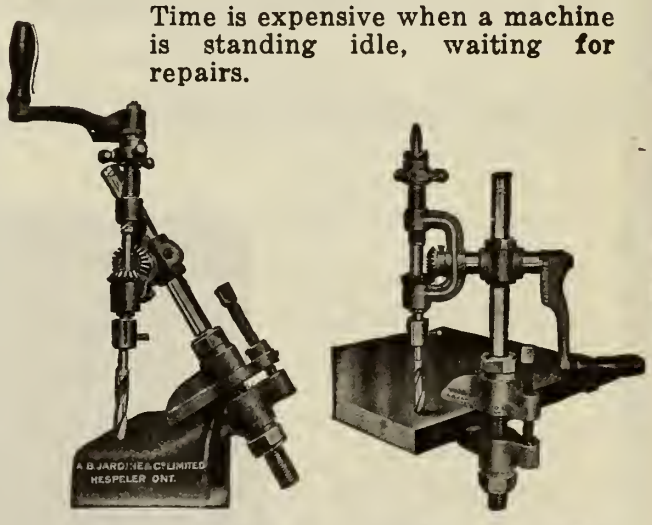
Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.



On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

Weight, 40 lbs. Price, $26.50 net.
Sold by all Machinery and Supply Houses

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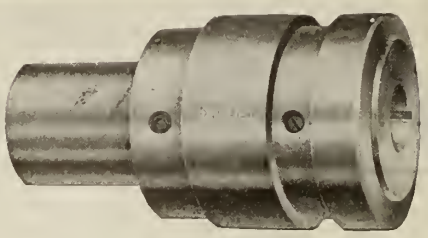
IF YOU BUILD MACHINERY

you are anxious to put into your product every refinement which will add to its efficiency — which will make it serve your customer longer and more satisfactorily.

One of the most important features of any machine is its clutches. No single item adds more to machine performance than a good clutch, and nothing can be a greater source of annoyance than a poor one.

Play safe and equip with Johnson Clutches.



Write for Our Yellow Catalog and Booklet "Clutches as Applied to Machine Building"

IF YOU USE MACHINERY

you are looking for the machine with the highest rate of production, the smallest amount of lost time, and the longest life. In all probability you will find that machine equipped with a Johnson Clutch, for the Johnson Clutch not only gives best service, but adds greatly to the convenience and speed of operation.

Look for it on the machine you buy, and to be consistent equip your plant transmission in the same way.

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Irrefutable evidence of the leadership of Jacobs Chucks is the fact that the people who know most about drilling—mechanics, foremen, superintendents and drill makers alike—prefer them by a large majority.

Equip your drills with them.

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Polisher and Buffer

FORD-SMITH

GRINDING MACHINES

and

POLISHING MACHINERY

Canadian-Made

Light Type Grinders

Water Type Grinder

You would not expect to keep your product up to the mark if you gave your workmen poor tools. It is equally as reasonable to suppose that a workman can not keep his tools in first-class shape with a poor grinder.

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The right kind of wheel, plenty of water, rigidity and no lack of belt power, put your grinding on a properly efficient basis.

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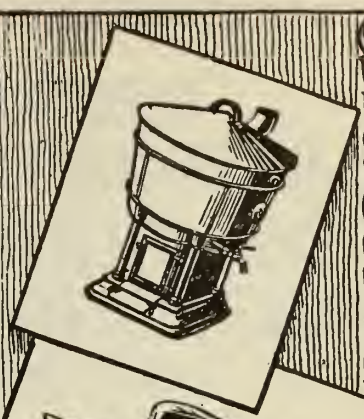

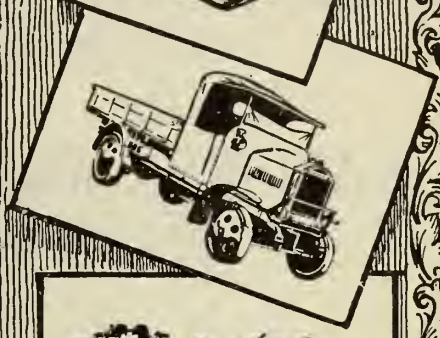

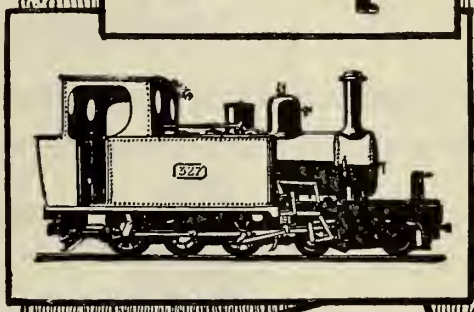

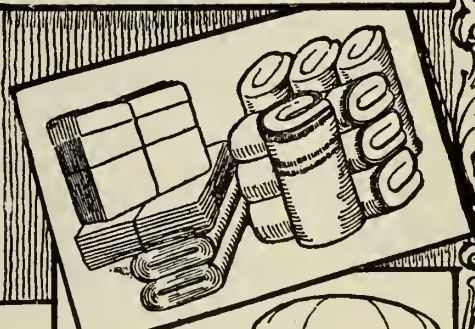

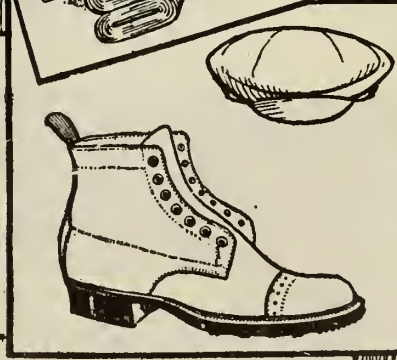

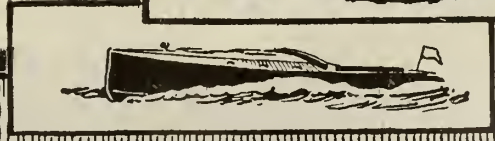

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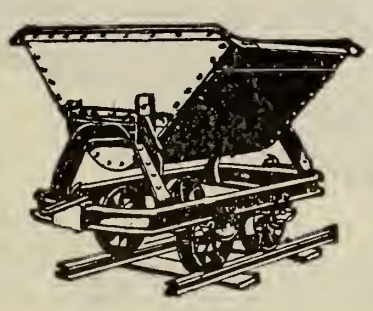

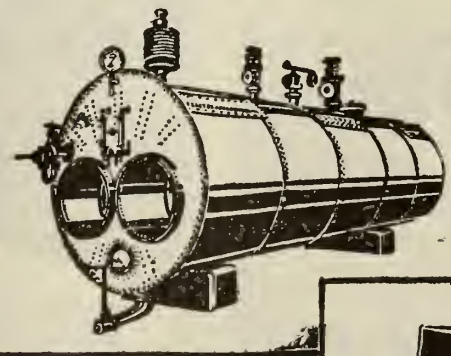

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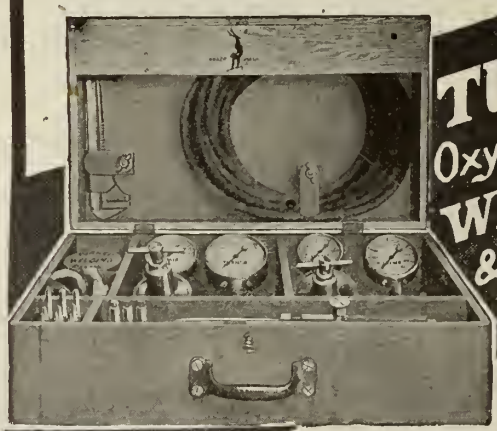

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These outfits will soon pay their cost in machine parts or tools reclaimed. The sectional extensions of the torch enable the operator to adjust it to any desired length or angle. The location of valves is such that the flame is controlled by one hand, leaving the other hand free for the work at all times.

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Perfectype COMPLETE WELDING and CUTTING Equipment

Safe *Saves Money* *Makes Better Welds*

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Will consider inquiries from live dealers and jobbers who care to stock torches in lots of five or more. Territory granted. Inquiries confidential.

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LIKE the Genie of the "Arabian Nights," Prest-O-Lite is a wonderful force confined in a small cylinder.

It is subject to the command of its master—the trained welder and cutter. Under his direction it performs feats of wonder—anywhere, at any time.

In the subway builder's excavation, or in the floating dry dock, in fact any place—any time where welding and cutting metals are required, the ready portability of Prest-O-Lite is an asset of genuine worth.

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It insures **effectiveness** and **economy** by **invariably** producing acetylene gas of **unusual purity.**

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Announcement

Our new plant at London, Ont., is now operating at full capacity. All Oxygen orders for consumption in the London district and in Western Ontario will, from now on, be executed from London, and our customers will derive the full benefit of the saving in freight, while being assured of an unsurpassed service.

All orders for Ontario to be sent as usual to our Toronto Office, Confederation Life Building.

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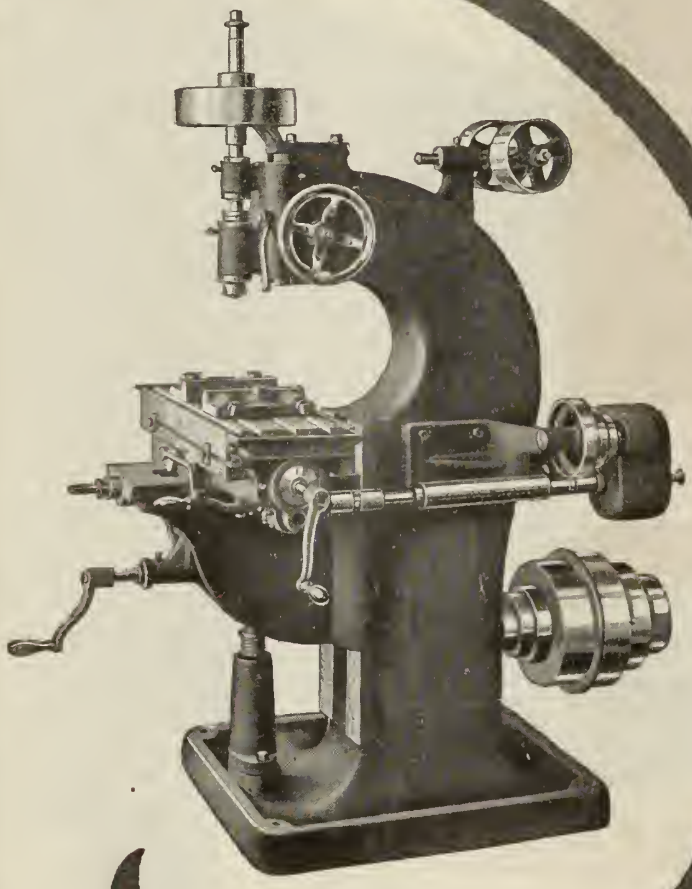
Bristol Vertical Milling Machine

A Tool of Large Capacity



Ball Bearings are used at the most important points making it a free running tool, which, combined with its being a belt-driven machine, makes it capable of turning out work on which an extra smooth finish is desired.

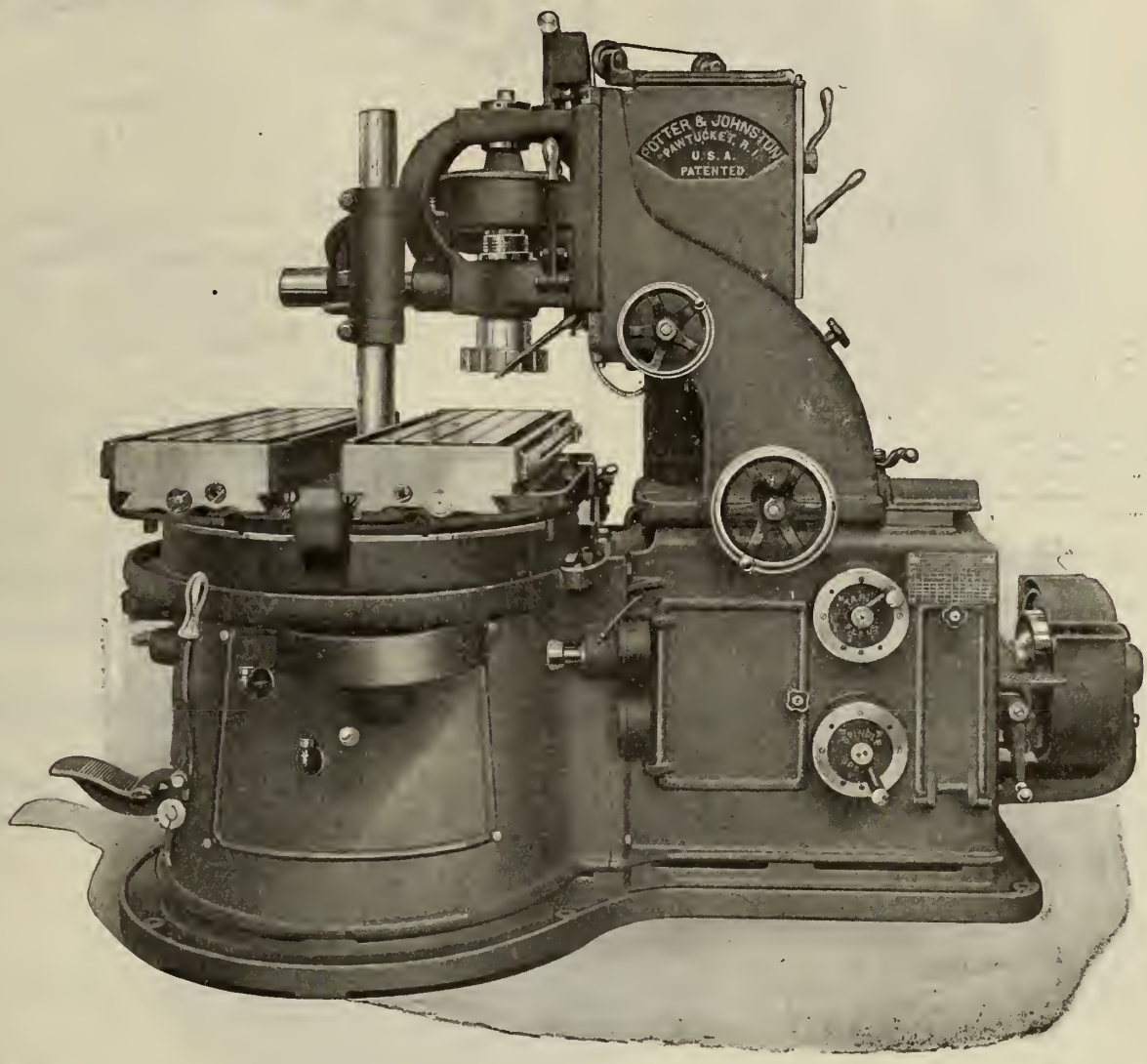
The longitudinal table feed is controlled by the gear change box which gives six different feeds for each change of spindle speed. A stop to gauge with micrometer adjustment is used on the head to regulate the depth of cuts.

Learn all about its production capacity.

Write for bulletin giving fullest particulars.

BRISTOL MACHINE TOOL CO.
SUCCESSORS TO C. G. GARRIGUS MACH. CO.
BRISTOL, CONN.

No Delay on a P & J



Absolutely no waste time. This P and J Automatic Milling Machine was made expressly to eliminate machine idleness between cuts. No lost time returning table by hand and removing finished work from vise or fixture. No delay brushing chips out of vise and inserting new pieces.

Keep two tables going at a time. Load up on one while the cutter is milling work mounted on the other. With the exception of 10 seconds for indexing table direct, bringing work into alignment with cutter, and advancing table—Automatically—to cutting point—there's no lost time—no waste of power—big production—practically continuous milling.

Canadian Offices: POTTER & JOHNSON MACHINE CO.

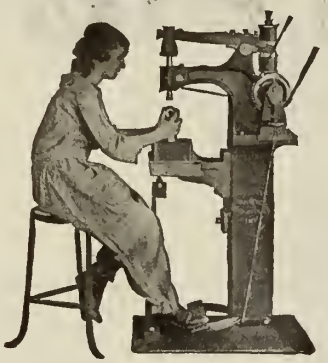
ROELOFSON MACHINE & TOOL CO., LIMITED

Head Office: 1501 Royal Bank Building, Toronto, Canada

Works and Warehouse: Galt, Canada

If interested tear out this page and place with letters to be answered.

The Hammer With The Human Stroke



HEADS RIVETS COLD

Heads 'em tight or loose, flush, countersunk, or finishes heads any shape desired, and at the rate of:—

A rivet a second, sizes up to 3/16".
A rivet in two seconds, size ¼" to ⅜".
A rivet in three seconds, size 7/16" to ⅝".

And on special order we build machines to handle rivets up to 1½" with proportionate rapidity.

Built in eight sizes.

Besides riveting, the High Speed Riveting Hammer does all kinds of peining, swaging, upsetting, etc.

Send us sample assembly parts with rivets or sketch of your work,

and

Let us shoulder your riveting problems.
Send for the High Speed Hammer Book.

THE HIGH SPEED HAMMER COMPANY, INC.
ROCHESTER, N.Y.

STEEL CASTINGS

QUICK DELIVERIES

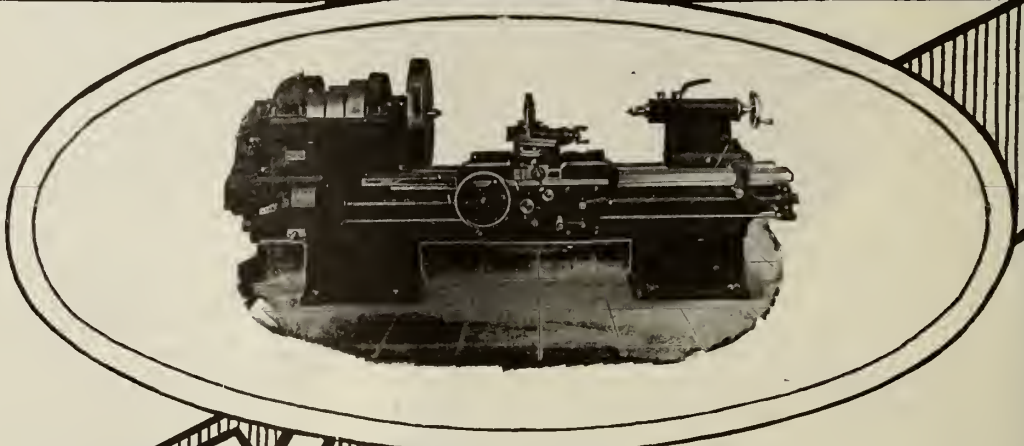
High Carbon Steel
Manganese Steel
Chrome Steel
Mild Steel

QUALITY GUARANTEED

Sizes—½ lb. to 5,000 lbs. each

THE WILLIAM KENNEDY & SONS,
LIMITED
OWEN SOUND, ONTARIO
ESTABLISHED 1860

Heavy Duty Lathes



SIDNEY

for service

Easy Masters of Big Jobs

Dependence put upon Sydney Lathes is never misplaced. Very heavy work can be done without apprehension.

The 25-inch Heavy Duty Quick Change Sydney here shown is the last word in lathe construction. Every possible improvement will be found in this model. Bed lengths of 10, 12, 14, 16, 18 and 20 feet are available.

Built also with 27 inch swing.
Write for full particulars of the more suitable machine to-day.

Canadian Agents:
THE YEATES MACHINERY & SUPPLY CO.
Montreal, Quebec
H. W. PETRIE, LIMITED, Toronto, Ontario

The Sidney Tool Co.
Sidney, Ohio, U.S.A.

STEEL CASTINGS

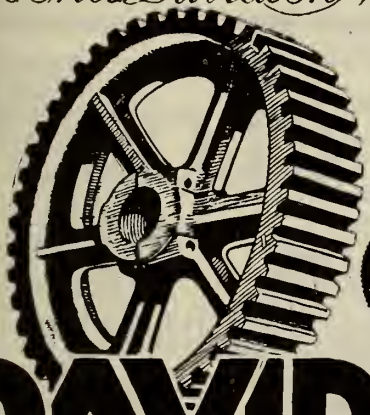
We shall be glad to supply, in addition to our General Catalogue, literature on

Steel Castings — Lithographed
Galvanizing — Ware
Wire Goods — Enamelled
Stoves — Signs

made by the Acid Electric process up to fifteen tons. Castings made by this process are free from blow holes, easy to machine, and superior in every way to ordinary Steel Castings.

Castings supplied for shipbuilding, cars, locomotives, all classes of machinery, etc.

The Thos. Davidson Mfg. Co. Limited

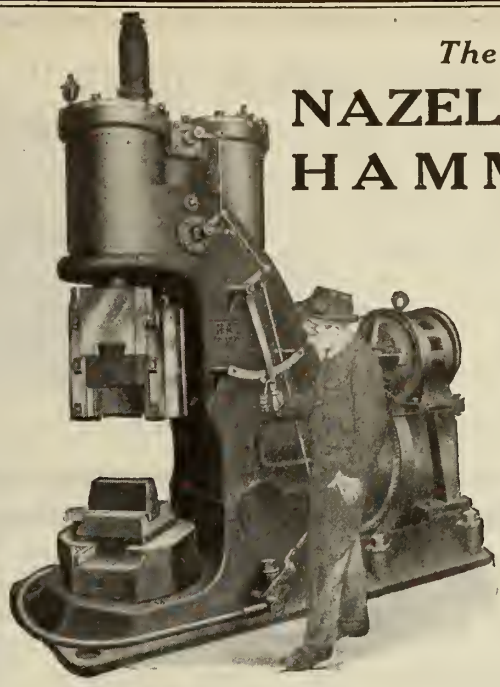


Head Office, Montreal
Branches: Toronto and Winnipeg
Steel Foundry Division, Lachine Canal, Turcot

DAVIDSON'S STEEL CASTINGS MADE IN CANADA THE SEAL OF DURABILITY

DAVIDSON

The
NAZEL AIR HAMMER



NOTED FOR ITS BLOW AND CONTROL

A self-contained unit, HAMMER AND COMPRESSOR COMBINED, built in three types, six sizes arranged for BELT OR DIRECT MOTOR DRIVE, with capacities up to 7 inches square, for all manner of jobbing, manufacturing and certain classes of drop forgings.

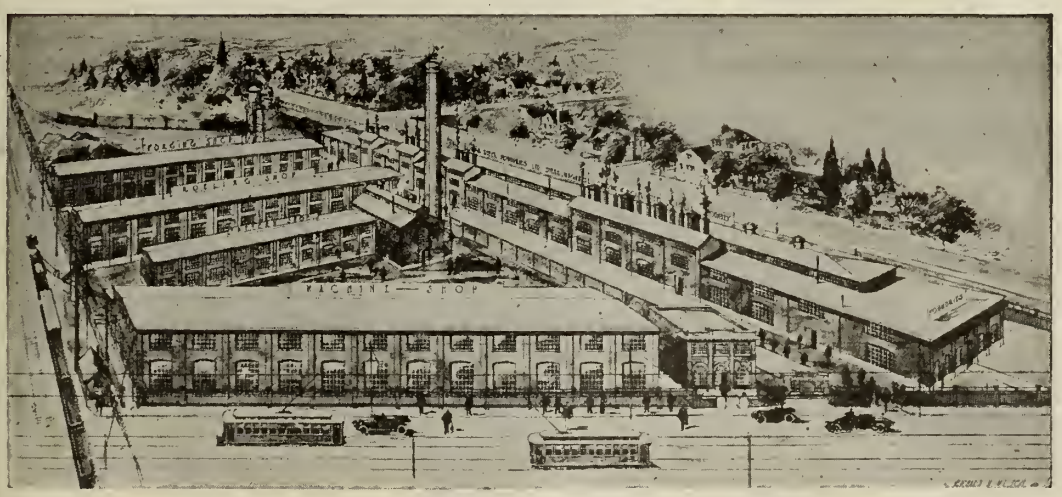
Nazel Engineering & Machine Works
Dept. F., Philadelphia, Pa.

Hull Iron and Steel
Foundries, Limited *Hull, Quebec*

Steel, Chrome, Manganese and Nickel Steel Castings

Annealed and Unannealed

Cement Mill and Mining Machinery Castings, Stamp Mills, Crushing Plants, Excavating Outfits, Steel Car Wheels, Locomotive Driving Wheels and Frames, etc.



Machine-Moulded Gears

"HISCO" machine-moulded gears, while requiring no pattern, insure accuracy, dependability, quality, and the price is minus the cost of patterns—which in these days of high prices of lumber is something to be considered.

Specify "HISCO" Products

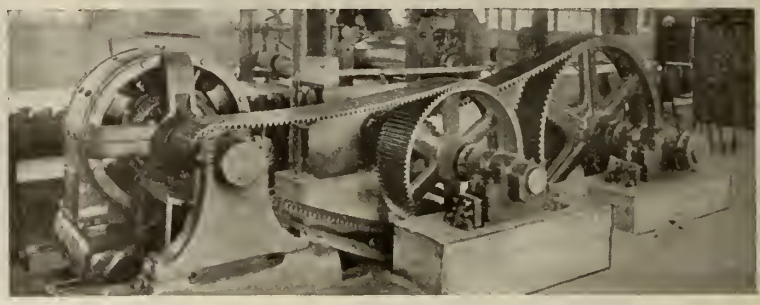
THE MORSE CHAIN CO.

are the
Largest Manufacturers in the world
of
High Speed Silent Chains

Why?

Morse Chain possesses the exclusive
Rocker Joint
Frictionless—Requires no Oiling

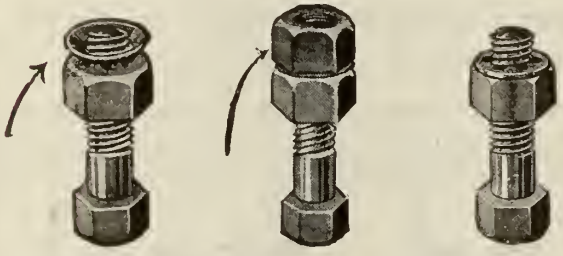
Jones & Glassco (Reg'd.)
Canadian Agents
Montreal - - Toronto



80 H.P. Morse Drive to Rolls, reverses direction every 45 seconds

HOLD TITE NUT LOCK

See How Easily Applied



Knowing the size Bolt—use same size Nut Lock. Place over Bolt—as shown above.

Screw another Nut onto Nut Lock and Depress it — as shown above.

Remove Second Nut and Nut Lock will Look — as shown above.

The Hold Tite Nut Lock cannot come loose when it is compressed into the thread of the Bolt. Compressing will not destroy the thread.

Head Office:

Edward A. Robinson Co., Ltd.
228 Craig St. West, MONTREAL, Que.

Branch Office: Bank of Toronto Chambers, 205 Yonge St., Room 32, Toronto, Ont.
U.S.A. Office: 166 Montague St., Brooklyn, N.Y.

GLOBE ANGULAR HOLE DRILLING TOOLS

For Drilling Square Hexigon or other Angular Shaped Holes

A GREAT TIME SAVER AND BOOST TO PRODUCTION

They have solved the problem of cheap and efficient drilling of square, hexagon or other angular shaped holes. The BIG advantage is, they can be used on any drill press or lathe.

Globe Angular Hole-Drilling Tools can be conveniently used for a large number of purposes. Such as making Chuck Screws, Socket Wrenches, Spring Chucks, Collars, Feeding Fingers, etc., for Counter-sinking for Square or Hexagon-Head Bolts or Machine Screws; for making Square or Hexagon Dies, and for cutting out the square corners in regular die work, etc.

Write for details.

The McClean Machine & Tool Company, Ltd.
125 Mary St. Hamilton, Canada

DIAMONDS
For Truing Grinding Wheels

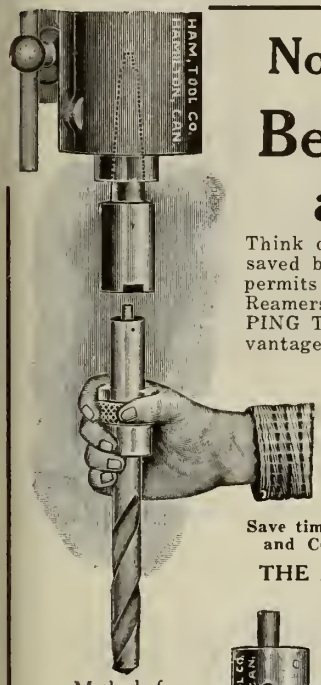
A new and large assortment of the finest diamonds for dressing emery wheels has been added to our stock. Canadian manufacturers will do well to let us know their requirements.

Canadian Desmond-Stephan Mfg. Co., Limited
Hamilton, Ontario, Canada

THIS IS ONE OF THE BEST THINGS WE MAKE. INCREASED SALES INDICATE OUR PATRONS' APPRECIATION.

HOYT METAL COMPANY

MONTREAL TORONTO WINNIPEG



Method of Using

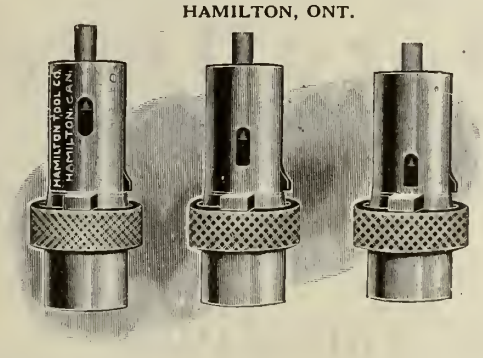
No Time Wasted
with the
Beaver Chuck and Collet

Think of the valuable time that can be saved by using a Chuck and Collet that permits the rapid interchange of Drills, Reamers, Counter, etc., WITHOUT STOPPING THE MACHINE? Such is the advantage embodied in the Beaver Chuck and Collet.

A self-contained device releases the Collet and tool instantly, requiring neither hammer, wrench, nor key to operate. And it only requires one hand to do it. There is nothing to catch or shock the operator.

Save time and expense with the Beaver Chuck and Collet—full particulars upon request.

THE HAMILTON TOOL CO., LTD.
HAMILTON, ONT.



View Collets

Buried in the Work and Broke!

Next time a tap breaks below the surface of a large casting, don't let some makeshift method of removing it injure the thread and waste half an hour of valuable production time. Instead—

Walton it Out in a Jiffy

And save the casting.

Special analysis steel fingers of the Walton Extractor drop into the flutes of the broken tap—and grip. Then a few turns of a wrench applied to the squared end of the Extractor backs out the buried tap.

Sixty-day trial offer proves the Walton Extractor pays for itself.

Write.

The Walton Co.
Hartford, Conn.

HARDENED SCREW GAUGES

ALL SIZES—STANDARD AND MISCELLANEOUS

Made to a fine degree of accuracy

Please ask for List No. 71

JOHN ACKWORTHIE
Ltd.
Coleshill Street
BIRMINGHAM
ENGLAND

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GENUINE EMERY

Sizes 180, 160, 140, 120, 110, 100, 90, 80, 70, 60, 54, 46, 40, 36, 30, 24, 20, 18, 16, 14, 12, 10, 9, 8, hole.

EMERY FLOUR AND WASHED FLOUR

Emery, Glass, Flint, Garnet, Corundum, Carborundum — Paper and Cloth — In Sheets, Rolls, Discs, Bands, Strips and Tapes, &c.

JOHN OAKEY & SONS
LIMITED
WELLINGTON MILLS
LONDON, S.E.1., ENGLAND

AGENTS:
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Winnipeg, Man.
Sankey & Mason
839 Beatty St., Vancouver

PERRIN FOR RELIABILITY

Hydraulic Screw and Filter Presses

Made in Canada

Hydraulic Truck Tire Press

WILLIAM PERRIN LIMITED - TORONTO

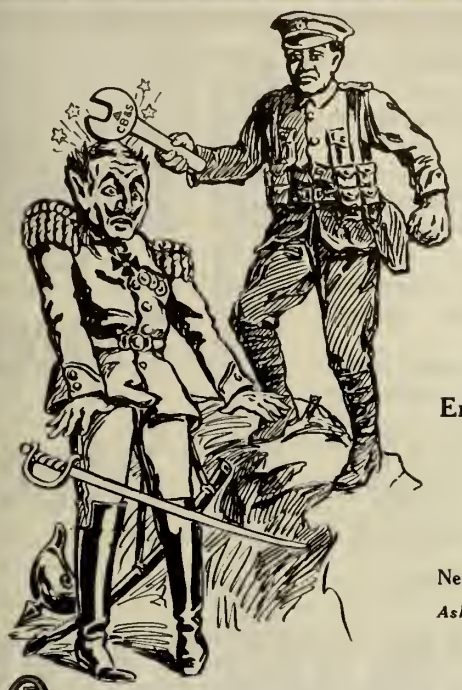
For Heavy Duty Drives USE

Forged Chrome Vanadium Gear Blanks and Pinions

Immediate Delivery, Rough turned, Sizes up to 12" diameter.

DOMINION FOUNDRIES & STEEL LIMITED
HAMILTON, CANADA

CANADA
FOUNDRIES & FORGINGS
LIMITED



If a Bad "Nut" Gets Loose
—Use a Wrench

Endurance Brand

Never Wear Out
Ask You Jobber

Canadian Billings & Spencer Plant
WELLAND, ONTARIO

Harris Heavy Pressure

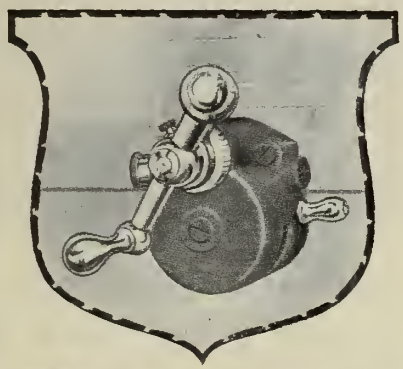
The Babbitt Metal that's at the Front in Efficiency and Economy

Order a Box from our nearest Factory

Our Guarantee is Back of Every Pound of Babbitt Metal We Make

Manufactured by
The Canada Metal Company, Limited

TORONTO - CANADA
HAMILTON WINNIPEG
MONTREAL VANCOUVER



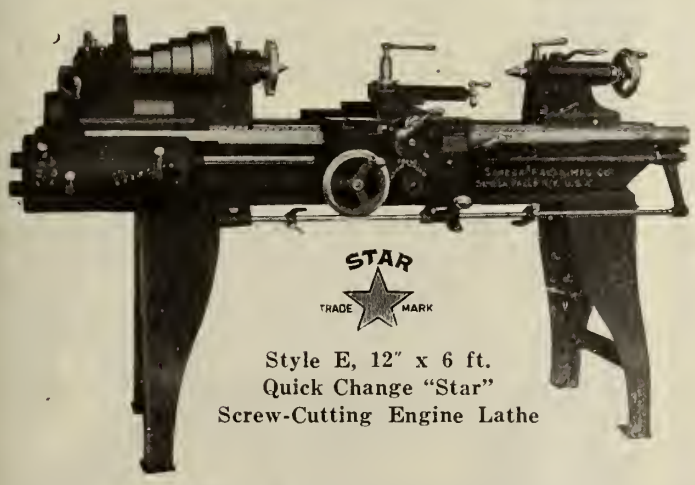
The Micrometer Cross-Feed Stop Is a Valuable Asset on "Star" Lathes

This stop i sinvaluable for all kinds of inside and which gives a positive stop for the desired depth of a cut.

This stop is invaluable for all kinds of inside and outside work. It saves time because it eliminates guessing at the depth of the cuts. It saves making several cuts to obtain a desired dimension. It saves stopping the lathe to caliper the work. And, **it insures uniformity in making duplicate parts.**

The depth of cut cannot be varied by crowding the machine. The stop is positive and may be used in conjunction with tape-attachment.

Other features of "Star" Lathes will be found in the "Star" catalog. A copy will be sent you upon request.



Style E, 12" x 6 ft.
Quick Change "Star"
Screw-Cutting Engine Lathe

The Seneca Falls Mfg. Co., Inc.
366 W. Falls St., Seneca Falls, N.Y.

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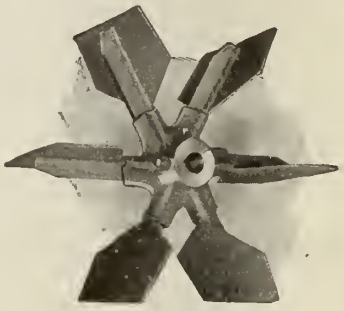
Canadian

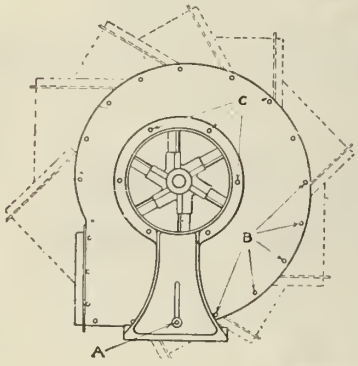
The Canadian Standard Reversible Mill Exhauster will keep your shop clean, remove sawdust, shavings, fumes, gas or any loose materials and disagreeable odors.

Insurance rates can be reduced; floors and machines covered with sawdust, chips or shavings, increase the fire risk.

Insurance companies reduce the premiums where adequate precautions have been taken to prevent fires.

Blast Wheel — This wheel is so constructed that it will handle any kind of stringy material efficiently, such as sawdust, shavings, cotton lint. Will also handle gases, fumes, smoke, etc.





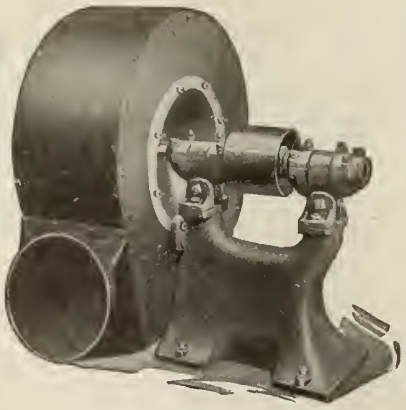
The Canadian Standard Planing Mill Exhausters have reversible housings so that the outlet can be adjusted instantly to any angle desired.

This eliminates necessity of crossed belts. Simplifies changes on alterations in piping or building.

The housing is of heavy rolled steel plate securely bolted together with angle irons. Round cast iron outlet bolted to the housing. Blast wheel mounted on heavy cast iron spider.

Every fan carefully tested by running test at speeds in excess of that required.

Write for catalog 16.



Canadian Blower & Forge Co.

Kitchener - Ont.

Electrite

Electric furnaces, automatically regulated, the most modern methods, and the introduction of Uranium — make this a steel of truly remarkable cutting properties.

We know "Electrite" cannot be bettered — and stand ready to prove it to you.

LATROBE ELECTRIC STEEL CO.

LATROBE, PA.

High Speed Steel

Uranium

DUNBAR SPRINGS

ACCURACY ASSURED

You can always depend upon Dunbar Springs being accurate. Before proceeding with any order the first few springs are carefully tested and checked up for this very purpose.

Seventy-two years' experience making flat and spiral springs of every description enables us to furnish you with springs of the highest quality, that can be depended upon under all conditions.

Send blue prints for estimates.

The Dunbar Brothers Co.

BRISTOL, CONN

MATTHEWS

Pittsburgh Bevel Steel Letters and Figures

Hand Made

Matthews' Letters and Figures are hand made from carefully selected tool steel. The characters are neatly formed, producing stamps that make easily read and durable marks on all classes of products. They reduce considerably the cost of high grade marking.

Try them! Mark your next order—"MATTHEWS' Letters and Figures."

JAS. H. MATTHEWS & CO.

3946 FORBES STREET - PITTSBURGH, PA., U.S.A.

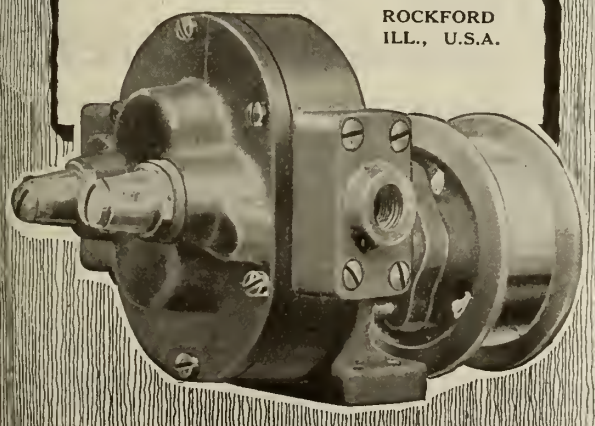
Steel Lettering Dies and Stamps

TRAHERN

Circulating Pumps

TRAHERN Coolant Pumps are Rotary Geared.
Simple in construction.
Operate at low speed—which means long life.
Self priming.
Shoot coolant with sufficient force to reach deepest cuts.
Reverse automatically with machines.
Will operate against 100 lbs. pressure.
Will deliver up to 16½ gals. of coolant per minute.
Have many advantages over Central Station method.
Used exclusively on the product of a large number of Machine Tool builders.
Our Bulletin No. 44 will explain in detail.

TRAHERN PUMP DIVISION
Geo. D. Roper Corp.
ROCKFORD
ILL., U.S.A.



MESTA MACHINE COMPANY
General Office and Works: Pittsburgh, Pa., U.S.A.

GAS AND STEAM ENGINES

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Blast Furnaces, Rolling Mills
Power Plants
Gear Drives, Rope Drives, Condensers
Air Compressors Vacuum Pumps

ROLLING MILL MACHINERY

Blooming Mills
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SPECIAL MACHINERY

Steam Hydraulic Forging Presses
Steam Hydraulic Shears
Pickling Machines Metal Mixers
Iron and Steel Cut Gears
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FORGINGS

Large Engine Shafts—Piston Rods
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CASTINGS

Carbon Steel—Alloy Steel—Bronze
Air Furnace Iron Castings
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Write for Bulletins

MESTA MACHINE CO.

Pittsburgh, Pa. U. S. A.

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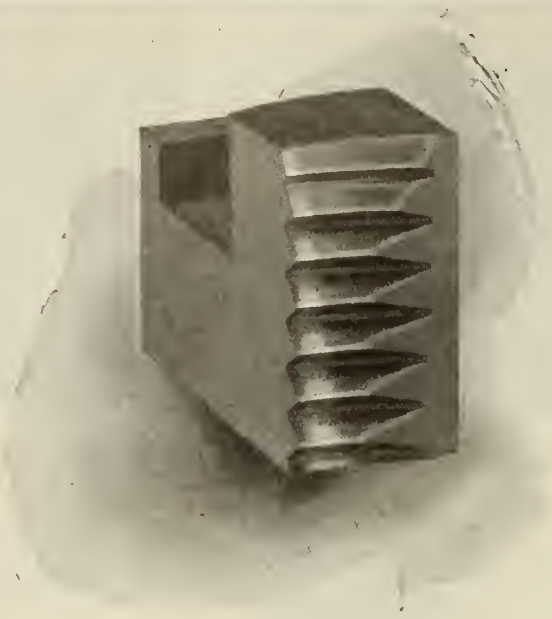


Don't Scrap the other Chasers

If one in a set breaks

Put in a New Chaser

Grinding set to Uniformity

This *Is* Practicable *If* You Use

HARTNESS AUTOMATIC DIES

Jones & Lamson Machine Company

(DIE DIVISION)

901 Queen Victoria St., LONDON, ENGLAND, SPRINGFIELD, VERMONT, U.S.A., 503 Market St., SAN FRANCISCO

American Agents for Dies and Chasers:

Boyer, Campbell Company, Detroit.

E. L. Essley Machy. Co., Chicago, Milwaukee and Moline.

Robinson, Cary & Sands Co., St. Paul and Duluth.

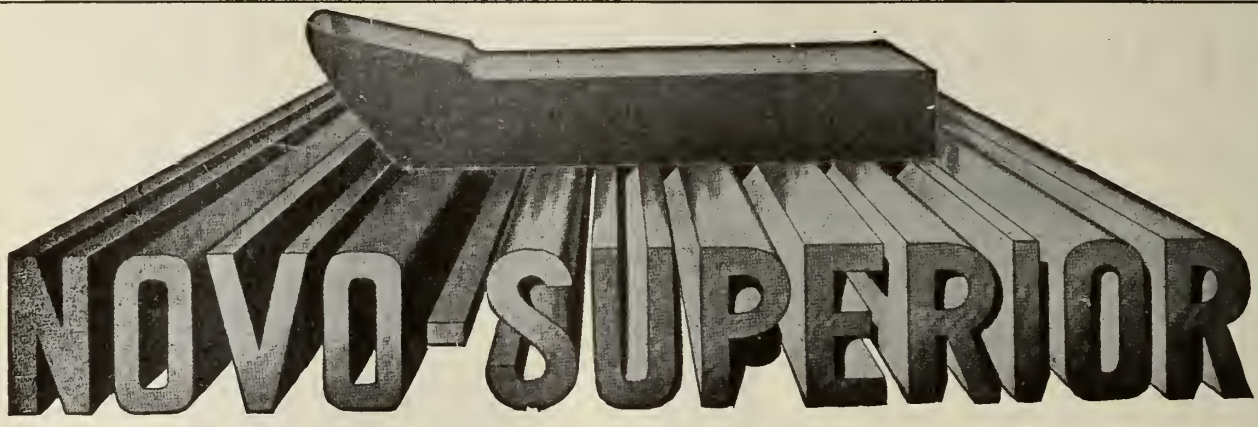
Foreign Agents:

France, Spain, Belgium—F. Auberty & Company, 91 Rue de Maubeuge, Paris, France.

Holland—Spliethoff, Beewukes & Company, Rotterdam, Holland.

Australia—McPherson's Pty., Ltd., Melbourne, Australia.

Japan, Manchuria, Korea, Formosa—Mitsui Bussan Kaisha, Ltd., Tokyo, Japan.



HIGH SPEED STEEL

INTRA STEEL *GIBRALTAR STEEL*

Tool Steel for Every Purpose

SWEDISH LANCASHIRE IRON

Twist Drills, Taps, Hack Saw Blades, Milling Cutters, Files, Etc.
Music Wire for Springs, Steel Balls
Cold Rolled Tool Steel in Strips and Sheets

We call to your particular attention that we make a specialty of and solicit your inquiries for

Circular Saws—for wood and for hot or cold metal cutting;
Machine Knives—for cutting wood, paper, tobacco, agricultural.

PILOT STEEL & TOOL COMPANY, Limited, 322 St. James St., MONTREAL

Sole Agents for JONAS & COLVER, LIMITED Novo and Continental Steel Works, Sheffield, Eng.

H. BOKER & CO., Inc. NEW YORK, N.Y.

15 TON PRESS

A Simpler Hydro-Pneumatic Press

Complications in the construction of our High Speed Hydro-Pneumatic Press are so few that its operation is more readily understood than that of a more intricate machine.

Straightening, Forcing, Broaching

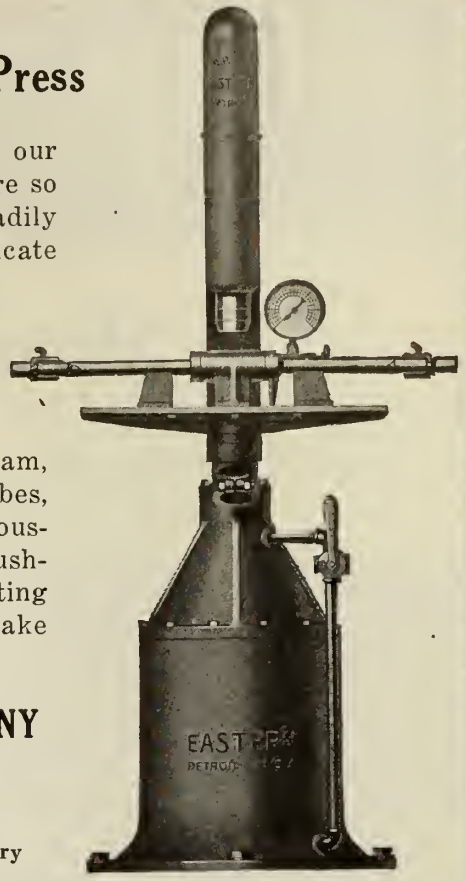
Particularly adapted for straightening cam, crank, pinion and wheel shafts, axle tubes, pinion tubes, assembling differential housings, assembling bearings in hubs, bushings in spindles and wheel rims, testing springs front and rear, broaching brake levers.

EASTERN PRODUCTION COMPANY

137 LEIB ST., DETROIT, MICH.

Branch: 120 Wisconsin St., Milwaukee, Wis.

Candian Representative: F. F. Barber Machinery Co., Limited, Foy Building, Toronto



15 TON PRESS

More Speed Better Work With—

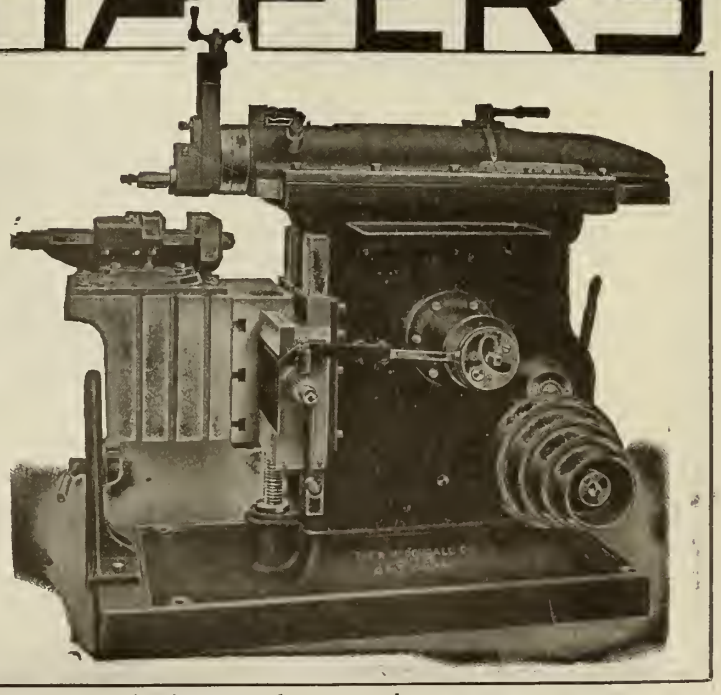
16 and 20 inch Crank

McDougall SHAPERS

Modern methods of manufacture require modern tools. McDougall 16 and 20-inch Shapers embody the best features of all machines which have been placed upon the market and can be depended upon to produce work accurately and fast.

An important feature is the column. It is massive in construction, well braced and reinforced internally. Has ample opening under ram for keyseating or other long work. Bearings for ram extend beyond vertical line of column both front and back. The ram is of exceptional strong construction.

McDougall shapers have other points of interest you should know about. Write for full description.



The R. McDougall Co., Limited

GALT, ONTARIO

THE CANADIAN FAIRBANKS-MORSE CO., LIMITED

Sales Agents

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Norton Grinding Wheels

Manufactured in Hamilton

THE Norton Company of Canada, Ltd., was incorporated on December 26, 1919. The new Norton grinding wheel plant in Hamilton, Ontario, was put in operation in March with an organization of skilled and experienced mechanics from the plant of Norton Company at Worcester, Massachusetts.

Alundum grinding wheels are being manufactured by both the vitrified and silicate processes and the plant is already giving Norton service to Canadian users of these products.

The plant is modern in every particular and is operated by a force of men with the advantages of long experience at the Norton Company which gives customers assurance of the high standard of Norton quality widely recognized throughout the world by grinding wheel users. With the plant located in Canada better delivery service is insured Canadian customers than they have hitherto enjoyed.

Orders should be placed as in the past with the established agencies for Norton products—Canadian Fairbanks-Morse Company and F. H. Andrews & Son.

Shipments of Alundum wheels, vitrified and silicate processes, are made from Hamilton. Crystolon wheels and other special products are shipped from Worcester, Massachusetts.

NORTON COMPANY OF CANADA, LTD.
HAMILTON, ONTARIO

Electric Furnace Plants

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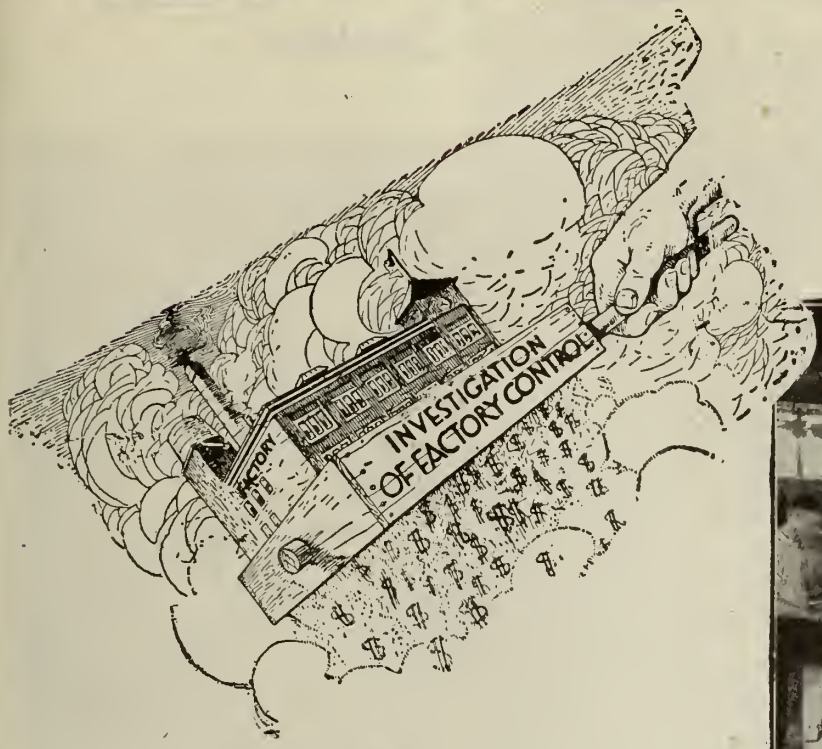
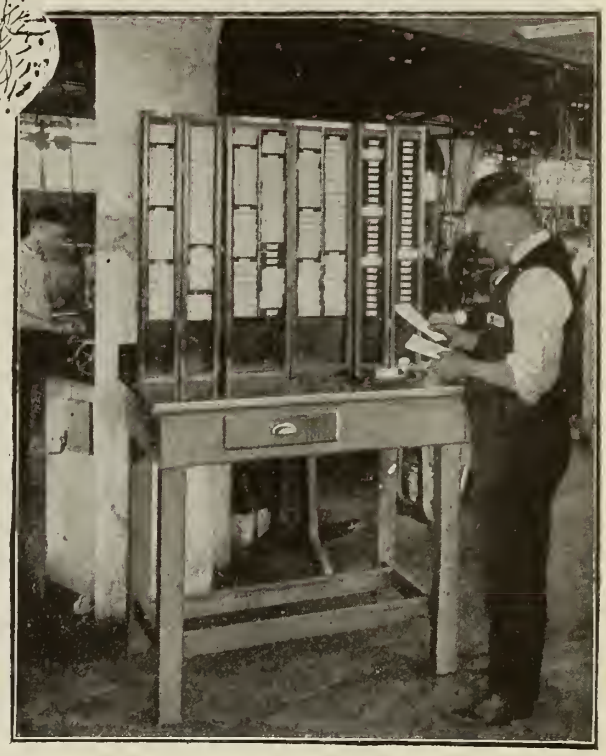
Canadian Agents: The Canadian Fairbanks-Morse Co., Ltd., Montreal, Toronto, Ottawa, St. John N.B., Winnipeg, Calgary, Saskatoon, Vancouver, Victoria. F. H. Andrews & Son, Quebec, Que. Simonds Canada Saw Co., Vancouver, B.C.

GISHOLT





Sift this Problem of Factory Management

Factory management means thinking, planning, scheduling, producing and RECORDING.

Recording *accurately*. You've got to know exactly how your workmen spend their time on jobs to determine accurate costs. Inaccurate labor charges mean just one thing—misleading cost records.

The PERIODOGRAPH accounts for every fraction of working time, no matter how spent. It enables you to get business-like instead of haphazard records, and it does this by taking away from the foreman or workmen the *writing* of time tickets.

Wouldn't you like to know more?
Then ask a Gisholt Salesman to call

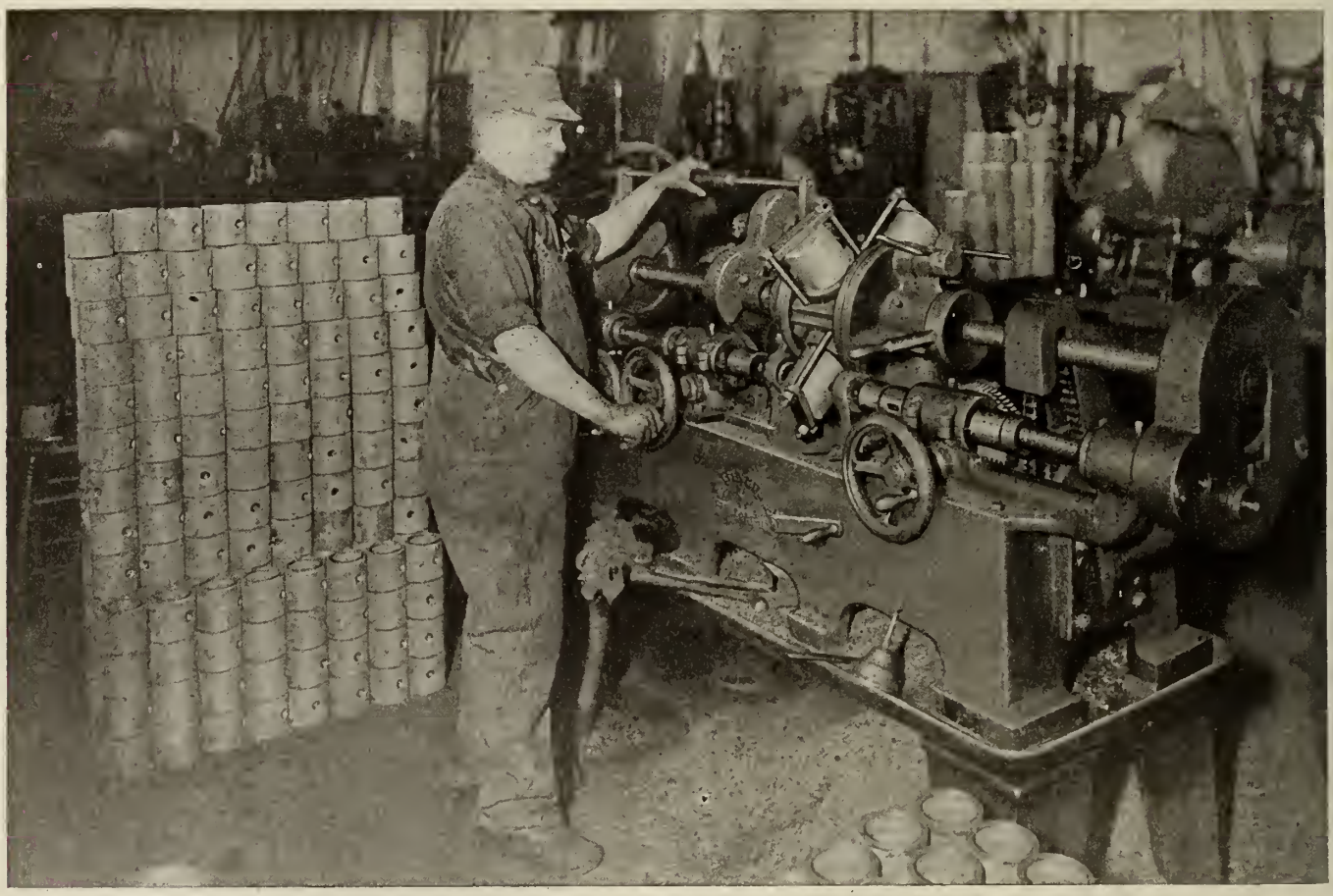
GISHOLT MACHINE CO., 1207 East Washington Ave.
MADISON, WIS., U.S.A.

Builders of Standard and Automatic Turret Lathes, Vertical and Horizontal Boring Mills, Tool Grinders, Small Tools, Special Machinery, etc.

Eastern Sales Office: 30 Church St., New York *Works:* Madison, Wis., Warren, Pa.

"The best time-saver and

was the way the boss summed up this HOEFER Driller



At the Bush Terminal machine shop of Arnold-Helmuth Mfg. Co., in Brooklyn, N.Y., the operator could use this Hoefer Driller to measure time. Each minute, with time-clock regularity, it delivers an automobile piston with wrist-pin holes accurately drilled, bored, and reamed. It's a performance that has never stopped, nor even slowed up, for any reason whatever since the machine was installed, and represents an increased production of 110% over the method previously used.

Sales Engineers for Hoefer Heads: Chicago, 621 Washington Blvd.; New York, 30 Church St.; Philadelphia, Bourse Bldg.; Buffalo, Ellicott Square Bldg.; Cleveland, Citizens Bldg.; Pittsburgh, Empire Bldg.; Detroit, 602 Kerr Bldg.; Milwaukee, Majestic Bldg.; Dayton, John M. Howett, 12 W. Second St.; St. Louis, Colcord-Wright Machinery & Supply Co.; Minneapolis, F. E. Satterlee Co.; Montreal, Canadian Fairbanks-Morse Co. (head office).

HŒFER

FREEPORT,

money-maker in the shop"

We asked the shop superintendent what he thought of this Hoefer Driller

"I'd call that Hoefer the best time-saver and money-maker we've got in the shop," he said. "About the only thing that limits its capacity is the speed we can drive our drill spindles. It's accurate, too. We've got to drill these wrist pin holes to .0005-inch limits and it does even better than that. And it's so simple to operate that a man can't go wrong on it—why, we've turned out good work even with beginners. We haven't found a weak spot in it, and it's seen a little rough handling, too. Yes, it certainly is a gem."

A straight-from-the-shoulder opinion from the man whose job it is to make that shop pay—and hundreds of other Hoefer users can echo it.

You are interested in making **your** shop pay, too. Have you exhausted all the cost-reducing possibilities in your drilling department? Better get in touch with Hoefer and make sure. Our advice will cost you nothing, and its value to you is indicated by our 25 years experience in reducing drilling costs.

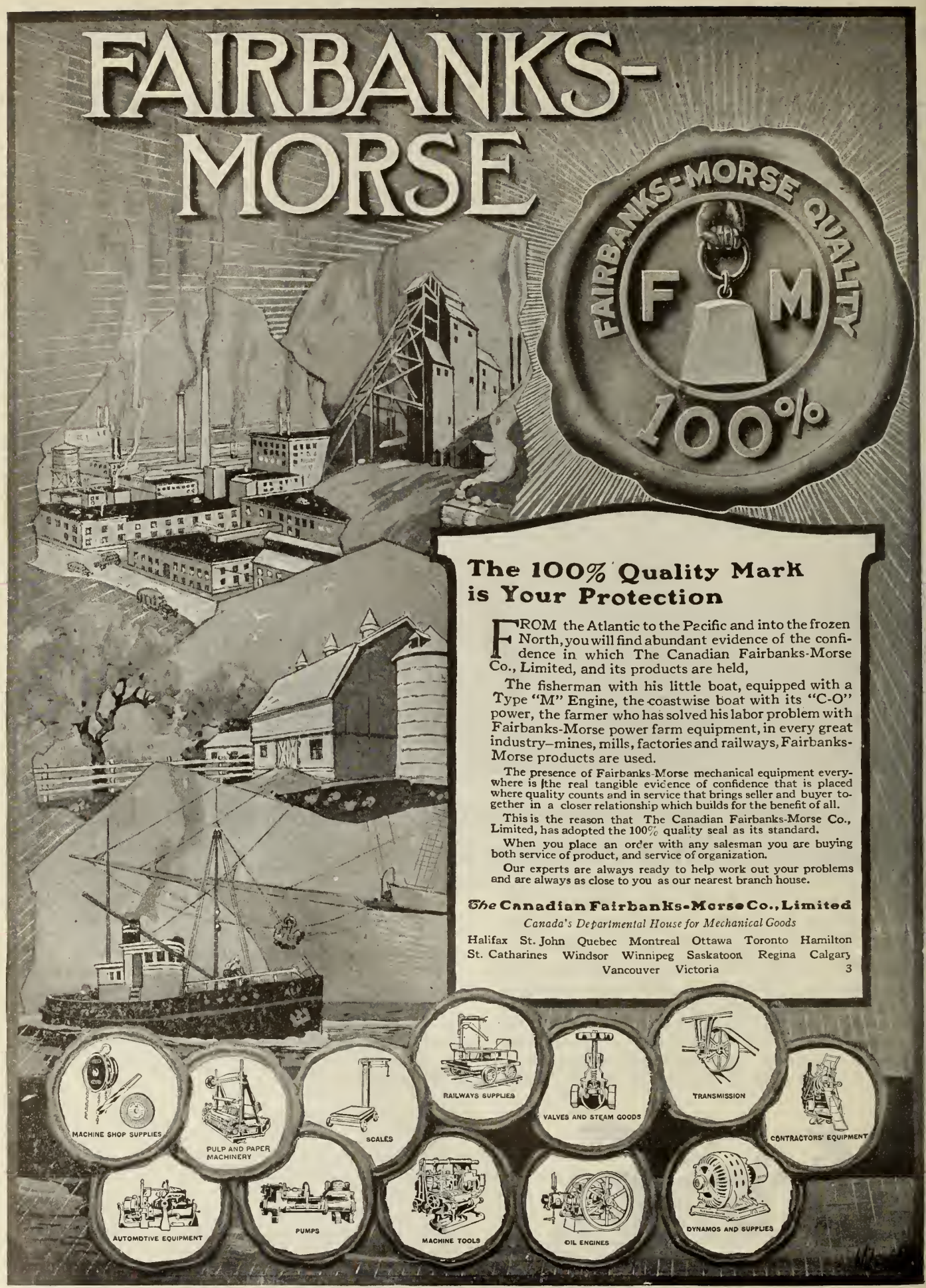
M'F'G Co
ILLINOIS

10

Sales Offices for Hoefer Drillers: Boston, Factory & Mill Supply Co.; Providence, Brownell Machinery Co.; New York, F. H. Niles & Co., Woolworth Bldg.; Philadelphia, Luster Machinery Co., 917 Arch Street; Baltimore, Aumen Machinery Co., 107 E. Lombard Street; Syracuse, C. H. Wood Co.; Rochester and Buffalo, Ogden R. Adams; Pittsburgh, Motch & Merryweather Machinery Co.; Cleveland, Cleveland Tool & Supply Co.; Dayton, John M. Howett, 12 W. Second St.; Indianapolis, E. A. Kinsey Co.; Detroit, Cadillac Tool Co.; Chicago, Federal Machinery Sales Co., 12 N. Jefferson St.; Milwaukee, Badger-Packard Machinery Co., Minneapolis, F. E. Satterlee Co.; St. Louis, Colcord-Wright Machinery & Supply Co.; Atlanta, Walraven Co.; Birmingham, Young & Vann Co.; New Orleans, Oliver H. Van Horn Co.; Seattle, Portland, Ore., San Francisco, Los Angeles, Eccles & Smith Co.; Montreal, Canadian Fairbanks-Morse Company (head office), for all Canada.

If interested tear out this page and place with letters to be answered.

FAIRBANKS-MORSE



The 100% Quality Mark is Your Protection

FROM the Atlantic to the Pacific and into the frozen North, you will find abundant evidence of the confidence in which The Canadian Fairbanks-Morse Co., Limited, and its products are held,

The fisherman with his little boat, equipped with a Type "M" Engine, the coastwise boat with its "C-O" power, the farmer who has solved his labor problem with Fairbanks-Morse power farm equipment, in every great industry—mines, mills, factories and railways, Fairbanks-Morse products are used.

The presence of Fairbanks-Morse mechanical equipment everywhere is the real tangible evidence of confidence that is placed where quality counts and in service that brings seller and buyer together in a closer relationship which builds for the benefit of all.

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When you place an order with any salesman you are buying both service of product, and service of organization.

Our experts are always ready to help work out your problems and are always as close to you as our nearest branch house.

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Canada's Departmental House for Mechanical Goods

Halifax St. John Quebec Montreal Ottawa Toronto Hamilton St. Catharines Windsor Winnipeg Saskatoon Regina Calgary Vancouver Victoria 3

CANADIAN MACHINERY AND MANUFACTURING NEWS

Vol. XXIII., No. 25 June 17, 1920

A Planning System that *is* a Planning System

The International Harvester Co., Hamilton, Canada, Who Have Perfected This System, Claim that This Department is to Them, What a Service Department is to Any Sales Organization.

—By J. H. MOORE

WHAT constitutes a planning system? In other words, when we say that a certain concern conducts a planning department, what do we mean?

As we are about to describe the planning department conducted by the International Harvester Co., Ltd., of Hamilton, Canada, it would be as good policy as any to quote what Mr. Gernandt, the general superintendent of this concern, said was his opinion of this section of his plant: "Our planning departmente is, to this plant, what the service department is, or should be, to any sales organization." Having hit the bull's eye, so to speak, at the first shot, we will proceed into the routine adopted by this portion of the plant.

The duties of the department are varied, so that our best plan will be to start from the time that a new piece (or sample, as it is called) is issued by the experimental department. Readers, no doubt, remember the previous article dealing with the subject of the experimental department and its attendant duties.

On a sample being issued, it is forwarded to the planning department whose duties are to study the piece carefully, deciding on its proper procedure throughout the plant. Readers must not run away with the idea that this decision is arrived at by a select few, for such is not the case. Every departmental head, and executed from the superintendent down, enters into the discussion. Included in the planning staff are four production experts, each a specialist in his own particular line. We will imagine that a new sample has been sent to the planning department, and that the time has arrived to discuss its destiny, so far as its routine of operations are concerned.

Each one interested is notified as to the time set aside for discussion, when at the appointed hour they meet ready for the problem. The part is now studied carefully, and a certain routine of operations adopted. The departments that are best equipped to handle the portion, right from its casting stage, are discussed thoroughly. Care is exercised that the piece makes no undue lengthy trip, but that in as far as possible the series of routine movements are confined to a small area.

The system is now perfected to such an extent that every foreman and departmental head co-operates to the very best of his ability in this regard. Having arrived at a satisfactory decision, the routine of operations are drawn up and o.k'd. This is later arranged in memo form as shown at Fig. 1.

This memo contains such information of real value from a systematic standpoint that we shall discuss it item by item.

First, it will be noticed that in the up-

January 14th, 1920.

Routing Memo 3036
Expl. Memo " 4064

NEW SAMPLE - 1920 DEERING GRAIN BINDER

Mr.
Ass't. Superintendent.

Dear Sir;-

We are turning over to the factory New Sample for:-

AA 540 Reel Bracket (Rep. & W.W.F. A540) W.W.F. means will work for
Grind
Drop
Drift File & Form 21 = malleable finishing dept.
Assemble Cap
Ream (2) 1.378 Holes
" (1) 1.757 "
Drill(2) 1/4" Hole
Drill(1) 17/64" Hole Double
Drill(2) 5/16" " " 11 X = repair dept.
Assemble into special shipping package 26 = Erect Shop No.1

AA 541 Reel Shaft Pinion (Rep. & W.W.F.A. 541)

Grind	
Chip	17 = Grey Iron Fdy.
Drift	31 = Grey Iron Finish Dept.
Turn 1.330"	11 X = Mach. Shop
Assemble	26 Erect No. 1.

Bearing part of above castings has been made 2-1/16" in place of 1-9/16" in accordance with Decision 2514-D.

Sample AA-540 was furnished by Deering Works, AA541 was made here.

Even up and use stock on hand of A540 and A541.

Copy to:
Messrs: Harrington = Production Dept.
Wiggin (2)= Inspection Dept.
McVinnie = Mechanical Dept.
Repair parts =Crowther Honeyford - achine
Stock Basement-Robertson Muldoon - Erect No.1
Order & Schedule - Gallagher Byrne - Grey Iron Fdy.
Cost - Gourley Warner - Grey Iron Finish
Salvage = Craig
Tool = Masterson
Mall.Iron Finish = Linklater
Mall.Fin. = Slater

Yours truly,
PLANNING DEPARTMENT,
BY P.G. Rigby
S.

FIG. 1—MEMO. USED FOR ROUTINE OF OPERATIONS.

per left hand corner is given the routing memo number, also the experimental memo number. This guarantees that both departments will place this memo on file, and in its proper place, ready to find at a moment's notice. Next in importance comes the name of machine on which the sample has to be used.

A description follows, stating that the sample is being turned over to the factory. Its symbol number, routine of operations, etc., are all described. Take for example the item AA 540. We note that this piece has an item stating, to drift, file and form (21). The (21) stands for a department number, in this case the malleable finishing department, which means that the piece goes to this department for the operations stated.

After such information is completed, the changes over the old sample are stated, of course, always providing that the new sample is replacing an old one, as the particular case we have illustrated depicts.

Then follows the information as to who furnished the sample, and if old stock has to be scrapped or used up. In other words, the latter portion of the memo is devoted to details which are of special importance.

A copy of this memo is sent to the various foremen interested, so that it stands as a permanent record regarding the meeting and decision.

Now comes the issuing of what is termed an interior order ticket. This form is shown at Fig. 2, the same style ticket being used throughout the entire plant. The first ticket made out is to the drafting or engineering department. An order is given to prepare such drawings as necessary, after which orders on similar forms are issued to the pattern, foundry and tool departments to make patterns, castings, jigs, fixtures, etc., from these drawings.

Taking it for granted that these elementary steps are thoroughly understood, let us pass on to the card shown at Fig. 3.

This card is known as the routing record card and contains all details of routing mentioned on the memo illustrated at Fig. 1, plus the price of production per 100 pieces. On the reverse side of the card is stated the various machines on which the piece is used. In this way, the planning department have a complete record of each part passing through the plant.

The Duties of the Production Experts

When speaking of the gathering together of the various departmental heads for consultation, we mentioned the presence of four experts in production. Let us consider the value of having these men on the planning staff. When we say that each of these four is an expert in his own particular sphere, we mean this in every sense of the word. For example, one man might be a crackerjack or lathes, but only a commonplace authority on milling machines, while another might be termed a whirlwind on lathe possibilities, but the very opposite on millers, and so on. Boiled down to a fine point the idea of having these experts on the staff is in order to obtain maximum production at the lowest possible cost. Each expert takes a keen interest in his duties as records are kept of their schemes, with attendant successes.

One concrete example, that came to the writer's attention while preparing this article, was a case of a certain product that was previously performed on drill presses. As readers understand, drill press labor is much cheaper than lathe help, and at the start it was felt that the drill press was the proper place to produce the part.

It was found, however, that only four out of one hundred pieces were perfect when drilled, so that immediately different procedure was decided upon. The part was now turned over to the lathe department and, while the labor cost was higher, it was found that only two or three out of every hundred were not perfect in every respect.

Naturally the lathe was decided upon, and while the labor cost was greater, the scrap percentage was so much lower that it wiped out easily the extra labor cost. A planning department, with experts such as described, is absolutely necessary to any plant turning out the enormous number of pieces this firm does every year.

These experts also help to set the piecework prices. This oes not infer that they are time or rate cutters, for the reverse is usually the case. They are the means by which the workman can prove if his rates are too small.

At Fig. 4, we illustrate some actual example of how piecework rates were advanced after proper investigation. The type of form illustrated, and which is only partially shown, is kept in the planning department, thus making certain that an accurate and up-to-date record of rates is kept.

The Control Board System

Let us next proceed to the last step in this system of planning production. A huge board is erected in the planning department, which is filled with small slits, or pockets, similar to the time card boards as used in almost any up-to-date industrial plant. In this board are placed certain production checking cards. Before going into a description of these cards, we will consider the object of the equipment control board system (as it is called).

As stated before, the equipment board consists of a series of visible pockets with cards showing a record of the progress of equipment, and is located in

Works Form 121

INTERIOR ORDER TICKET

Date..... 19.....

Mr..... Foreman..... Dept.

Please do the following work and charge to account. Material..... Labor.....

DESCRIPTION OF MATERIAL OR WORK AND FOR WHAT PURPOSE WANTED

Ordered by_____

Quantity and Full Description of Material Furnished	Quantity	Price	Amount

We delivered to-day the above material to _____ Dept

_____ Foreman Date_____ 19

FOREMAN DELIVERING WILL FORWARD THIS ORDER TO MAIN OFFICE IMMEDIATELY

FIG. 2—THIS STYLE OF ORDER TICKET IS USED IN ALL DEPARTMENTS.

NAME Reel Bracket — CAT. NO. AA 540
ROUTING 24 x 21 x 11 x 26 — MATERIAL Mall. Iron.
REPLACES A 540 — REPLACED BY — WILL WORK FOR A 540

SAMPLE AND ROUTING MEMO MEMO No.	DATE	DECISIONS	DEPT.	OPERATIONS	1916	1917	1918	1919	1920	1921
3086	Jan. 14 20	2514 D	Mall. Fdy.	24 Mold					$9.50	
				Core #1					32½¢	
			Mall. Core	" #2					22¢	
				" #3					16½¢	
				" #4					3¾¢	
			Mall Fin.	21 Grind					30¢	
				Drop					12¢	
				Drift file & Form					91¢	
			Machine	x Ream 2·1338					48¢	
				" 1·1757					36¢	
				Drill 2 — ¼					43¢	
				" 1 — 17/64					30¢	
				" 2 — 5/16					45¢	
				Assemble					$3.40	

Per 100 Pieces

FIG. 3—A GOOD EXAMPLE OF ONE SIDE OF A ROUTING RECORD CARD.

the planning department. Certain sections of the board are allotted to the various departments. For example, one portion is labelled "Grey Iron Foundry," another "Machine Shop" another "Tool Room," and so on. Every department in the plant is represented on this board.

The only orders which are not kept track of are standard orders or short orders which will not take more than nine hours to complete.

Suppose we take an actual example of a new sample issued and which has been forwarded to the planning department. As already stated, a meeting and discussion is held, the routing arranged, and interior orders issued to the various departments throughout the plant.

A reasonable limit has been arranged upon by all concerned, regarding the time necessary to complete the jigs, die or fixture drawings for the part. Next comes the setting aside of a certain time limit for the pattern making department to get out the patterns (if any), after which the tool rooms are allowed a stipulated time to produce their finished fixtures, and so on down the line of departments.

In other words, every detail is carefully and thoughtfully planned ahead. The space of time allowed these various departments is fair and reasonable, and is based on former experience. To illustrate the procedure in its entirety, we will suppose ourselves following a sample completely through its journey.

We will take it for granted that we have passed through the discussion stage, and that it has been decided to allow two weeks' time limit for the preparation of necessary drawings. At this stage we had better refer to Fig. 5, which illustrates the production card.

On the card is first marked the catalogue number of the piece, next the name, the machine used on, and the equipment necessary. Now comes the

-Piece Work Price List- Mch. Dpt.-

New prices will take effect on date shown.

May. 5th 1919.

Cat. No.	Operation	Price New	Price per 100 Old	Reason for Changing
H53	Taper Ream	15¢	12¢	Rate was too low
K518	Ream ¼" hole	10¢	·07¢	Deeper Hole
K808	Turn 2 11/32" S.O.s.	36¢	30¢	Longer Shoulder
B9/1019	Tap 7/8"	18¢	13¢	Deeper Hole

FIG. 4—THIS SHOWS HOW PIECE WORK RATES ARE WATCHED.

D 4013

Cat. No.

Name

Mch. Used on

Equipment:-

Order No.	Date
Dept.	
To be Finished	
Sample Rec'd	
Drawing Ord.	
" Finished	
Casting Ord.	
" Finished	
Wood Patt. Ord.	
" " Finished	
Estimated Hours	
Equipment 10%	
25%	
In. Progress 50%	
75%	
100%	

REMARKS:
THE PRODUCTION CARD WHICH ENSURES WORK BEING KEPT ON THE MOVE.

order No., the department, etc., etc. Readers cannot do better than follow each item carefully as marked on the card shown. It will be noted that the drawings, patterns, castings from these patterns, and the completed fixtures are supposed to be completed in the tool room one month from the issuing of the order. At the bottom of the card is a section devoted to the progress of the equipment.

As soon as 10 per cent. of the equipment is completed, the date is marked in the proper place. Should the schedule be a little behind, the proper department at once gets a gentle hint to get busy.

Twenty-five and fifty per cent. are likewise marked, but when it comes to 75 per cent., this point is watched with special care. Should the work be behind schedule at this point, a red star seal is stuck on the card in such position as to demand immediate attention. From this point on, which is termed the alarm point, every possible effort is made to speed up the equipment in order to get it out in time. When a red star shows up on a card, everybody concerned knows that this means Rush with a big R.. and that they must all co-operate in getting the material out on schedule time.

As the equipment progresses, the card is moved from one department section to another. Immediately the drawings are completed, the card is marked as completed (in as far as this department is concerned). and passed into the pattern making section. As soon as the patterns are finished, the card is once more filled out, and passed into the foundry department (grey iron or malleable, as the case may be). Immediately the casting is completed, the card is again filled in and passed on to the tool department. This method anyone can tell not only how the equipment is progressing, but in what particular department the part is passing through.

It might be well to mention that these cards stick out two inches from the mouth of the pockets on the board which ensures that they are easily read at a glance.

Should the work be of a special nature, that is, equipment for special attachments, a green seal is placed on the card, which, of course, separates it from the regular line of work. In this way, confusion between special and regular equipment is avoided.

The Tickler System

In conjunction with the board is conducted a tickler system, so arranged that on certain dates, up comes a card reminding you that the equipment for piece No.—so and so—, should be 10 per cent. finished.

At once you go to the equipment board and ascertain what progress the equipment is actually making. Nothing is left to memory, but the system is simplified to such an extent that one has no excuse for error. Periodically these tickler cards turn up at 10 per cent., 25 per cent., 75 per cent. and 100 per cent., so that one is constantly reminded of his duty.

It is only by the adoption of some such system as already described, that a plant of any fair sized proportion can hope to cope with the immense amount of parts and equipment passing yearly through their hands.

Factors in the Heating and Cooling of Steel

There is a Great Deal More in the Problem of Proper Heating and Cooling of Steel than One Would Imagine—Variations of Different Kinds Can Occur, and Herein is Given Certain Factors which Should be Considered*

IT is generally assumed that the proper heat-treatment of large quantities of steel of similar size and shape requires nothing more than a uniformly heated product; that a uniformly heated product requires nothing more than a uniformly heated furnace; that a uniform pyrometer record indicates a uniformly heated furnace and, therefore, a uniformly heated product within that furnace. Nevertheless, variations in metallurgical quality of the finished product frequently occur even with an indicated uniform temperature in the furnace chamber. There is a great deal more in the problem than the maintenance of a uniform temperature in the heating chamber. It may be expected that there would be a material variation in the uniformity of heated product from furnaces of different types, but, as a matter of fact, wide variations quite frequently occur in material heated in the same type of furnace, the pyrometer readings in each case being the same. Such variations are generally brought about by a difference in method of placing material in the chamber and of applying heat to the material so placed. The final test is the uniformity of the heated product, which is determined by the manner in which the individual piece is cooled. The cooling is of great importance, although as a rule little attention is paid to this portion of the process.

While uniform heating is one of the main factors in the heat-treatment of metals, it is the uniformity of the final set or adjustment of the structure in cooling that DETERMINES the uniformity of the actual heat-treatment.

To heat the charge uniformly it is necessary that each piece be subjected to the heat in the same manner, at the same temperature, and for the same length of time. This requires something more than a furnace which will maintain a uniform temperature, without reference to the manner in which the heat at that temperature is applied to the material in the furnace.

If a large quantity of material is piled in a chamber, it is very likely that the outside pieces will be heated to, and cooled from, a higher temperature than the pieces at the centre or at the bottom of the mass. If a large quantity of uniformly heated pieces is plunged into a quenching bath at one time, there is a tendency for the bath to become irregularly heated and for the pieces at the outside of the mass to cool at a different temperature and in a different period of time than those in the centre.

With such mass methods of heating and cooling it is unreasonable to suppose that each piece receives the same amount of heat or is subjected to the same heat-treatment. Notwithstanding the temperature indication, unless all pieces are heated and cooled exactly alike, the indication of uniform temperature, either in the heating or cooling zone, serves merely as evidence but cannot be accepted as proof of a uniformly heated chamber, a uniformly heat-treated product within that chamber, or a uniformly heat-treated product as the final result. There should be a better appreciation of the difference between a pyrometer record indicating an apparent uniformity of temperature in a chamber and of the factors that determine the uniform heating of a piece to that indicated temperature.

A piece of fairly low grade steel, by proper and careful heat-treatment, may be made to meet physical requirements that a higher grade steel, improperly or carelessly heat-treated, would not meet. Of course, no heat-treatment, however good, will ever make the low grade steel as good as the high grade steel can be made.

Doctor Howe, in his book "Iron, Steel and Other Alloys," page 241, states: "You cannot make a bad beefsteak good by the cooking; you can cook it better or worse, and it will be a worse or a less bad beefsteak, but always bad. On the other hand you can easily spoil a good beefsteak by bad cooking. Now, just as cooking is to food so is heat-treatment to steel. Indeed, a pedantic cook might reasonably call cooking heat-treatment."

Doctor Howe's homely simile is very apt and to the point, and it would seem in order to draw a few comparisons between the stove that cooks the steak and the average furnace that heats the steel.

The housewife, unconsciously perhaps,

*Copyright, W. S. Rockwell Co., New York.

shows an appreciation of the fundamentals of good heating when she uses a slow fire in baking bread or in cooking a pudding, of which the centre has to be thoroughly done. She cooks a ten-pound roast much longer than a three-pound roast. She realizes that if she fills her oven completely with food, it will prevent the proper circulation of heat. She does not take it for granted, just because the thermometer on the oven door registers a given degree of heat, that her bread or pudding is well done. She makes certain that these are so placed in the oven that the indicated heat is applied uniformly to the bread or pudding.

While the application of heat in a furnace is better than in a cook stove, it is questionable whether the average heat-treater manipulates his dampers as intelligently as the housewife does, or employs the same effort and skill to get a properly heat-treated product.

Many furnaces now in use are not provided with the dampers so essential for controlling the air entering and the gases leaving the furnace. Even when furnaces are euipped with dampers, the dampers are frequently pulled wide open and left so, or sometimes entirely closed, the spent gases being permitted to escape from the heating chamber as best they can, often completely destroying the effect of good heat distribution within the chamber.

Four Factors to be Considered

Consideration of uniformly heat-treated product involves four factors which govern the heating and cooling of all material, whether it be a loaf of bread or an ingot of steel, i. e.: Temperature, Time, Surface and Mass.

(1) TEMPERATURE: The degree required to saturate the individual piece to the required temperature and to permit the required metallurgical reaction or diffusion and equalization.

(2) TIME: The period required to saturate the individual piece to the required temperature and to permit the required metallurgical reaction or diffusion and equalization.

(3) SURFACE: The area of the individual piece exposed to the heat—which influences the rate of heat absorption, the time of saturation and the degree of uniformity throughout the piece.

(4) MASS: The unit body to be heated—which influences the time required for saturation, the rate of absorption and the manner of exposure to the heat. Mass should be considered with reference to the individual piece and with reference to a mass composed of a number of individual pieces.

Temperature and Time are the two basic factors. The temperature is determined by the metallurgical requirements. The time period is based primarily on the factors of surface and mass, which may be laid down as a rule to govern the heating or cooling operations. Due regard must be paid to the nature of the material itself. For instance, the time required for the proper saturation of a low carbon steel might vary from the time required for a high-grade alloy steel of identical surface and mass. Generally, in annealing, the time allowed for heating or cooling is too short, particularly with large pieces. From the heating standpoint this statement also holds good in some cases where there are large surfaces in proportion to mass, as in the heating of large circular saws for hardening.

It is desirable to expose to the heat as much of the surface of the individual piece as possible. This holds good whether the operation is one of heating a single piece as a mass or of heating a quantity of individual pieces as a mass. This done, the only other element seriously affecting time is the mass, whether it is the mass of the individual piece or the mass of a quantity of pieces. When heating or cooling a quantity of individual pieces at the same time, it is desirable to avoid the large mass effect in order that there shall be no material variation in the surface area of each individual piece exposed to the heating or cooling atmosphere. In such cases it is desirable to break up the mass in a manner to reduce the depth of material and increase the surface of the material exposed to the heat. This generally reduces the time required and results in more nearly exposing each piece to the same temperature for the same time, instead of subjecting the outside of a dense mass to the heat for a longer time than the pieces at the bottom of the mass.

The ideal cooling condition is approached when the same factors are considered after heating. An illustration of this, from the standpoint of heating, would be to consider the difference in uniformity of a product in the form of small balls or bolts piled in a large mass on the hearth of a stationary furnace, or when passed through an automatic furnace in the form of a thin stream or layer. In cooling there would be a pronounced difference in uniformity resulting from plunging such a mass of heated material into a non-circulating bath and dropping a few pieces at a time into a circulating bath.

The construction and operation of the automobile radiator illustrates the relationship of mass and surface to time and of time to temperature. In the radiator it is necessary to break up the mass and to increase the surface in order to decrease the time of cooling. The same laws control the heating and cooling of steel.

In heating large dies it is desirable that they be thoroughly saturated at a temperature slightly below the final temperature before the formed corners or edges on the face reach the final temperature. As the life of a die is no greater than the life of the corners or edges, it naturally follows that every possible effort should be made to prevent overheating the corners or exposing them to the final temperature any longer than is absolutely necessary. The corners of the piece are the first to heat up and the first to cool off, and it is at these same sections that the evil effects of unequal contraction are manifested. These corners heat and cool more rapidly because the surface in proportion to the mass of these sections is much greater than that of the body of the die, which naturally reflects a difference in time of heating or cooling. With such dies it is most essential to consider the difference in time required to reach a given temperature in heating or cooling, due to the difference in surface and mass of the various sections of the die. Improper heating and cooling, resulting from a disregard of these factors, are responsible for a great deal of the limited service and loss of production, material and labor. Such loss greatly offsets any saving in time or fuel resulting from an attempt to heat the piece quickly without due regard to all the factors involved.

The difference between a small piece and a large one is mainly one of degree, insofar as these points are concerned. The principles hold good in either case. When a quantity of small pieces is heated indifferently, those on the outside of the charge are likely to be affected as the corners of the die, and while, in one case, it is only those outside pieces that are spoiled, in the case of the die the entire piece is ruined. The heat-treatment of a small piece involves no large amount of money and the difference in cost between proper and improper methods is surprisingly slight. The difference in results is all out of proportion to the cost, and it is only good business to bear the slight extra cost in order to produce a superior product, which is cheapest in the long run. In many cases a piece may be properly heat-treated by a suitable method much more cheaply than by an inferior method.

The usual lack of consideration of these points of identical area and time of exposure for saturation accounts for the variations that so often occur in the finished product without any apparent change in the indicated temperature. Notwithstanding how elaborate the pyrometer or temperature recording system may be, good results cannot be secured unless the factors of mass and surface are considered along with the temperature and the time.

The practice of charging and discharging material to or from a furnace without regard to these factors, but with an eye only to the pyrometer, seems to be more of a job of manufacturing pyrometer records than of producing a uniformly heated product. The manner of exposing a piece to the heat is just as important as the manner of indicating the temperature of the heat to which it is exposed. The pyrometer does not necessarily indicate the temperature of the material but merely the temperature of that part of the chamber in which the couple is located. Like the gauge on the steam line, it indicates the existence of heat energy but it does not necessarily indicate the use made of that energy. The indicated temperature must be considered with the element of time and with the influence that the factors of mass and surface have upon the time. The only test worth while to determine these points is the degree of

structural uniformity disclosed by the microscope. A laboratory determination of temperature, with a surface exposure or mass effect different from that likely to obtain in the shop, is frequently responsible for material variations in quality disclosed by physical tests, in spite of evidence in the form of pyrometer records to show they should not exist.

Educate the Workman

Proper consideration must be given to the importance of the human element and the necessity for educating those in charge of heating operations to the fact that the heating of metals is an art or trade and that the man in charge of the operation is a sort of metallurgical chef, upon whose skill and judgment depend many subsequent operations and a considerable amount of money.

It is apparent that there is a waste of effort incident to the average heating test, which generally involves nothing more than an investigation of fuel consumption or temperature variation, without regard to the other important points involved in the process of producing properly heated material. Such tests are useless in determining the value of a furnace from the standpoint of heating material. The process of converting the energy in fuel to heat in a furnace is substantially the same as that employed in the operation of an automobile engine. If the average furnace were designed and operated as intelligently as the automobile, there would be much less ground for complaint in reference to waste of time and fuel and misdirected effort. With the automobile, fuel is considered but one factor in the transportation results sought for, and it should be considered in the same light with furnaces for the production of results in the form of heated product. It is the results in transportation that test the automobile, and it should be the results in uniformly heated product that test the furnace.

The trade needs a better appreciation of these points and of the fact that the real goal is the production of quality product at the lowest cost, and that it is invariably cheaper in the long run to do it right than in the haphazard fashion so prevalent at this time. An encouraging feature of the matter is that while heat-treatment should be considered as an art or trade, the principles involved are not complicated or mysterious but subject to appreciation on a common-sense basis of reasoning. If the heat-treating public can be led to an intelligent consideration of these principles, there will be an improvement in methods as well as in quality and cost of operations. Consideration of the highly technical side is a matter to be dealt with by the skilled metallurgists, but after they have determined the method of producing a result there should be good judgment employed in the production of that result on a large scale.

STEEL TREATERS TO HOLD CONVENTION, EXHIBIT, AND SALES MARKET

An event of special importance to the heat treating industry will take place in Philadelphia from September 14 to 18th inclusive, when the American Steel Treaters Society, and the Steel Treating Research Society will hold their second annual convention.

The plans are on a much larger scale than ever before, and will be in the nature of a convention, exhibit, and sales market combined. The commercial museum, where the exhibit will be held, has 80,000 sq. ft. of floor space, and is claimed to have the largest and finest display floor in America. It is interesting to note that this is only the third exhibit of heat-treating appliances and products ever held in the world.

In addition to the various displays and installations, some of the best talent in America will present papers on different heat treatment subjects.

Power will be supplied in the booths, making it possible to demonstrate by actual operation the product or appliance, and other booths will be fitted up with fuel oil, gas and compressed air, in addition to the electrical current. This will be a live convention in more ways than one.

Lines to be Exhibited

All grades of steel, process of heat treatment, hardening department equipment, supplies, laboratory equipment, first aid equipment, inspection bureau equipment, etc., etc.

Following are some of the firms who will display examples of their products:

Bausch & Lomb Optical Co., metallographic equipt., Rochester, N.Y.; Arthur H. Thomas Company, lab. apparatus and reagents, Phila., Pa.; Geo. H. Hagan Co., furnaces, Pittsburgh, Pa.; The Bristol Company, recording instruments, Waterbury, Conn.; Quigley Furnace Spec. Co., furnace specialties, New York; Railway Mech. Engr., publications, Chicago; Metal & Thermit Corp., welding materials, New York; Brown Instrument Co., recording instruments, Philadelphia; American Drop Forger, publications, Pittsburgh.

Bell & Gossett Co., carburizing materials, Chicago, Ill.; Rodman Chemical Co., carburizing compound, Verona, Pa.; Tate-Jones & Co., furnaces, Pittsburgh; Strong, Carlisle & Hammond, furnaces, Cleveland; Steel Treating Equipment Co., carburizing materials, Detroit; Carborundum Company, refractory materials, Niagara Falls; Elec. Furnace Construction Co., electric furnaces, Philadelphia; Driver Harris Company, nichrome, Harrison, N.J.

Mahr Mfg. Co., furnaces, Minneapolis; Scientific Materials Co., laboratory apparatus, Pittsburgh; W. S. Rockwell Co., furnaces, New York; Leeds & Northrup Co., recording instruments and electric furnaces, Philadelphia; Halcomb Steel Company, steels, Syracuse, N.Y.; Simonds Mfg. Co., steels, Lockport, N.Y.; Roessler & Hasslacher Chem. Co., chemicals, New York; Wm. Ganschow Company, gears, Chicago, Ill.; Wilson Maeulen Co., recording instruments, New York; American Metallurgical Corp., electric heat treating apparatus, Philadelphia.

Modern Equipment Co., electric tempering furnaces, Taunton, Mass.; Hoskins Mfg. Co., recording instruments and electric furnaces, Detroit, Mich.; Vanadium Alloys Steel Co., steels, Latrobe, Pa.; Wayne Oil Tank & Pump Co., furnaces, Fort Wayne, Ind.; Pyromagnetic Instrument Co., Magnetic instruments, Chicago, Ill.; The Macleod Co., sand blast equipment, Cincinnati, O.; Midvale Steel & Ord. Co., steels, Philadelphia; B. M. Jones & Co., steels, New York; American Gas Furnace Co., furnaces, New York; The Widney Test Laboratories, modulimeters, Chicago; Industrial Press, publications, New York; Ludlum Steel Co., steels, Watervliet, N.Y.

Dearborn Chemical Co., oils, Chicago; Horace T. Potts Co., steels, Philadelphia; Crucible Steel Co. of America, steels, Pittsburgh; Tinius Olsen Testing Machine Co., testing machines, Philadelphia; McGraw Hill Publishing Co., publications, New York; Advance Furnace & Engr. Co., furnaces, Springfield, Mass.; Wheelock, Lovejoy & Co., Inc., steels, Cambridge, Mass.; The Buda Company, industrial trucks, Harvey, Ill.; Hardite Metals, Inc., alloy carbur. boxes, New York; The Penton Publishing Co. (Iron Trade Review), publications, Cleveland; The Iron Age, publications, New York; Surface Combustion Co., furnaces, New York.

OF INTEREST TO SHIPPERS

Shippers in manufacturing plants will no doubt be interested to know that on and after July 1 the American Railway Express Co. will keep a duplicate copy of every receipt it issues when receiving business from shippers. The duplicates will be retained by the express company for the purposes of record and reference and will be held at their shipping office

Shippers who have been accustomed to prepare their own receipts or who have their own forms are requested to make provision for supplying duplicates of such receipts to the express driver or receiving clerk who signs them. As a matter of convenience the regular receipt forms of the express carrier will be revised to permit their use in duplicate form.

In cases where prepaid receipts are now being issued in duplicate the extra copy being used as a record of charges paid, a third copy will be required under the new system, and in such instances prepaid receipts will be issued in triplicate. One of the objects of the new system is to bring about better protection for and methods of recording the movement of express packages in transit.

Tight-Fitting Threads for Bolts and Nuts

A Thread that Will Not Loosen—Is There Such a Thread? Read This Interesting Paper as Presented at the Spring Meeting of the American Society of Mechanical Engineers.

By CHESTER B. LORD

WHAT is the cause of our periodic dissatisfaction with threads when in general they are so satisfactory? What other machine element is so easily made or is so satisfactory as regards strength? Why are there so many different kinds of threads when all are equally satisfactory, or rather unsatisfactory? Furthermore, is the dissatisfaction founded on performance or merely upon theory? Also, is the form or angle of thread a matter of importance or merely an excuse for mathematical gymnastics? The only answer the writer has been able to elicit in reply to these various questions is that we are looking for a better thread; which statement, however, is rather indefinite and usually simply means a thread that will pass the gage. Of course, the real object of the search has been to find a thread that will not loosen.

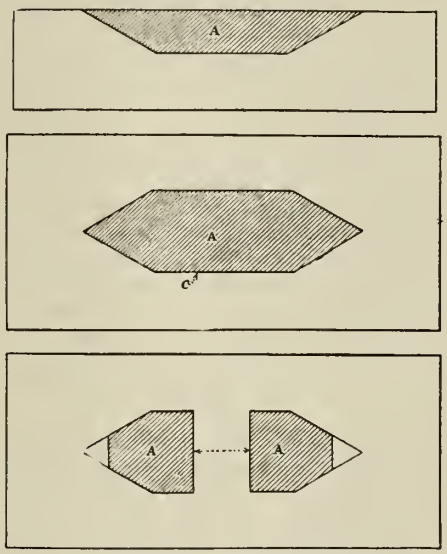
In the past we have attributed our troubles to the fact that our fits were not close enough—the engineer's alibi for a poor design. But fundamentals cannot be violated in mechanics any more than elsewhere in nature, and we are attempting to violate two by insisting upon our present methods of inspection: (a) that interchangeable manufacture is a matter of percentage which depends upon tolerance and cost; and (b) that a force fit is not possible between two parts the surfaces of which are complements one of the other.

Having in mind the first fundamental, it is obvious that the chances of securing a perfect fit are limited by the cost, and the second fundamental would seem to render this entirely hopeless. It is therefore proper to conclude that a good fit is usually due to error, and that if changing both male and female threads produces no relative change, changing one thread must of necessity do so. It is the object of this paper to demonstrate that by making this latter change threads can be produced that are interchangeable practically regardless of tolerance, that will not loosen, and are cheaper to manufacture.

A physician always diagnoses a case before prescribing, so let us do likewise. The loosening of a thread fit is caused by vibration or repeated shock, the chief result of which is to flatten and burnish the parts of the thread that are in contact. This produces a slight looseness and the nut tends to follow the thread incline until it again fits. The same performance is repeated until finally the nut reaches an obstacle too large to flatten, or else the bolt and nut vibrate in unison and there is no further relative movement. This same phenomenon occurs in the case of a bolt screwed in a tapped hole.

Experiments with spring lock washers having a projection that will not allow the nut to turn without cutting the metal, and the same type of washer made without holding projections, show very little difference in their holding power; and this would seem to indicate that their function is to prevent vibration. But we also find nuts without lock washers in places where there is vibration, and still they do not loosen. The answer is that they are individually fitted.

The writer can remember in his shop days picking out and numbering nuts and bolts, and every mechanic knows that he cannot take the bolts out of a cylinder head on an engine of good make and put them back again indiscriminately. They must go back into the holes from whence they came. All have demonstrated to their satisfaction the fact that a tight thread will not loosen by vibration, and that one with tolerance will, unless it is prevented from loosening by a lock washer or its action limited by some type of nut lock. We cannot lessen our tolerance because the tap wears small and the die wears large, and the lesser cannot contain the greater.



FIGS 1 TO 3—SHOWING APPLICATION OF PRESSURE IN THREAD FITS.

The Problem to be Solved

To gain a better conception of the problem to be solved, consider a board cut as shown in Fig. 1. We cannot obtain a forced fit between the two pieces because one surface is the complement of the other. If we apply a force to A, we are no better off because the pieces cease to fit the instant the pressure is released. We may therefore state as a rule that where two surfaces are complementary to one another a tight fit cannot result without some means of maintaining pressure. But if we cut the board as shown in Fig. 2, theoretically removing no material, we can replace A without force, and any pressure exerted will not make a tight fit unless we distort A or drive a wedge at C. This is analogous to a perfect thread, and driving the wedge at C is equivalent to introducing a slight difference in lead. If, now, we cut off the ends of A as shown in Fig. 3, and apply a force in the direction shown, we can obtain a forced fit because only the angles are complements and because we have a method of maintaining pressure. We can also even distort A because we have room for it to expand. We have only then to provide for three things: a method of making the parts in contact absolutely complementary; the introduction of sufficient metal; and a method of maintaining pressure. With our present type of thread we can only meet one of these—namely, that of partly maintaining pressure. This is demonstrated in Fig. 4, which shows in an exaggerated manner the effect of off lead.

To secure a good fit it is necessary to exert pressure on all flanks of thread, and not on only two as we do with standard thread. Practice demonstrates that the nut and bolt must be held by internal pressure on all flanks, and that the force maintained by screwing the face of the nut against another surface does not prevent loosening; but the writer again affirms that for practical purposes an off-lead thread is better than a perfect one, because in our present practice it is the lead or burrs that usually determine the fit.

While two slightly varying leads make a better fit, both as regards gaging and in actual use, this practice is not to be commended. Using a different lead to secure a fit is doing imperfectly on one side of the thread what the different-angle method does perfectly on both sides, because by having the leads identical and the thread supported on both sides, we secure a uniform finish instead of a distortion. Where the leads are different, the amount of distortion necessary to secure a fit increases with each thread. Thus, if the lead of a 20-thread stud is 0.05 in. and we make it 0.052 in., it will be 0.002 in. off centre on the second thread and 0.018 in. on the tenth thread. This is entirely possible, and superior to a so-called perfect thread as regards fit, but a distortion, unmechanical, and unnecessary.

This is what is done with railroad fish-plate bolts where the specifications

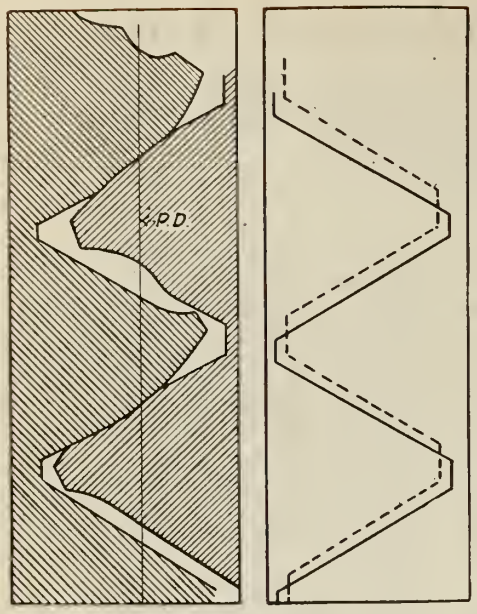


FIG. 4—THE EFFECT OF LEAD, GREATLY EXAGGERATED.

state the minimum foot-pounds at which the nut and bolt may be assembled. The impossibility of meeting these requirements in quantity production is recognized by purchasing agents and most engineers; and so the lead is slightly changed. This, however, is merely a subterfuge and really defeats the purpose of the specifications in that it permits of a poorer and weaker thread than would otherwise be possible.

We are thus confronted with this problem: Without sacrifice of strength, without increase of rejection, without additional manufacturing costs, find a method whereby a male and female thread of the same lead and pitch diameter may be made after repeated loosenings to fit tight without the aid of a locking device. This, according to specifications, calls for a full thread at contact points, pressure applied continuously on all flanks, and maximum strength at the pitch line. This means the addition of surplus metal to the male (which is the only one affected) sufficient to fill out the female threads, which would be an impossibility were it not for the ductility and elasticity of steel. If we add this surplus metal we will find that we can more than fulfil the required conditions by changing the angle of the male thread to a lesser one than that of the female, having the two intersect on the pitch line.

Theoretically, this means a smaller amount of material below the pitch line of the male, compensated for by an increased amount above the pitch line. Actually it means more, because we do not have to recognize as great a tolerance below the pitch line because of our lesser angle, nor above the pitch line because we can take care of a reasonable surplus and the question of initial fit need not be considered. The space below the pitch line in the male, due to difference of angle, is not as great as the tolerance usually allowed.

Every nut is bell-mouthed, and every bolt, whether cut or rolled, is tapered. This is fundamental and cannot be avoided. This being so, we have no trouble in entering, for one or two threads, a bolt of larger angular but less total displacement than the female. It is also true in practice that the first threads of either nut or bolt are weaker than the rest, because they lack support on one side and hence flow easily.

When a male thread of this type and a standard mate are screwed together, we will have transformed a male of lesser angle to one of larger angle or of wider base than the standard U. S. thread, because we have filled out the female thread tolerance as well as that of the male. We will also have uniform pressure on all flanks; the maximum possible material at the pitch line; a hard, smooth surface analogous to a case-hardened one; a fit that will remain snug despite repeated removals and that may be screwed together by ordinary means; and yet we still retain an interchangeable bolt and nut according to U. S. standards. The nut has not been changed or distorted in any way, but has simply served as a finishing roll.

The writer has stated in a previous article that, aside from threads, nowhere else in machine work do we expect micrometer limits on a roughing cut; and the question naturally arises whether an operation similar to that described would not be an effective finishing and sizing operation for commercial work. This would be the equivalent of making them fit the gage, and would greatly reduce the cost due to rejections. We would, of course, still have variable nuts and the necessity of sizing them.

Reasons for Departing From Accepted Practice

Let us now see what authority and precedent we have for making so radical a departure from accepted practice. To do so, let us consider how threads are made, especially by rolling. Generally speaking, thread rolling is circular knurling, knurling being that process whereby the diameter of a part is increased at certain points by a corresponding reduction of diameter at other points, due to pressure alone. It is applicable to both flat and round surfaces, but for the purpose of this article we will consider only round surfaces.

In turning screws and bolts to size the diameter is held, generally speaking, to the pitch diameter. The displacement of metal from the root and lower flank forms the addendum under the process. Cutting a thread on a bolt with a die is a somewhat analogous operation, the similarity increasing as the die becomes duller. For a die-cut 1 in. bolt it will generally be found that with a diameter of 0.990 in. a fuller thread may be secured than with one of 1.000 in., the explanation being that with the die we secure a combined cutting and rolling operation. Due to lack of clearance, if the diameter is too large, part of the metal is pressed into the bottom of the die and with such force that it drags and is torn off, thus leaving a thread of smaller outside diameter than would have been otherwise secured. This same phenomenon occurs when a nut is too tight.

If we require a holding fit on a shaft, do we use tolerances that allow of the shaft being several thousandths smaller than the hole it is to fit? Quite the contrary. We not only specify the fit but also the minimum pressure allowable to assemble the two parts, and we do this both for single units and for quantity production. We might term a shaft and rotor spider a nut and bolt with microscopic threads and assembled with a right-angled instead of a helical motion. Why not fit our bolts the same way, making our tolerances plus instead of minus and using force fit we can depend upon when it means no change in the tools necessary for assembly?

If we look at a finished commercial thread through a microscope, it will be seen that the edge is serrated and that slivers stand up all over its surface. By running a nut over it once we but slightly change its appearance, but by repeatedly doing so—always using a tight nut—we may finally burnish the thread so that it will not thereafter change its size and will have a surface somewhat comparable to a case-hardened one.

The writer has stated that the different-angle thread was practically independent of tolerance. This is self-evident on the finishing operation. Let us now see how true it is as regards the roughing operation. Excluding the ideal condition, there are six variables that may be met with, and these are caused by large and small angle on both male and female. A diagrammatic sketch will show that of six possible variations due to angle alone, the different-angle thread is usable on four, and the U. S. thread only two. Any multiplication of these errors of angle by maximum or minimum tolerance would obviously still further favor the different-angle thread.

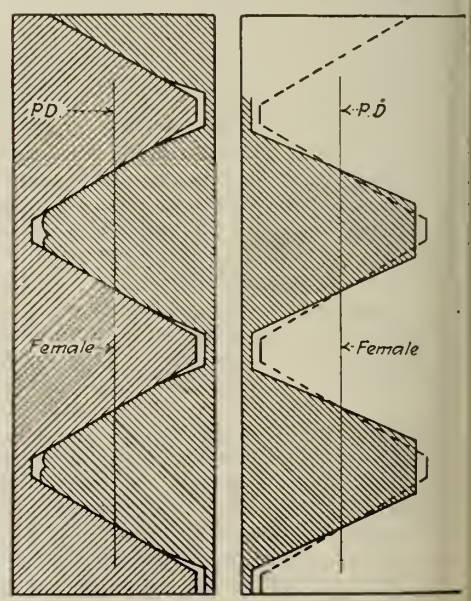


FIG. 5—DIFFERENT ANGLE THREADS, GREATLY EXAGGERATED.

Fig. 5 shows diagrammatically the different-angle thread with the angles of the male greatly exaggerated to demonstrate the principle. We are complying in this case with all the conditions we have just been discussing: we are making the lesser contain the greater, angularly speaking; we are applying force from both directions, at right angles to the axis of the bolt; we have made the angles complementary—not merely two equal angles; we are securing the maximum strength at and near the pitch line, and transforming a thread with a lesser angle than that of the standard made to one with a larger angle, thus filling out the space perfectly and so doing away largely with vibration; and we are securing, whether under pressure or not, contact on all flanks, whereas the standard thread when under pressure secures contact on possibly one-half the flanks, both because it is compressible and because it does not fill the female thread. The only problem to be solved, therefore, was to find an angle of such slope that it could be formed without distortion of the nut or requiring too much force to screw home. To demonstrate this, threads as small as No. 10-32 were used, and as being of possible interest, the writer presents a brief outline of the engineers' report of the experimental work.

Results of Experimental Work

Diagrams of the different threads were fisrt laid out on a 100 to 1 scale so as to determine approximately the most suitable angles to be tested; the Lowenherz thread with an angle of 53 deg. 8 min. being used as a basis. The nut was to have the regular Lowenherz thread with same diameter and pitch as in the 155-mm. shell adapter used by the U. S. Government.

Threads of 44 deg. and 45 deg. for the plugs seemed most favorable and accordingly the following cold-rolled steel plugs were made up, with nuts having the same pitch diameter and lead as the plugs but a thread angle of 53 deg. 8. min.:

1 Angle of thread 44 deg. 54 min., pitch diam. 0.8748, lead 0.0787.

2 Angle of thread 45 deg. 2 min., pitch diam. 0,8748, lead 0.0787.

3 Angle of thread 44 deg. 0 min., pitch diam 0.8748, lead 0.0787.

Test No. 1. Nut No. 1 and plug with thread angle of 44 deg. 54 min. were screwed together without a lubricant. They were started about a half a thread by hand, and then an 8-in. wrench was used for about four threads. The plug was then in so tight that a 10-in. wrench was required to turn it to full depth. After a couple of backward turns the plug stuck so tight that a 20in. wrench would not move it. The nut was then sawed open and removed from the plug and about one-third of a thread of the plug was taken off in a piece of the nut. A magnifying glass showed that the threads in both plug and nut were drawn and cut out of shape where there was a tendency for them to overlap, due apparently to too much metal and no lubricant.

Test No. 2. Nut No. 2 and plug with thread angle of 45 deg. 2 min. were screwed together with a lubricant. They were started by hand for about one-half turn, the an 8-in. wrench was used for five or six threads, and a 10-in. wrench for the remainder. The plug came out slightly easier than going in. After this had been repeated three times the plug could be screwed in by hand. The maximum and minimum plug gage for the nut showed no change in the thread of the nut. Under a magnifying glass it was seen that the metal had flowed to the top of the plug thread from about the pitch diameter outward. The plugs were screwed into the nuts fifty times and there was still what could be termed a "snug fit."

Test No. 7. Plugs were tried out with commercial 1-in. nuts. The thread angle of the plugs was 58 deg., and the pitch diameter 0.9228 in., with one plug this diameter plus 0.001 in., and one minus 0.001 in. This diameter allowed the plug thread in the layout to overlap the entire thread of the nut instead of only half, as in the previous cases. The nuts used were picked out of stock for size with a standard 1-in. thread gage. The smallest plug went into the nut easily by hand. The largest two went together easily with an 8-in. wrench. After being twice screwed together with the wrench, they went together with a snug fit by hand. The magnifying glass showed that the thread from near the pitch diameter outward had been drawn and compressed slightly.

Test No. 9. Plugs of ½-in. diameter with pitch diameters of 0.4684 in. and 0.4699 in. (same as ½-in. S. A. E. nuts) and a thread angle of 50 deg. were tried with commercial ½-in. S. A. E. nuts. The difference in the two pitch diameters made practically no difference in the fits, as they both readily went in with an 8-in. wrench. After they had been screwed together four times, they would go together by hand, but without shake. After they had been screwed together 75 times there was still what could be termed a "snug fit."

Test No. 10. An attempt was made to compare the strength of an S. A. E. standard ½-in. thread with a 50-deg. thread of the same size. The plug with the standard thread on one end and the special thread on the other end was used with standard nuts. A pull of 14,000 lb. was gradually applied and the metal began to give way, which prevented an additional load. During this pull observations were made to determine if there was any "give" in either of the threads, but both remained the same throughout. The nuts were removed and there was no apparent distortion of the threads.

Test No. 12. In this test ¼-20 plugs with pitch diameters of 0.2165 in. and 0.2181 in. with 50-deg. angle were tried out with ¼-in. U. S. standard nuts, one being a commercial nut and the other of a standard size but made in our toolroom—the tap being 0.250 in. in diameter. Both nuts were tried with a ¼-in. standard plug gage, both being apparently the same size. The nut made in the toolroom was screwed on the maximum plug and went on about one and a half times its length and then stuck and would not go either way. It was finally removed by hammering it on the sides. The threads were rolled and torn from about the pitch diameter outward, but there was not that tendency for the metal to roll upon the outside of the thread as in the previous tests, the outside diameter being only 0.251 in. as against its original 0.250 in.

The commercial nut went on the minimum plug with an extremely tight fit, but it came off very readily with the wrench and left quite a different thread from the previous one. The thread was not torn at all but rolled out ot almost a perfect V-thread with outside diameters of 0.2555 in. as against the original 0.250 in. The outside diameter of the tap for the commercial nut must have been over 0.250 in. to allow this metal to flow out to 0.2555 in. and not jam the nut. If the toolroom tap had been sharper on the flats or its outside diameter greater, there would have been room for the metal in the test plug to flow out to a larger diameter and avoid tearing the thread, and consequent jamming of the nut. Two facts are clearly demonstrated: first, necessity of room for metal to flow; second, one of the limitations of the thread gage.

Test No. 13. Plugs corresponding to standard 10-32 with 50-deg. angle were tried out with standard 10-32 nuts; pitch diameters 0.170 in. and 0.1716 in. They were a trifle too tight a fit to go together by hand, but after being screwed together once with a wrench they went together by hand snugly.

Conclusions

In conclusion it may be stated that the tests would seem to indicate the following:

(a) The cause of stripped threads is lack of room into which the metal can flow.

(b) The pitch diameter should be the same in both threads.

(c) The lead should be the same.

(d) The thread angles should differ by not more than 10 deg.

(e) The limits for the inside diameter of nut need not be adhered to closely, as the inner part of the nut thread exerts very little, if any, holding power.

(f) The outside diameter of plug and pitch diameter of both plug and nut are important and should be adhered to fairly closely.

Molybdenum Steel.—Production rights for the new Arnold high-speed steel method have been acquired by J. D. Moffat, a director of the Sir Thomas Salter Pyne Company, of Sheffield. The company in question is making preparations for placing the new steel on the market at a lower price than tungsten steel.

John Conley Decides to Become a Machinist

When You Are Sweet Sixteen Anything is Liable to Happen—This Story, which Will be Followed by Later Incidents, Tells the Tale of an Apprentice and His Experiences.

By J. DAVIES

ROBERT CONLEY, superintendent of a large manufacturing concern known as the Queen City Engine Works, was sitting on his verandah one summer evening, when his son, John Conley, age 16, came bounding up the verandah steps three at a time. "Well, dad," he said, "I have done it." "Done what." "Why, got a job at the engine works. I am going to start as an apprentice in the machine shop next Monday morning under old Bill Smith."

"Excuse me," remarked Conley senior, "but I don't know any old Bill Smith machine shop foreman; possibly you mean Mr. Smith." "Oh, well," said the younger, "you know who I mean, it's all the same." "Alright, if it is all the same; in future always refer to him as Mr. Smith. Do not get too familiar with him because you are the son of the superintendent. Did you tell him that you were the son of the superintendent?" "Why sure, that is how I landed the job." "That is mistake number two. If I know anything about Mr. Smith the fact of you being my son didn't help you a particle, in fact it was an hindrance to you, it shows that you were not entirely depending on your own merits, and believe me, son, how you get on with your foreman depends entirely on yourself. Remember this, however, I shall be very glad to give you the benefit of my experience and to listen to your experiences.

"The first advice I would offer to you is to join some evening technical class, where you can acquire a knowledge of machine drawing and construction and workshop mathematics. Although it will be some time before you are called upon to work from a blue print, it is a good plan to begin to learn reading drawings as soon as you enter the shop. Then, when the time comes that you are expected to work from a blue print, you will not have to be continually chasing the foreman around to know what every little thing means. If you think you are a smart boy, don't let the men know that you think so. A certain amount of confidence in your own ability is necessary for your success, but don't let that confidence grow into conceit. You may expect to be fooled a few times by being sent after the left-hand monkey wrench, or some other tool that only exists in the imagination of the man who sent you after it. When you find that you have been the victim of a practical joke, don't get angry. Anger does not improve anything except the arch of a cat's back; take it as a part of your workshop education and you will soon make friends.

"Study in order to become familiar with all ordinary shop tools and their uses. Plan to get some tools of your own as soon as possible, for the youth that is always running around borrowing, and perhaps returning tools, soon gets in disfavor with both men and masters. You do not need an elaborate kit to begin with—a hand hammer, a combination set, comprising square, bevel scale, with square ends graduated on 4 edges; a 6-in. flexible rule, and a pair of inside and outside calipers.

"Combination tools are more likely to be inaccurate than tools made for a single purpose. When buying a combination set, have them tested in the workshop, and if you find them inaccurate to any appreciable degree, the makers will gladly exchange them and thank you for calling their attention to the fact. It is not often that you will have any room for complaint if you buy your tools from some well-known maker, but it gives you more confidence in your work if you know that your tools are correct.

"You will always need a machinist's tool chest, as machinist's tools ought to be handled carefully and not thrown indiscriminately on the top of each other, as is sometimes the case." "Couldn't I make my own tool chest?" "I suppose you could, after a fashion, but it would never give you any lasting satisfaction, and in the end would cost you more than you can buy one for, made especially to suit your purpose.

"Do not take your tool chest into work the first day, get acquainted with the men and the use of the tools, and as soon as you have any use for your tools, then take them in. I remember a young man starting in the shop when I was working at the bench, who came in the first day with a fancy mahogany tool chest, with plush linings, a mirror inside the lid and a very expensive equipment of tools. He didn't know even the name of some of them. Before the week was out the men had borrowed all his tools and invented new uses and new names for some of them, and it was weeks before he really knew the names of his own tools and what they really were intended for. So you see you can go to extremes either way, use your own judgment, be willing to lend, be slow to borrow.

"I guess that is your mother calling us for supper. Be sure and let me know from time to time how you get along."

In this manner Conley, Junior, got started off in his chosen profession. A few days after, his father enquired how he was getting along.

"Well, the first day I was cleaning up and running errands, and Ernest Jackson, that's the shaper hand, asked me to go to the tool crib and get him a side tool, left-hand. I was a bit suspicious about that side tool, but when he said left hand, that settled it. I told him he couldn't pull none of his left-hand monkey shines off on me. I remembered what you had said about the left-hand monkey wrench, so I told him to go and get it himself." "What did he say?" "He said, I suppose you think yourself a wise guy. I said I was too wise to be taken in by any left-hand stunt like that. He told the fellow running the lathe next the shaper and they both had a good laugh, but I didn't see the joke."

"The joke was on you, son. Don't imagine that there are no legitimate left-hand tools. There are left-hand dies, taps, side-cutting tools for lathe, planer and shaper, cutting-off tools, knife tools, threading tools, hobs used on milling machine and gear cutters for making worm wheels. Remember that a left-hand side-tool or knife is bent toward the right and is called left-hand, because it is used for cutting the left-hand side of the work or job that is in hand.

"To distinguish a left-hand tap or thread, take a pencil point, a nail, a piece of wire, or anything that is handy; place the point in the thread somewhere about the centre and move it around the thread clockwise—if your hand travels toward the top, it is right-hand; if towards the bottom, it is left-hand. Make a sketch of a left and right-hand thread and fix it definitely on your memory. If the thread inclines upward from left to right, it is right-hand; if it inclines downward from left to right, it is left-hand. A little study of this will fix it definitely on your memory and you will find it a very useful thing to be able to distinguish right from left at a glance.

"The only exception to this rule is a sectional elevation of a nut or internal thread, such as a thread inside a hand wheel. When an internal thread is shown in section it reverses the angle, because you are looking at the opposite side of the thread to what you are in elevation or outside view.

"Do you understand that son?" "Yes, I think I do, but I will try a little experiment at the shop, attempting to pick out right and left-hand threads for myself, then I'll let you know later how I get along."

The Vanadium Alloys Steel Co., P. O. Box 1250, Pittsburgh, Pa., have issued a very attractive booklet descriptive of Vasco Vanadium Tool Steel. This booklet contains much information of value, also some suggestions concerning heat treatment, etc. Copies may be had upon request."

Construction and Calculation of Gauges

Position Gauges, or in Fact Gauges of Any Description, Require Considerable Degree of Skill in Their Making—This Article, which Appeared in "Engineering," Discusses the Subject Admirably.

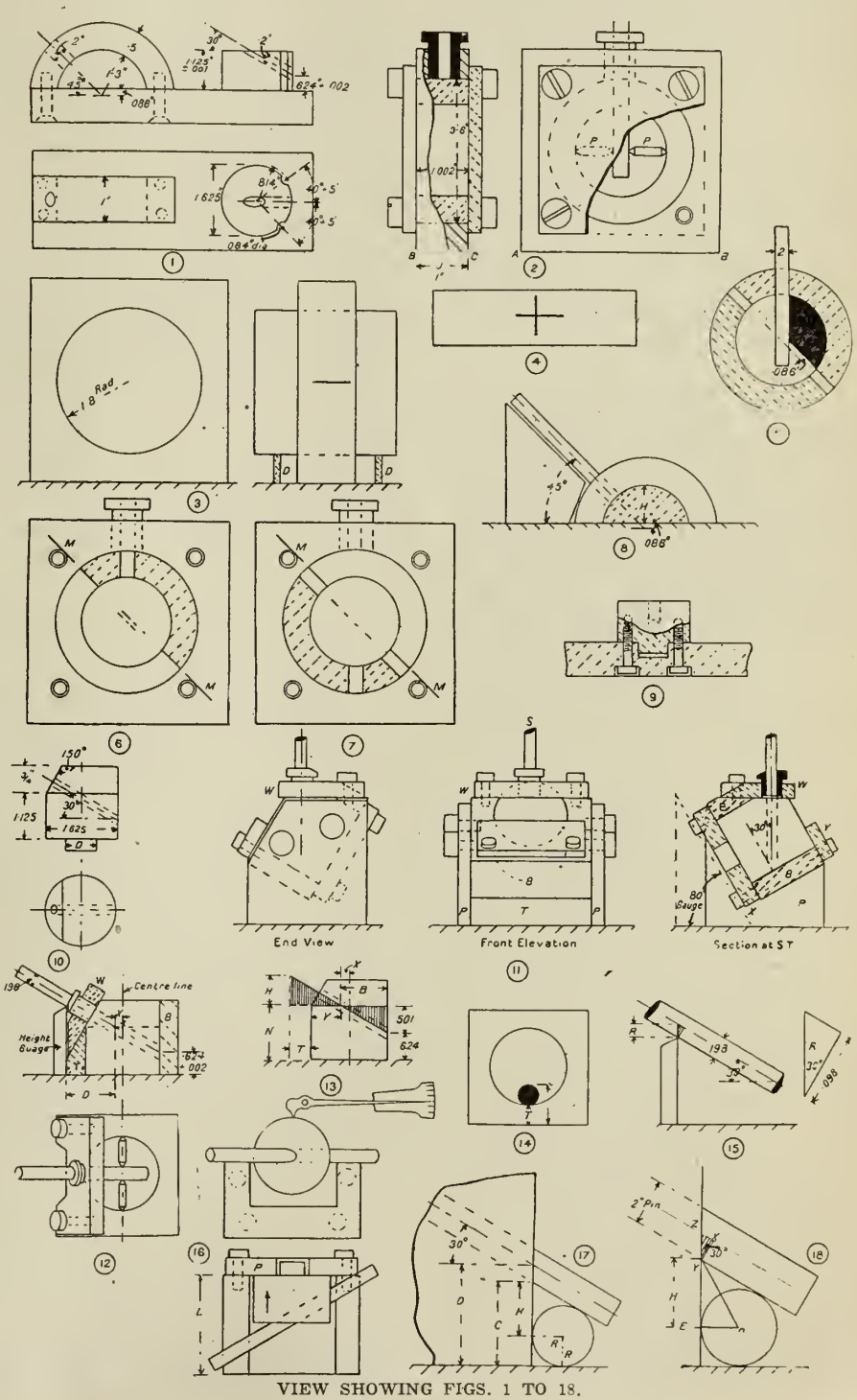
By ARTHUR G. ROBSON

THE production of position gauges usually requires a considerable degree of skill, and the best class of workmanship. Not only is skill necessary to secure a definite measurement, but in obtaining the correct positions of several details, in which the tolerances may be as small as .0003 in., and perhaps not larger than .002 in. It is not always possible to secure a size such that it is the mean of the high and lower limits. Nevertheless, nothing perhaps is more important in precision work than taking advantage of the tolerance. Pins that are called "low" sizes should be made nearly to the "low" limit, whilst holes that are "high" sizes should be about .0002 in. less than the "high" limit. These tolerances give the worker a little "radius" or "freedom" in his manipulative work, and it is to his advantage always to know the tolerances upon work of such an exacting nature.

In Fig. 1 an example of a position gauge is shown. It consists of a circular boss and a curved portion nearly semi-circular mounted on a base. It is evident that although we are left without instructions to the methods of attaching these parts or other means of manufacture, advantage is gained by making them separate and permanently securing them to the base. There will thus be a saving in material and the work will also be less costly.

The boss has a .2 in. hole inclined at 30 deg. to the horizontal, which passes through the boss, intersecting the surface at a height of .624 in. + .002 in. from the base. In the plan, this hole is shown on the horizontal centre line. The only tolerance in this respect is .0003 in., implying that the .2 in. hole must not be more than .0003 in. to one side or the other of the centre line. As a matter of fact, it is here extremely advisable to make the hole central within .0001 in. It is at once evident that any tolerance allowed on the positions of the half holes at the edge of the boss—where 5 min. are allowed on each 40 deg.—is at once reduced if we are compelled to measure from an axis which is not coincident with the geometric axis of the boss. The radial distance of the .084 in. holes is .814 in.—that is, .0015 in. larger than the radius of the boss. In the case of the ring portion of 1.3 in. radius, the centre is .086 in. below the face, and the .2 in. is radial and inclined at 45 deg. The relative positions of the boss and part ring do not matter.

The making of the ring will be dealt with first. A rectangular jig block, marked J in Fig. 2, is required. This block should be of tough steel to withstand usage without becoming indented. It should be ground to 1 in. thick as shown, and the bore must suit the external diameter of the rings, viz., 2 (1.8) = 3.6 in. A short mandril should be made to fit the jig block, to act as a check for grinding the 3.6 in. hole, and as a means of securing the edge or base A B × B C, Figs. 2 and 3, parallel with the axis. Since the top face is fitted with a hardened steel thimble for drilling, it is necessary to have both the base and the axis of the bush or thimble true, otherwise the .2 in. hole in Fig. 1 will not be parallel with the width of the ring. In Fig. 3 the block is arranged as shown until the distances D are



VIEW SHOWING FIGS. 1 TO 18.

equal. The radius of the hole plus the distance D is the height of the axis from the face B C. The scribing block is then set with the aid of a magnifying glass to the height of the axis, and the line is marked as shown. By turning the block over, as in Fig. 4, and striking another centre line, the intersection will give the centre of the hole for the thimble.

The hole in the bush is made .004 in. smaller than .2 in. to give an allowance for finally determining the size and central position of the .2 in. hole. The hole in the bush is central with the ring when the distance piece P—Fig. 2—just fits each side of a pin passed through the bush. By making the ring 1.002 in. thick as compared with 1 in. for the block—Fig. 2—the ring can be securely held in the block by the two plates shown. As shown in Fig. 5, two portions can be made from one ring. In Fig. 6 a ring is shown in the block with the cover plate removed. By making two marks M on the block, corresponding marks may be made opposite M on the ring when one hole is drilled, and by twisting the ring round until the marks on the ring become parallel with M—as in Fig. 7—the second hole in the ring can be drilled. In executing a large order this arrangement is a time-saving one.

To secure the distance .086 in. in Fig. 8, a segment must be made from a ground plug to the height H. This height is equal to 1.3 — .086 = 1.214 in. If the faces of the cut ring are made level and parallel with the face of the segment, the centre will be .086 in. below the face of the ring. At the same time the faces must be adjusted so that the pin is inclined at 45 deg., as shown in Fig. 8. By making a segment, and then cutting a face at 135 deg., so as just to touch the pin as in Fig. 5, the work will be adjusted better and the desired results more easily obtained. Finally, the securing of the segmental ring to the base is attended to.

The making of the boss will now be dealt with. It is proposed to secure the boss to the base as in Fig. 9 by means of a spigot fitting in a recess and two cheese-headed screws holding the boss down. The finished sizes of the boss are indicated in Fig. 10, as it comes from the grinding machine. The pip D is used to secure the boss in the grinding machine chuck, whilst the boss is made about ¾ in. longer than the finished size to enable a flat surface to be made on it, so that the drill for the inclined hole will have a normal surface to drill on. A portion of the boss is therefore cut to 150 deg. with the end face, until there is left a length of 1.125 in. on one side of the boss. The jig for drilling the inclined hole is shown in Fig. 11. The rectangular block B, in which the boss fits, is held at 60 deg. by means of two side plates P. The bottom plate X merely rests on the base of the block B, but is ground parallel in thickness. The block also has its lower face at right angles to the axis of the hole in which the boss fits. If the bottom plate be set to 60 deg. by a plate gauge applied to it, as shown by the dotted lines, the direction of the hole is obtained. The plate Y is for applying a slight end pressure to the boss. Finally, a plate W fits on the oblique face of the block B. If the mandril is applied in the bush as shown, it should be true by a try square. It is very important that the mandril should be square, for a small amount out of the vertical means a considerably increased amount by the time the hole cuts through to the opposite side of the boss. It is therefore necessary to secure absolute squareness before this stage is left.

As the hole is .2 in., the bush should be .196 in. in diameter of its hole. The .004 in. allowance permits of a little adjustment. It should be observed that there are four conditions that must be fulfilled with respect to this .2 in. hole. There is its size, its inclination of 30 deg., the height of the exit .624 in., and its central position in the boss. As regards the bush being central with the boss, this may be secured as shown in Fig. 12 by use of a pin gauge applied to each side of a rod in the bush.

We have now to find where the plate W in Fig. 12 must be secured so as to guarantee that the height of the exit will be within a few thousandths of an inch of .624 in. If the distance X be found—that is, the position the hole cuts the face of the boss off the centre line—then we can find how high the height gauge must be when at a distance D from the axis of the hole in the face of the boss. Looking at the shaded triangle in Fig. 13, we have:

B = .501/tan 30 deg. = .501/.5774 = .869 in.

Hence:

X = .8694 — 1.625/2 = .0569 in. and Y = 1.625 — .8694 = .7556 in.

The thickness T may be found—as in Fig. 14—by taking the distance from the outside of the block to the surface of a lapped pin, and by deducting the diameter of the pin. If T is found to measure .7325 in., then Y + T = 1.5881 in., and the height H is 1.5881 tan 30 deg. = 1.5881 × .5774 = .9169. Therefore H + N or .9169 + 1.125 (= 2.0419 in.) is the height of the axis of the inclined hole at the distance D in Fig. 12. As the height gauge measures from the under side of the pin in Fig. 15, it will measure 2.0419 less the distance R. This distance R is equal to .098/cos 30 deg., that is R = .1131 in. Therefore the height gauge will measure 2.0419 — .1131 = 1.9288 in. If the gauge just touches the pin in Fig. 12 when the pin is inclined at 30 deg., the height of exit of the pin will be correct.

Appliances will be required for testing the central position of the hole in the boss and the height of its exit. For the central position test a channel-shaped piece of steel of length L—Fig. 16—is provided with a back plate P screwed on to it. The boss is held in the direction of the arrow whilst a pin is inserted in the hole and rested upon the upper faces of the channel pieces, the top and bottom faces of which are ground parallel and at right angles to the face against which the plate P is screwed. By using a surface gauge or universal test indicator capable of reading to thousandths of an inch, the upper surface of the boss is tested, and by turning this surface to the underside any difference in the readings of the gauge will clearly show in which direction the hole has to be "thrown over" by rimering. As a hole is drilled .196 in. diameter the allowance of .004 in. can be utilized to correct its position.

It is evident, however, that the height of the exit of the hole must be tested in conjunction with its central position, and the angle of 30 deg. must also be tried. We therefore require five sets of rimers and pins—a pin and a rimer constituting a set—differing by .001 in. When the hole is drilled the .196 in. rimer is used to clean the hole and then its corresponding pin is tried. Any alteration in the angle, central position, or height of exit is now made whilst the hole is enlarged by .001 in., viz., to .197 in. The success of this operation will depend largely upon the accuracy of the details in the jig, Fig. 11. Even assuming that we have been very exacting in our work, it will be found a little tedious and laborious finally and truly to determine the size and positions of this 2 in. hole.

The next subject to engage our attention is how to test the height of the exit (.624 + .002 in.). In Fig. 17 a pin is shown in the .2 in. hole with a roller just passing under it. This roller is a measure of the height in question. We therefore require to know the size of the roller when the exit is at .624 in., and that of another roller when the exit is on the upper limit .626. If the smaller roller goes under, but the larger one refuses to pass, the height of the exit will be between the prescribed limits. Referring to the triangle X Y Z in Fig. 18, we have

X Y = .1/cos 30 deg. = .1/.866 = .1154.

∴ height C (Fig. 17) = D — Y Z = .624 — .1154 = .5086 in.

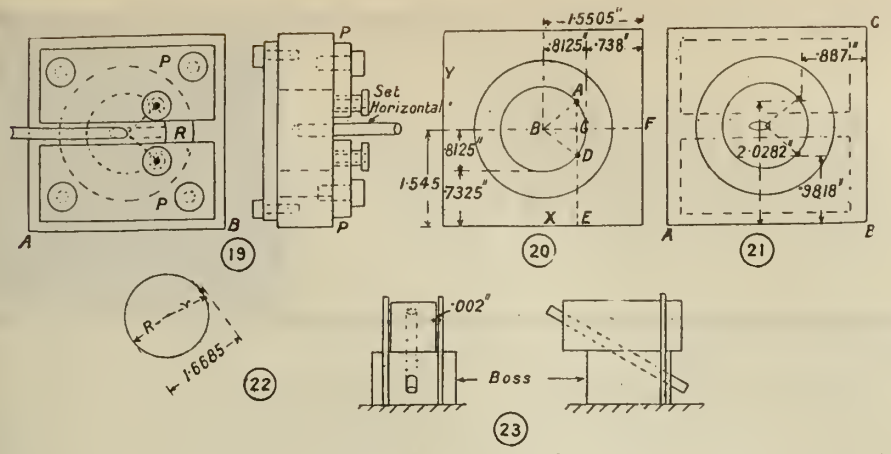
∴ H = .5086 — R (where R = radius of roller).

Now angle D Y E (Fig. 18) = 30 deg. Therefore D Y = E D/sin 30 deg. = R/½ = 2 R.

Further, H = D Y cos 30 deg. = .866 × 2 R. Hence .5086 — R = .866 × 2 R. ∴ R = .18616 in. So that the diameter of roller .18616 × 2 for the low limit is .3723 in. For the high limit roller, C = .626 — .1154 = .5106 in. ∴ .5106 — R = .866 × 2 R, or R = .18653. The diameter of the roller for the high limit is thus .373 in.

These rollers should be hardened and ground and have square ends. Although there is only .0007 in. difference between their sizes, it is possible to have the low limit one quite free when the height is near the upper limit.

We have now to consider the partial round holes down the side of the boss. It is necessary to fit a ring over the boss so as to permit the drilling of these



JIGS FOR MAKING POSITION GAUGES.

holes. The jig block B—Fig. 11—could be used for this purpose if originally the hole is made larger than the boss to permit of a ring being inserted. If this method is resorted to there will be a saving of work and material by using one block, but the advantage of having two blocks is that the drilling shown in Fig. 11 and that of the half holes can be proceeded with at the same time by two workers. In Fig. 19 a block is shown with the boss in a ring R. Two plates P are bolted to the vertical face as shown with thimbles fitted for drilling the .084 in. holes. The positions of these holes are shown in the plan Fig. 1, and we must so fix the plates P as to secure these positions. We may drill the holes .08 in. in diameter so as to allow .004 in. for locating finally their positions and squareness. In Fig. 19 the pin in the .2 in. inclined hole must be set horizontal and a good fit in its hole. The faces A B and B C must be at right angles and parallel with the axis of the hole in the block. The true positions of the plates P, with their thimbles, are then determined by obtaining the heights from the faces A B and B C—that is, by knowing their co-ordinate from the axes X and Y in Figs. 20 and 21. The distances .7325 and .738 in. are obtained as shown in Fig. 14, and by adding the radius of the boss to these measurements the heights of the centre lines are obtained as shown from the faces A B and B C.

Now A C = .814 sin 40 deg. = .814 × .6428 = .5232 in. Hence A D = .5232 × 2 = 1.0464 in. This is the distance between the centres of the holes. Also B C = .814 cos 40 deg. = .814 × .766 = .6235 in.

Hence D E = C E — C D = 1.545 — .5232 = 1.0218 in.; A E = C E + C A = 1.545 + .5232 = 2.0682 in.; and C F. = B F — B C = 1.5505 — .6235 = .927 in. These distances are measured from the centres of the holes. As the holes in the thimbles are .08 in., we place a .08 pin in them and, measuring from the underside of this size pin, the foregoing distances will be reduced by .04 in., as shown in Fig. 21. Distance pieces must now be made so as to be able to set the plates P correctly.

By very careful working the holes can be so located that the .004 in. allowed on the drilled size is ample for finally determining their positions. It is advisable to make the ring R of the same material as the boss. Various hardnesses of material and the use of slightly too coarse a feed with a drill, the cutting edges of which may be slightly dulled, have to be guarded against. Great care is necessary in drilling the two part holes, for time has already been spent upon the .2 in. holes, and if the small part holes are inaccurately placed then the boss with all the labor employed upon it is wasted. The radial distance .814 in. of the part holes can be tested as shown in Fig. 22, by applying a micrometer across the boss and a pin placed in the hole. The micrometer should read .814 + .8125 + .042 = 1.6685 in., as shown. To test the angles of 40 deg. + 5 min. between the holes and the centre line we may use a rectangular piece of steel passing over the .2 in. pin and resting on the face of the boss as shown in Fig. 23. This piece must be made correct for squareness and the two vertical faces must be symmetrical about the hole. Now A C in Fig. 20 was found to be .5232 in. If A C is found when the angle is 40 deg. + 5 min. we shall know the latitude allowed in thousandths of an inch. Suppose also that the radius .814 can be worked to .814 + .001. For the upper limit A C = .8141 sin 40 deg. + 5 min. = .8141 × .6441. ∴ A C = .5244 in. The tolerance on each side is thus .5244 — .5232 = .0012 in.

If the block is made .002 in. less than the inside measurement of the pins on each side as shown in Fig. 23 when the angle is 40 deg., then for the upper limit of 40 deg. + 5 min. the space on each side is .002 + 0012 = .0032 in. Therefore in Fig. 23, if the two-thousandth feeler goes in easily in the space shown, while the three-thousandth feeler just refuses to go, then the holes will be situated between 40 deg. and 40 deg. + 5 min.

CUTTING POWER OF LATHE TOOLS

At a recent meeting of the British Institute of Mechanical Engineers the above subject was discussed. In the course of this discussion G. W. Burley, who is quite an authority on the subject, stated there is no practical cutting speed below which it is impossible to obtain a satisfactory surface on plain carbon steels by means of ordinary lathe finishing tools, whether these be made of plain carbon tool steel, ordinary (non-vanadium) high-speed steel, or superior (vanadium) high-speed steel. There is, however, a maximum limiting speed at above which a satisfactory finish cannot be obtained on account of the tendency of the tool to pluck at and tear the surface, this tendency being related to the phenomenon of building up on the cutting edge of the tool. For the finishing of mild steel this limit is not very different for each of the above three varieties of tool steel and is within the range of 48 feet to 58 feet per minute. For the finishing of hard steel this limit does depend somewhat on the variety of tool steel which is employed and is within the ranges of 23 feet to 28 feet, 17 feet to 21 feet, and 28 feet to 34 feet per minute for the three varieties of tool steel respectively.

(2) The durability or life of a lathe finishing tool, whether of plain carbon or high-speed steel, is for all cutting speeds below the limiting speed some function of the reciprocal of the cutting speed; in other words, an increase in the cutting speed below the limiting value is always accompanied by a decrease in the life or durability of the tool.

(3) The most suitable angle of side rake (that is, the angle of side rake associated with maximum durability and cutting power) for a high-speed lathe roughing tool working on steel depends upon the physical properties of the steel. For mild steel turning it lies between 20 deg. and 25 deg., whilst for hard steel turning it is of the order of 10 deg., and if these angles are either increased or reduced there is always a depreciation of cutting power.

(4) The color of the turnings formed by high-speed lathe roughing tool when working on steel is not necessarily a true index of the condition of maximum cutting efficiency. Thus in the case of hard steel turning the turning color, which is associated with maximum cutting efficiency is a pale blue, whilst a mild steel turning which is removed under the conditions of maximum efficiency is practically uncolored, apart, of course, from the natural grey color of the steel.

(5) The net power consumption of a high-speed roughing tool is dependent, other conditions being constant, upon the amount of top rake on the tool, the relation between these two quantities being reciprocal in character, so that, within the limits of ordinary practice, a reduction in the top rake angles of a tool is always accompanied by an increase in the net amount of power consumed. The law connecting the variations of the two quantities appears to be that of the nature of a straight line law for all qualities of steel machined. There are therefore no critical values of the rake angles in regard to power consumption as there are in regard to durability and cutting power.

WELDING AND CUTTING

Lessons on the A.B.C. of Good Welding

Various Types of Welds Are Discussed in This, the Sixth Chapter

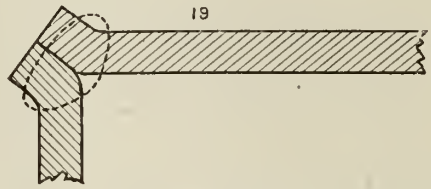
By W. B. PERDUE *

WELDS in mild and steel, which apparently can be executed without special effort or ability, require conscientious effort and painstaking care. It is not difficult to produce a weld of good appearance and with a smooth even surface on the side from which welded. To produce a weld that is strong and will stand up under service is another thing entirely. Automobile frame and crankshaft repairs demand the utmost strength, equal to that of the original metal, because a break in the weld at an inopportune time might be of serious consequence.

Some welders, realizing that they have not secured penetration will smooth over the opposite side of the weld with the torch in an effort to eliminate the telltale edges of the bevel which shows that proper penetration has not been secured, and that the metal has been welded only part way through. The fact that any weld in ordinary steel plate shows the mark of the torch on both sides may, therefore, be taken as conclusive evidence that the welder was willing to admit his own lack of skill.

The increasing application of the acetylene process to manufacture; its marked superiority in all cases where extreme strength is essential; and the demand for operators sufficiently well qualified to produce welds with mechanical properties equal to or identical with the parts welded should awaken a greater interest on the part of those who are now, in some measure, familiar with the process, but who have not yet taken the trouble to grope beyond its elementary applications.

For the information of the reader, let the statement be made that all these matters can be adequately and fully described in simple language that all can understand, so that with the aid of a pocket dictionary, to explain certain terms applied to metals, which with the layman may be at first unfamiliar, no additional treatises are necessary.



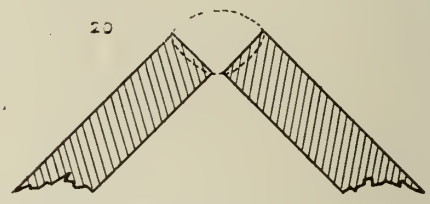


FIG. 19—FLANGED CORNER WELD. FIG. 20—CORNER WELD MADE BY ADDITION OF WELDING ROD.

Careful reading of trade journals, such as apply to his own particular line of industry is of course necessary, and beneficial, since these contain current information for the progressive mechanic not to be found or obtained elsewhere.

Potentialities of the Process

One of the first things to be mastered by the welder is the proper control of the effects of the terrific heat of the welding flame—the hottest flame known to science. When one ponders the fact that metals may be annealed, or made softer; tempered, or made harder; that the grain may be drawn, or made finer; crystallized, or made larger; that the carbon content of the steel may be either increased or diminished, he will realize that he is dealing with potentialities far greater than he at first imagined.

The laws of the process operate whether the person using them is or is not aware of their existence. It is amusing to hear the untrained welder blaming the flux for the fact that he has a weld that is too soft or too hard—generally too hard—the flux intended only as a cleansing agent. Many times the whole blame for a hard weld can be attributed to the fact that the flux was not removed while still warm, if allowed to harden on the surface it—the flux—will be extremely hard and glassy.

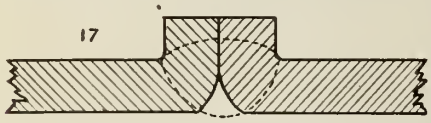
Melted Steel

There are perhaps many welders who do not know that melted steel is capable of dissolving 1 and 1-9 per cent. of its volume of oxide or slag in the same form as an alloy in the metal. This happens in every weld made by any process and the only method yet discovered for its elimination is that of the manipulated acetylene ripple weld described in a previous chapter.

There is, of course, no dissolved slag in a forge weld as made by the old-fashioned blacksmith, but the amount of surface slag is considerably more than the small percentage above mentioned. It is also possible to incorporate surface slag in welds made by the electric or acetylene processes, but any good acetylene welder can eliminate practically all slag of any nature whatever.

Manipulation of the metal, to refine the grain and eliminate impurities from the weld, is far more difficult to realize with the electric process, while in addition the oxygen of the air is at all times in direct contact with the heated and molten metal; there being no flame to protect the surface and consume the surrounding oxygen.

As an experienced operator, myself able to use both processes, I feel that I am fully qualified to draw comparisons. Only recently I happened to hear a well-known exponent of the electric process severely condemning the acetylene process. Upon inquiry as to whether or not he was an acetylene operator, he said, "No, and I don't want to be. But as an electric welder I can't be beat." Suffice it is to say that he now knows that at least two acetylene operators can



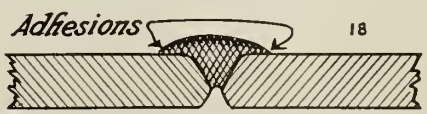


FIG. 17—PREPARATION AND PROPER OUTLINE OF FLANGE WELD. FIG. 18—FLANGE WELD AS COMMONLY EXECUTED.

*Welding Instructor, Heald's Engineering School, San Francisco, Cal.

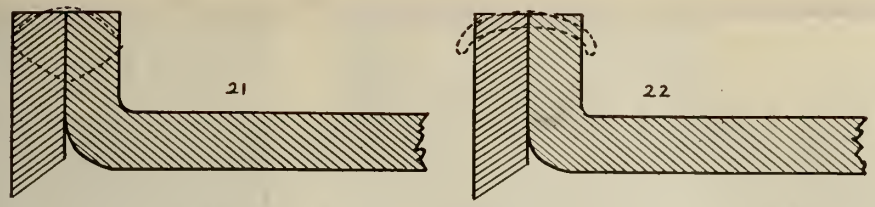


FIG. 21—LIGHT PRESSURE CYLINDER HEAD PROPERLY WELDED. FIG. 22—ORDINARY WELD OF SAME HEAD.

beat him at the electric game, and that he is doing less talking.

Whenever you hear someone loudly condemning either process as "entirely useless" you may take it for granted that he is either ignorant, or that he is trying to get someone to believe something that is not quite true.

In another chapter I have outlined the requirements of a good welding torch. To reduce oxidation to the minimum it is quite important that the gases composing the flame be present in proper proportions and that they be so thoroughly stirred that their contact before reaching the flame is that of molecule to molecule. Thus commingled, and with their flow properly stabilized, complete combustion takes place, the maximum protection is given the weld and the results obtained are dependent entirely upon the ability of the operator.

On heavy work pre-heating should take place both in the path of and behind the welding torch. This tends to eliminate many of the dangers which might otherwise cause change in the characteristic features of the metal within or near the weld; offsets the terrific internal strains which result from too sudden heating and cooling; and results in a saving, since the actual work of welding is accomplished more rapidly and with less gas.

Heat Treatment

The welder, without personal instruction at the hands of an instructor, well qualified to judge the colors of metals, and to pass by observation upon their approximate carbon content, should not undertake too much in the line of tempering and annealing metals.

If he must depend upon his own resources it is best to go slow and err on the side of caution rather than the side of rashness. This is not because of his lack of mental capacity but, rather, because of the fact that the training of the eye to distinguish the colors of metals is a rather slow process.

It may be said here, that many welders make the sad mistake of trying to temper welds without allowing them to first be heated uniformly in a furnace for that purpose. To attempt to restore the temper in a local section of any steel article with the heat of the weld is utter rashness. Steel shafts and other articles may be hammered while still at a bright cherry red, but the first hammering must be light, and all hammering must cease as soon as the bright redness is lost.

The cooling process must be slow—the slower the better—and no quenching with water should be permitted. It is believed that the use of the proper filler and of sufficient time and patience to secure proper penetration and perfect fusion will remedy most of the troubles encountered along such lines. In the illustrations which follow we have endeavored to show the proper and the common ways of executing certain welds. Examine those you are doing, or those that others have done for you. The comparison with the illustrations will be both instructive and refreshing.

Types of Weld

In addition to the Butt weld previously and fully described, we have another and similar weld called a flange weld, which is often used in very light sheet metal work. Its preparation involves some difficulty except where the edges of the sheets are flanged over by some mechanical means already available in the shop. It is seldom used in thicknesses exceeding 1-16-inch and requires the use of no additional filler since the metal fused from the upturned edges acts as a filling agent. By proper manipulation of the torch the edges can be fused down to a small bead practically flush with the surface of the sheet.

In inspecting a weld of this type one notes most carefully adhesions on the upper surface and that good penetration has been obtained on the reverse side.

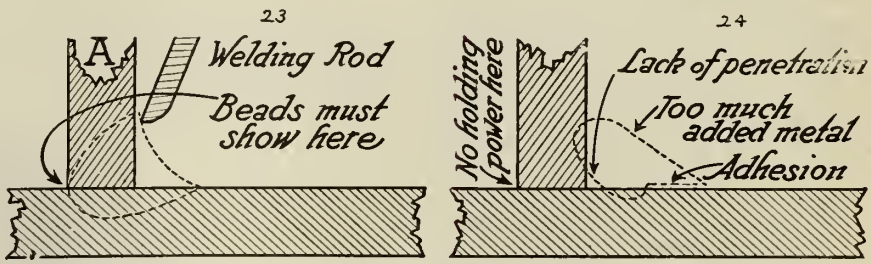


FIG. 23—PROPERLY EXECUTED FILLET WELD. FIG. 24—COMMON TYPE OF FILLET WELD.

The flanged weld is sometimes used as a corner weld by preparation as shown in figure 19, but its use is limited to very thin sheet metal. It is not recommended and preference should be given to the form shown in figure 20, which is made by the addition of welding wire.

In making any form of corner weld, the process of preparation should be given proper consideration. Jigs and clamps must be used to secure proper alignment of the parts, but much valuable time may be saved by securing the proper position of the sheet at some point near the centre, and marking off the locations for tacks, or spot welds, at intervals of from three to five inches in either direction from the centre to the ends.

Having made the tack in the centre, it will often be found that the effect of the heat has been such that one of the locations next thereto on one or the other sides will be in proper position. If so weld it and look at the next mark. This saves a great deal of time over looking around for a new spot to tack, and insures regular spacing of the tacked spots. All tacking should be completed before the actual work of welding is begun.

Welds for cylinder heads as shown page 00) should be bevelled at an angle of about 90 degrees as shown by the bottom of the dotted lines in figure 21. This illustration, however, is intended to show the proper form of weld made without the addition of welding rod by "boring in" with the torch.

When "boring in" the flame is made a little stronger than is ordinarily used for welding and a shorter stroke is given to the torch. At intervals the torch is twisted smartly away to permit the melted metal to fill up the deep holes that are thus dug out, and occasionally to cool the dip, which becomes quite hot from the striking back upon it of much of the heat from the weld. This additional heating of the tip is also augmented by the position—very near the vertical—in which the torch is held to force the heat of the flame directly downward. It takes considerable practice to execute a satisfactory weld of this type.

With a little experience it will be found possible to bevel work of this nature with the cutting torch. The saving in time and gas over the method of boring in with the welding flame will be considerable. In this way it will be found possible to the more readily manipulate the metal in the weld with the result that a finer grain and greater strength is imparted thereto. The danger of oxidizing or burning the metal in or near the weld when boring in is also eliminated.

To determine the efficiency of welds of this type it is a good plan to prepare a few test pieces of ordinary steel plate of similar thickness to the cylinders to be welded. After welding together the upper edges of these plates they may be tested by splitting open the weld by means of a chisel driven in from the opposite side. A weld that is strong enough to break the plate instead of splitting can be produced, but it is not

(Continued on page 67)

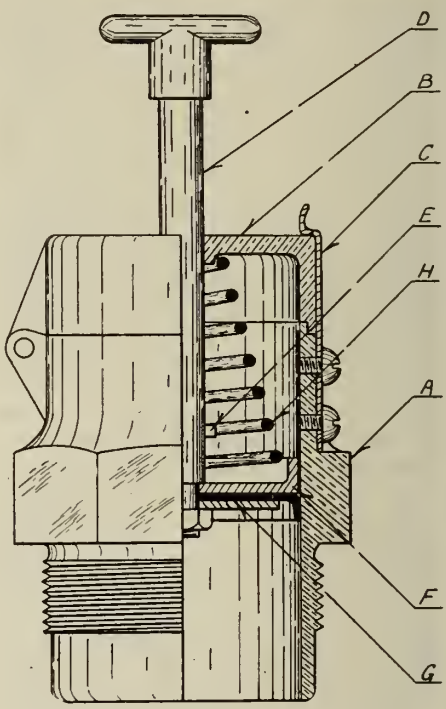
DEVELOPMENTS IN SHOP EQUIPMENT

PULPWOOD RECLAIMER

This machine for handling pulpwood blocks from storage is being put on the market by Canadian Reclaimers Limited. As most of the mills store the wood in big piles for winter use and take the blocks from the pile by hand, this machine is claimed to be a decided labor-saver as it drags the wood into a conveyor, thus doing the work of quite a number of men. Taking this into consideration and also the labor situation with regards to the class of men required for this heavy work, the Reclaimer will effect quite a considerable saving in the cost of handling winter wood. The machine is capable of delivering 40 cords per hour into the conveyor. The main principle in the designing of the Reclaimer was to retain the angle of repose of the pile, so that the blocks would come into the conveyor as needed. Accomplishing this, the machine, as shown by the sketch, was designed with a bottom carriage running on a portable track on the ground. Connected to this carriage is a boom lying at approximately the angle of repose of the pile with its upper end resting on the crest of the pile on a small track. The boom, by means of idlers, carries chains which drag down the slope of the pile and pull the blocks into a portable conveyor at the base of the pile. The chains have pointed attachments set at such an angle that they will engage the wood and start it down the pile but do not hold the block after once starting it in motion. The sag in the chains makes it possible to dig a swath from 4 ft. to 8 ft. in depth into the storage pile. After the chains have dug to their capacity, the Reclaimer is moved laterally along the pile and the dragging continued until the full length of the pile has been covered, the boom is then shortened and the machine is moved back along the pile, dragging as it goes.

By thus taking the wood from the face of the pile rather than from the bottom, it means the systematic handling of the blocks. It also eliminates the dangers due to slides, which are a serious problem when the angle of repose of the pile is broken. At pulp and paper mills and also at rossing mills where they have no stackers the Reclaimer can be used for that purpose and, when put in use as a stacker, it is built up as it makes the pile. By the time the wood is all stored in the fall, the machine is in place to be used as a Reclaimer. When used to stack wood it again cuts the cost considerably over some of the present methods of operating.

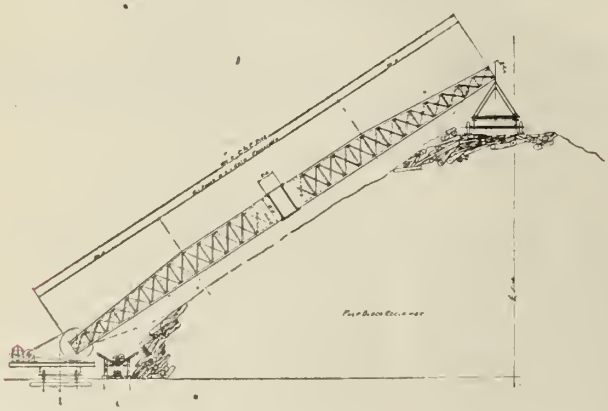
Many pulp and paper engineers have endeavored to design a machine that would handle this wood mechanically, but to date this is said to be the only one that has taken all the factors into consideration and that on trial has proven to be practical.



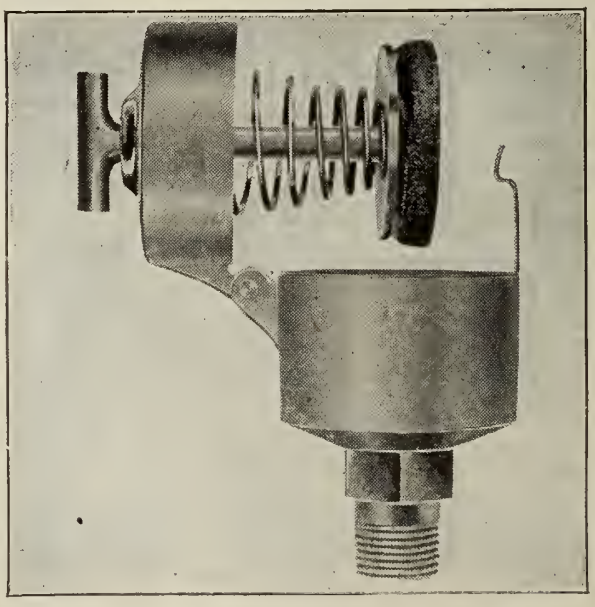
SECTIONAL VIEW THROUGH THE CUP.

AUTOMATIC GREASE CUP

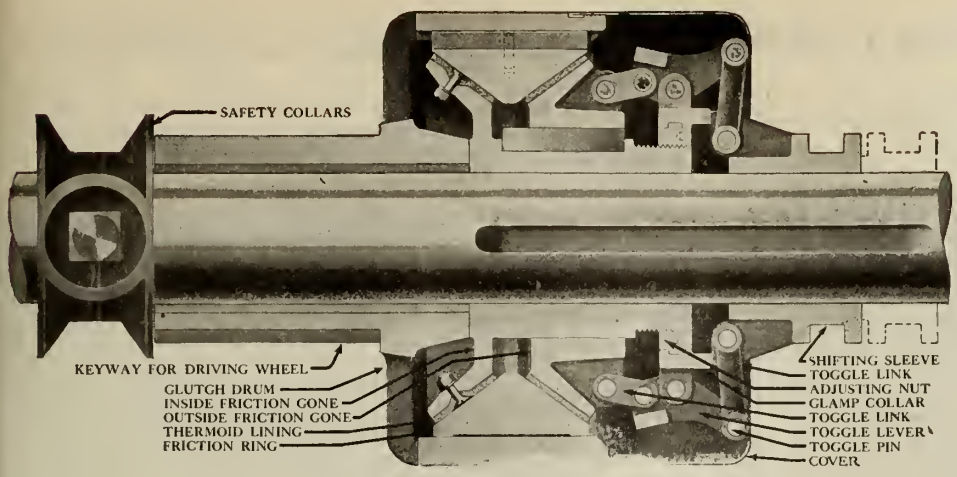
The need of effective lubrication to bearings and all surfaces subjected to friction, has been, and probably always will be, an outstanding factor in engineering problems. The varied conditions under which many mechanisms are required to operate makes it imperative that ample facilities be provided for proper lubrication in order to avoid the in-



DIAGRAMATIC VIEW OF THE PUMP RECLAIMER.



THIS SHOWS CONSTRUCTION OF THE CUP.

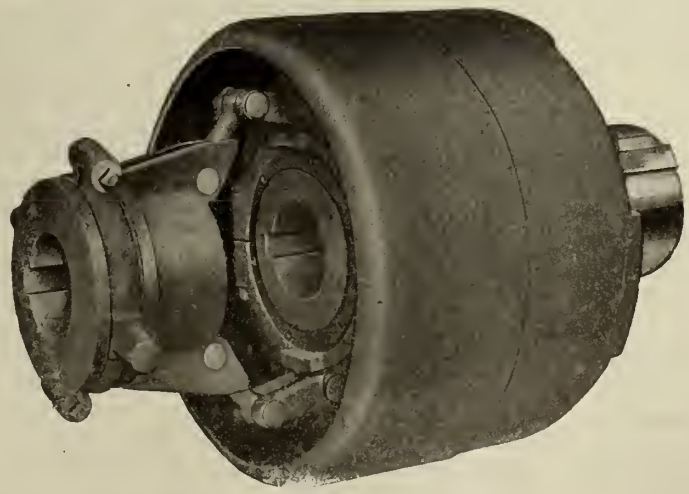


SECTIONAL VIEW OF THE CLUTCH.

convenience and even destruction that frequently follows from insufficient foresight in this connection.

The illustrations depicted show a new design of grease cup which is automatic in its action, for when the cup is once filled and pressure applied, the feeding process is constantly maintained until all the grease has been delivered to the bearing. These grease cups are made in a variety of sizes and designs to suit any desired purpose or condition, the action of the automatic principle being identical in every instance. In Fig. 1 it will be seen that the body A is bored clear through, but the lower portion may be made to any desired shape and threaded to suit.

The cover B is hinged to the body, and when closed is locked in position by the steel spring C. When filling the cup the spindle is raised to its extreme position, the small pin passing through a slot in the cover. A slight twist of the spindle locks it in this position and the cover is opened. It will be seen from the construction that the cover can only be swung open when the pressure disc F is retained within the cover. An accurate fit within the cylinder is maintained by the cupped leather washer G.



GENERAL VIEW OF THE CLUTCH.

The spiral compression spring H provided a steady pressure upon the grease in the cup so that an automatic feed to the bearing is always assured.

The action of this spring prevents the formation of a vacuum beneath the pressure disc as the latter will follow the grease down as it is gradually delivered to the bearing. Suitable springs are provided for the different grades of grease. All parts are interchangeable on each size of cup so that separate pieces are available for any replacements. The cup may be inverted or located in any position without affecting its efficiency. These cups are adapted to locomotives, marine, gas or stationary engines, and all mechanical equipment where grease cups are used. These cups are made and sold in Canada by the Edward A. Robinson Co., 228 Craig St. W., Montreal.

TWYNCONE FRICTION CLUTCH

The Link-Belt Co., 910 S. Michigan Ave., Chicago, Ill., have placed on the market what is known as their Twycone friction clutch. One of its exclusive features is that it has a one point adjustment. All moving parts are inclosed, making for absolute safety. The clutch is also perfectly balanced, this feature allowing it to run at high speed without causing it to throw in—or out.

The construction is very simple. Moving parts are reduced to a minimum, and high speed does not affect its operation. The clutch has to be eased in when running at any speed, and the friction cones are lined with thermoid. Every part is easily asséccible, and if neseccary can be easily replaced. The accompanying photographs will still further show the construction and appearance of this new style clutch.

NEW THINGS IN MACHINE TOOLS

MACHINE VISE

The Hoosier Drilling Machine Company, of Goshen, Ind., are now making a new line of machine vises The jaws are of hardened steel, but may be modified to meet specific needs.

SINGLE-END DRILLING MACHINE

The Cadillac Tool Company, of Detroit, Mich., are placing on the market a single-end machine similar to the one recently designed for double-end tapping. The spindle feed is operated by a lever above the spindle head. The machine has a capacity of 17/32 inch drilling in steel, and may be provided for either belt or motor drive.

AERIAL GRINDER

The Van Dorn Electric Tool Company, of Cleveland, Ohio, are now building a small aerial grinder, which may be obtained for operating either with d.c. or a.c. installation. The grinder has a 12-inch extension that carries the wheel well out from the frame. Ball bearings are used throughout and grease lubrication is provided.

RE-DESIGNED SHAPER

The re-designed 20-in. crank shaper of the R. A. Kelley Company, Xenia, Ohio, incorporates many improvements over the old design. The machine is constructed for either belt or motor drive. The link connection from the rocker arm is such that the ram is forced on to the bearings, which helps to neutralize the upward thrust of the tool. The apron is so mounted that it may be completely rotated. Table is located by means of a hardened taper plug. Ball bearing thrusts are provided for elevating the screw. A special feed box is fitted to the end of the cross rails, and the amount and the direction of the feed may be controlled without touching any moving part of the machine. Feed is automatically disengaged at the end of the travel. Helical teeth are used on all gears and pinions.

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Signs of Business Safety

AN encouraging sign of the last few weeks has been the greater stability of prices. By that we mean that there has been a noticeable absence of the price-jumping that was so active some months back.

Price stability will do more to hold things in control right now than all the plausible explanations that could be put forward for price increases.

The high prices that are asked for putting up a building now are a big factor in keeping orders from coming into the machine tool market. No doubt the same can be said of other lines.

When a firm is going to put in any considerable amount of new equipment, they are going, in nearly all cases, to build a new house for it. When the price of the house is too high they simply drop all, house, equipment, and all that goes with it.

There are contractors in several lines reporting that they are getting more production now per man per day or hour than they did two months ago. Production is one of the much-needed things in this country, but not at a price that converts a large production into a large loss.

Alberta's Coal Crop

THE taking of the Canadian Manufacturers' Association to the West this year has given the people of Alberta a chance to renew their propaganda for sending their coal East to the exclusion of the tonnage shipped in from the States.

According to figures, Alberta has seventeen per cent. of the coal reserves of the world, and about 80 per cent. of the coal reserves of Canada. Of course, these figures may vary a good deal, but there can be no question that Alberta is one of the greatest coal fields in the world.

Last year Alberta found a market for some 5,150,000 tons of coal, including the home market, while 21,000,000 tons of coal from United States came into Canada.

Coal production has gradually come up from 2,174,329 tons in 1909, until this year they are confident of taking out seven million tons.

There is more or less prejudice to be overcome in the Middle West against burning Alberta coal while there is a chance of securing Pennsylvania anthracite, even at a higher figure.

Alberta's best chance for driving eastward is to make certain that she puts on the market coal that is clean and adaptable for heating during the winter in the Canadian West, where cold is extreme and long-continued.

People in Western Canada are like the people in any other country. They will buy Alberta coal if it suits them and if it pays them to do so. If not, they will buy elsewhere, and all the propaganda under the sun will not make them trade where they don't want to.

Grabbing the Railroads

AGITATORS find little difficulty in showing why the railroads should be taken over by the people. The United States furnished a horrible example of what a bunch of political tinkers can do to railroads.

Congressman W. B. McKinley recently brought out something that should cause confiscators to pause and think. He said:—

"I regret to see expressions by certain classes of newspapers, and also occasionally by a congressman, of a desire to confiscate railroads. There are outstanding in the United States 40,000,000 life insurance policies, policies owned by you and by me for the purpose of protecting our loved ones in case death comes to us. I wonder if these people who so glibly talk of confiscation, or, what is the same thing, cutting off the railroads' power to earn interest, realize that the security back of their insurance policies is in a large part railroad mortgages. About one-fourth of all railroad bonds are owned by savings banks and insurance companies."

There are large numbers of Canadians holding insurance in United States companies, and anything that affects them is of immediate concern on this side of the line.

Culling Out the Weak Spots

SOME idea of the care needed in turning out special steel can be gathered from points brought out in a paper by Mr. De Mare, superintendent of the open hearth department of the Midvale Steel and Ordnance, Philadelphia.

Speaking of the tests made in armor-piercing projectiles, he stated:—

"From each lot of 500 projectiles, four are selected to be fired against a face hardened armor plate at a certain velocity and angle of impact of which two must pass through the plate and remain in effective bursting condition. Should this test be a failure, four more projectiles may be selected and fired, of which three must pass through the plate and remain in effective bursting condition. In the case of 16 in. shells, the cost to the contractor of this second test would amount to about $20,000. Should it fail, the whole lot of 500 projectiles may be condemned or the contractor may be permitted to retreat it and resubmit it as a new lot, which would entail an extra expense of approximately $100,000. It is thus evident that every possible attention must be paid to the quality of this steel, in order to avoid great financial loss, as well as loss in reputation."

There is a point here that could very well be brought out and emphasized, viz., that each piece is good or bad by itself. There is no such thing as an average.

Other lines of industry should get that idea. It would pay and pay handsomely.

A mechanic can work it, so can the foreman—so can the manager or owner.

Each day's work, each day's output can be put up against that simple standard.

Good or bad? Not the average of a week or month.

Perhaps Your Order is Down at the Bottom

Canadians Have Been Wondering for Some Time Just When Their Orders Were Going to Be Filled—The Railway Situation is on the Mend, But a Big Job Faces the Roads.

THOUSANDS OF TONS OF BARS WAITING FOR SHIPMENT

THE photograph here shows how bar iron and steel is being piled at some of the large mills in the steel belt of United States. The space occupied, according to the official furnishing the photo to Canadian Machinery, is not intended for storage, but is right in one of the regular finishing departments.

Speaking of the matter he remarked, "If you or anyone else can come along and tell us how to get this moved, our hat is in the ring for a try at it."

Other pictures show tubes piled, also plates and black sheets.

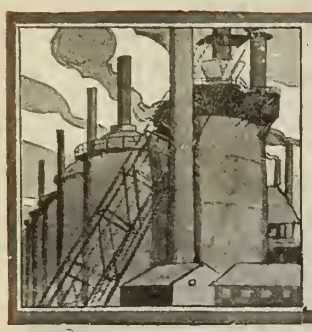
Canadian firms wonder when their shipments are going to get across. Some of your long-looked-for material may be in some of these piles—and dangerously near the bottom, too.

Another U. S. steel man, who was in this district a few days ago, drew attention to the way in which piling was going to throw their shipping schedule out of order. As soon as the roads were unable to keep up with the mill output, material was piled. Shipments that were ready to go out weeks ago were laid down, and others have been put on top in many cases. So it seems likely when the stuff does start to move that "the first shall be last and the last shall be first."

Were all the material now stored around the U. S. mills released it might do much to bring the steel market nearer an even break between supply and demand.

The steel trade has gone through some remarkable right-about-faces since the end of the war. First, there was the period when steel salesmen were right out after trade, in an endeavor to secure a capacity tonnage for the mills. Then followed the export demand, and the domestic trade, waking up, came into competition with it. In a few weeks, a month or so at best, the mills were all booked beyond capacity for some time in advance.

The incessant demand has been kept alive and to the front by the switchmen's strike. Everything has played into the hands of the premium operator. The increased tonnage reported as going through the mills has meant practically nothing to the consuming trade in Canada. Turning it out is one thing, but getting it across is one greater thing at present.



MARKET DEVELOPMENTS

Some Shipments Are Coming Through Now

But the Dealers Are Booked Against Any Steel that Comes In—Machinery Market is Quieter, but Inquiries Nearly Always Turn Into Sales—Scrap Market is Dull.

ALTHOUGH figures given out indicate that the steel mills of United States are producing at a good rate the relief this ought to bring to Canadian industries is largely negatived by the inability of the roads to get the material away from the mills. In the last few days some fairly large shipments have been coming to Toronto, mostly in sheets, plate and bars, although in no line have the receipts been in keeping with the business waiting to be satisfied.

U. S. auto firms have had buyers in the Canadian field looking for much-wanted sections, which are not being produced in any quantity at the mills now. One Michigan firm was able to pick up a nice tonnage in a Toronto warehouse a few days ago. Canadian firms, on the other hand, have their own men in United States to see what they can get from the warehouses or the mills there, but as a rule they are meeting with very scant success.

Machine tool dealers report a rather quiet week, and the same is true of the New York market, where they are looking to the railroads to come in and be the large purchasers of equipment. In the Canadian field the inquiries that do come in are very easily converted into real orders. No large orders are reported, the most of the business being for replacement purposes or small additions to existing plants.

The scrap metal markets in Montreal and Toronto are very quiet. Foundries and melters in general that would, in ordinary times, be taking on scrap, are out of the market, because they cannot get their right supplies of coke, etc.

MONTREAL TRADE REPORTED ON A BETTER BASIS THAN FOR SOME TIME

Special to CANADIAN MACHINERY.

MONTREAL, June 17.—Business activity in and about Montreal continues to be of an encouraging characmter. Some disturbing elements have featured the situation of late, but the general trend is toward steady progress. The port has taken on midsummer interest and operations on the waterfront compare favorably with pre-war days. Additions to trade routes have become extensive this season, so that at the present time connections can be made with almost any country on the globe. The strike among the foundry workers has been terminated and activities in this line are again becoming normal. This will give relief to other industries that have suffered more or less by the shortage of castings. Considerable interest is being displayed by the A. F. of L. convention, which continues throughout the present week.

Slight Improvement Showing

Without committing one's self it is safe to state that the situation this week has shown slight improvement. The gradual relief that has been given to railroad operations in the States has been reflected in the steel shipments to this district, yet, while the change has been very encouraging, some weeks must inevitably elapse before normal transportation can be effected. The present demand continues to be of such a character that any addition to current supply can easily be disposed of to customers whose orders for material have been on the books for months. Dealers are anticipating the possibility of warehouse accumulation before long, provided the present improvement is maintained. The relief that is beginning to show is more in the lines that are in general demand than in odd shapes or sizes, as the large mills are operating for longer periods on this class of commodity; the lines in lesser demand having to wait the accumulation of sufficient tonnage, or be taken to a smaller mill where a higher price will rule. Dealers here state that supplies of tubes are under the demand, and that it is frequently difficult to meet the needs of their customers. Deliveries are uncertain. as the state of transportation offers little assurance of through shipments, as long as two months having elapsed, recently, between shipment from the mill and the receipt of the material at the fabrication point. Sheet requirements continue to be a feature here and dealers are unable to secure sufficient to meet even the most conservative demands. The local quotation is muc stronger and dealers are asking as hig as $12 for No. 28 black; the nominal pri may be given as $11 per hundred lb Canada dull plates are quoted at $10-52 sheets to the box. Galvanized shee are not plentiful and the little that com in is immediately absorbed by the trad so that warehouse supplies are next impossible. Premier sheets are quot nominally at 12 cents per lb.

Deliveries Show Gradual Improvemen

Despite the general quietness of sor markets, dealers in machine tools ha no complaint to offer as regards t volume of business, but believe that i proved delivery would tend to add the sales of new equipment. Some deale state that shipments are coming forwa better, while others claim that no i provement has developed. One deal remarked this week, that he has be waiting for a small piece of equipme that was shipped from the Americ factory by express, on May 20th. J quiry as to non-arrival brought out t fact that the article has been held up the border awaiting the regulations th must be carried out in regard to exp of goods from the States. Second-ha machinery continues to be placed a considerable of the present business m be credited to sales of used equipme Small supplies and accessories are good demand but showing a slight falli

off. Prices are generally well maintained.

Dull Scrap Market

Dealers are looking forward to a betterment in old material activity, but present reports do not indicate that any significant developments have taken place to alter the dullness that has marked the situation for the past several weeks. Trading here is quite light and the demand shows little signs of improvement. The bulk of the present business is with local foundries, but even these have been operating below normal, due to the disaffection among the workers. However, a settlement has been arrived at and activities are again being resumed, and a return to better demand for machinery scrap is expected. A little heavier demand has turned up for some of the non-ferrous scraps but not what would appear to be a steady improvement. Brass and copper scraps are quite strong, an advance of ½ cent per lb. being noted on light brass, zinc and lead, the present quotations being 7, 7, and 7½ cents respectively. Steel scraps are very quiet with dealers showing little buying interest.

SOME CAR LOTS COMING ACROSS NOW

But Shipment is Still Indefinite—Machine Tool Market Not Active This Week

TORONTO.—The past week has been quieter in the machine tool market. There are inquiries coming in, though, and these are real honest-to-goodness prospects in most cases. The present level of prices means that a man is going to think seriously before buying, and when he comes into the market he is very likely to buy. Much of the business now is in small orders. In other lines there is a good volume of business moving. There is nothing unusual in the fact that there is a falling off at this time of year, as the market generally experiences the samething at the start of the summer season.

Dealers find that deliveries of orders are still slow and many machines have been on the road for an unreasonable period. For instance, one dealer has a machine that left Jamestown, about 50 miles from Buffalo, on the 27th of April, and as far as this end is concerned, is still on the way here.

Several questions have been asked by United States firms regarding the taking off of the seven-and-half per cent., and the payment of the one per cent. sales tax. Of course, the 7½ per cent. is off and is not now being collected. The sales tax of one per cent. can best be explained by a suppositious case. Take the purchase of a machine worth $1,000. The duty on that would be 27½ per cent., making the price on which the one per cent. would be paid $1,275, or $12.75 tax. That amount would be collected when the machine was cleared at the customs, and the American maker would not have to bother with it at all.

POINTS IN WEEK'S MARKETING NOTES

Shipping conditions are reported better at Montreal, both for import and export business.

New York machine tool market continues to be very quiet. The railroads are counted upon to do heavy buying very shortly.

No very large orders are reported in the Canadian field. Most of the inquiries that come in are readily converted into real business.

Scrap metal markets are very quiet. Old rubber is also at a low market, only 2½ cents per pound being offered for old auto tires.

Pittsburgh reports that steel mills are producing at a high rate, but shipments are stil backward.

Buyers from U. S. auto concerns have been in Canadian centres in the hope of finding certain much-wanted steels in warehouse stocks here.

Shipments of black sheets and plate reached Toronto this week in fair tonnage. Nothing much came through in the way of tubes.

Some traffic reports claim that inside of two months conditions will be normal.

Dealers in small tools report a lot of orders coming in. There are no very large buyers in the market at the moment, but a lot of different lines are contributing.

According to some reports, there may be changes in prices announced before very long, in the relative selling figures of high speed and carbon tools. It is not likely that there will be anything radical in this, the adjustments being intended to put Canadian makers in better position to meet competition.

The Steel Market

A number of cars came in over the week-end, mostly 10 and 12 black sheets and some plate, one warehouse stating that they had a string of eight ready for unloading. Pressure is being brought to bear continually on the mills to get them to put through certain much needed tonnages. One Canadian mill-man states that under circumstances such as are existing at present the only thing is to go ahead with their own programme, "for no matter which way I turn some one is on my neck," he explained. Mills may have a preference for putting through rounds, and the men in the mills may like that work because the tonnage generally piles up quicker on that work—and all this may please the man selling steel to contractors who use rounds for reinforcing.

All of which is fine, but it does not fit in very long with the programme of the agricultural implement man who wants flats.

Boiler tubes are not arriving. One Toronto house had one order for a car 16 ft. x 3½ in., which were placed with the mills weeks ago, and work on which was finished weeks ago. There has been no chance of moving this material, so U. S. warehouses were resorted to, and a stiff advance paid over mill prices. The Canadian jobber handling the business makes very little on the deal, but he has secured much-needed material for his customer. There is hardly any limit to the tubes that could be sold now were deliveries any better.

It is a common thing now for Canadian firms to have their own men scouring U. S. centres for much needed lines. Some pick up odd lots, but others find, as one superintendent states, "scouring through U.S. stocks that don't exist." This business of looking for material works both ways: A big auto firm in Lansing, Mich., had buyers through here just a few days ago looking for small angles, about ¾ inch. A certain Toronto warehouse had 40 tons and it was a pleased U. S. buyer who came down and carted away the lot. The warehouse replacement price, based on a 100-ton lot of the same material, was $1,000 more than in December.

Scrap Market Dull

One large firm of scrap metal dealers sized it up like this to-day: "You can take the phrase that suits you best—dull, quiet, stagnant or inactive." Any of these will tell you what is going on in our business this week, and we don't see anything in sight that is going to make much difference.

The weakness in the scrap market is due largely to lack of buyers who can't buy scrap, especially steel, cast iron or stove plate, because their supply of coke is uncertain.

The new one per cent. sale tax makes little or no difference in this trade. If material comes from the U. S., the tax is paid at the border.

The yards of some of the smaller dealers are stocked with rubber, especially tires. The prices for these stay very low, not over 2½ cents per pound being offered now. Dealers say the market is full of new rubber and the demand for scrap is not keen.

RAILROADS WILL ENTER THE MARKET

U. S. Machine Tool Trade Look to Them To Be Big Buyers Before Long

Special to CANADIAN MACHINERY.

NEW YORK, June 17. — About the same conditions prevail in the machine-tool trade that have been reported during the last three or four weeks. There is very little enquiry or buying,

and such purchases as are being made are single tools or small lots.

It appears quite certain that the major portion of the machine tool business for some months will come from the railroads. Their wants are well known, and as soon as financial or other necessary preliminary arrangements have been made many roads will come into the market for shop equipment. The purchase of $600,000 worth of shop tools by one road, the Atlantic Coast Line, reported last week, shows that the aggregate purchases of the railroads will be tremendous if other roads buy on a comparative scale.

Manufacturers, quite generally are staying out of the market. All metal-working lines are dull and inactive so far as new business is concerned, though there is plenty of business on the books to carry plants along for several months or longer.

IT MAY TAKE FOUR MONTHS TO CLEAR OUT THE BLOCKADE OF STEEL

Special to CANADIAN MACHINERY.

PITTSBURGH, June 17. — There has been an increase of about one-third in steel production to date, from the low point caused by the recent rail strike, the rate being now only a few per cent. under the rate of last March, the highest rate since October, 1918.

The American Iron and Steel Institute reports a production in May of 2,883,164 gross tons of steel ingots, by 30 steel companies which in 1918 made 84.03 per cent. of the entire production of the industry. Using this proportion as a basis, and taking account of the number of working days in the month and year, it appears that production of steel ingots in May by the whole industry was at the rate of about 41,050,000 gross tons a year. The average rate for April had been about 37,550,000 tons, but in the forepart of April the rail strike was only affecting the Chicago district, the other districts proceeding at the high rate they had attained in March, when the industry was making ingots at the rate of about 45,200,000 tons a year. The low point in production fell in the third and fourth weeks of April, and for a short time production was probably under 34,000,000 tons a year. There having been a progressive improvement during the greater part of May, the 41,050,000-ton average for the month suggests that production at the close of the month was at about 43,000,000 tons, and there has been a further increase thus far this month, so that attainment of a 45,000,000-ton rate before the end of this month seems rather probable.

These comparisons have great significance. Since the armistice there have been two scarcities, the first being a scarcity of orders at steel mills, the second a scarcity of steel on the part of consumers. At no time since the armistice has there been anything like full production except in February and March of this year. Full production, therefore, has not been tested out, for two months of full production would not furnish a test, when all buyers had been absolutely bare of stocks. The stocks normally carried by jobbers and manufacturing consumers, for the ordinary and convenient prosecution of their business, amount to several weeks of production. It is probable that the rail strike of April and the great curtailment in deliveries that ensued, found not a few consumers with fair sized stocks, accumulated in the brief space of two months, otherwise the curtailed deliveries of steel would have caused still greater hardships than were apparent. If steel production and deliveries had continued at the March rate, it is quite probable that steel would now be so plentiful. Now the production rate is being restored. It is true that some members of the trade continue to speak of there being barriers to full operation of the steel industry, but it does not seem at all logical to assume barriers to the production of steel and not at the same time take into account that unfavorable conditions would also affect the disposition of people to consume steel. The natural presumption would be that if the steel consumers can function the steel producers can also function. The steel making capacity has increased 50 per cent. since before the war and it is yet to be seen whether the steel demand has also increased 50 per cent.

Traffic Conditions

The major testimony is that rail traffic conditions have experienced a further improvement in the past week, though a few observers claim there is no really definite improvement. The general feeling among the mills is a sanguine one as to the nearby future of transportation. The argument is that while thus far the improvement has been slow, in the number of cars furnished for loading and in the time required to get shipments through, it is always the case with a traffic congestion that the beginning is the difficult thing. Once some little inroads on the jam are made the work of clearing it becomes easier and easier, the effects being cumulative. Thus the more common prediction is that within a very few weeks rail conditions will be normal. That would mean simply that the railroads would be able to furnish the furnaces and mills with full supplies of raw materials, and be able to take away the current production of steel. Even at this time the shipments of steel, though increased, are somewhat under the production. Normal operation of the railroads, however, would not take care of the large accumulation of steel that would be left at mills, for moving that steel would mean the railroads taking an overload. The common prediction, therefore, is that it will be a long time, say two to four months, before all the accumulated steel at mills is cleared off. Even with an ample car supply, it takes time and labor to pick up the steel and load it, while furthermore it must be remembered that some of the accumulated steel is in billet, sheet bar and ingot form and requires further rolling. A stock of ingots can be worked off only gradually, by the blooming mill working a few per cent. above normal.

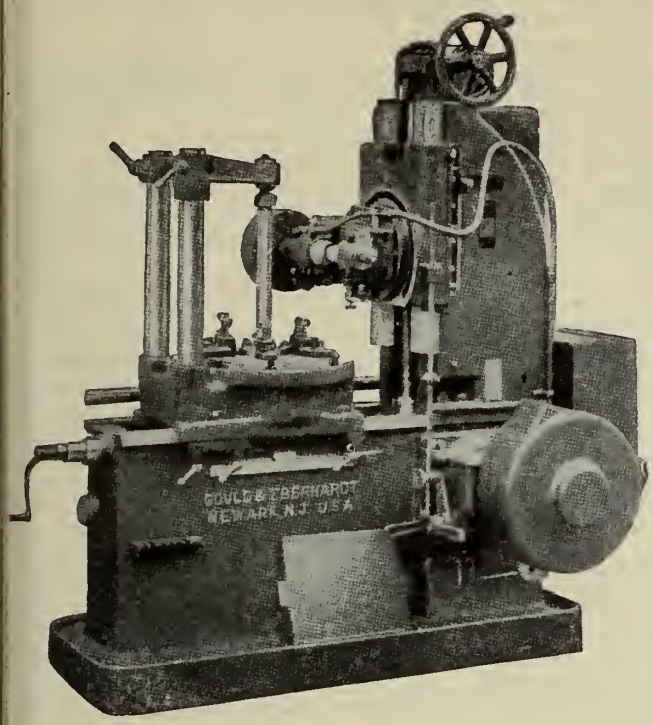
Steel Corporation Tonnages

The Steel Corporation continues its remarkable sales record, the unfilled obligations having increased during May by 580,719 tons, bringing the total June 1 to 10 940,466 tons. This is equal to the tonnage that would be produced in 8.2 months, working at full rated capacity of 52,500 tons per working day, or nine months, working at 90 per cent. of capacity. A few months ago, when the independents were advancing their prices and hoping the Steel Corporation would do the same, the claim was made that the corporation could not continue its adherence to lower prices, as it would soon become hopelessly oversold and its customers would be unwilling to buy for the late deliveries which alone the corporation could offer. A test showing the incorrectness of this reasoning was furnished in May. The independents, sold up in few cases for as much as four or five months, had a dull market, while the Steel Corporation, sold up for an average of eight or nine months, had an active market. The case was simply that buyers expected the independent prices to come down eventually to the Steel Corporation level, hence would not commit themselves any distance ahead, while they had great confidence in the Steel Corporation prices and would place with the corporation all the tonnage that would be accepted. The increase in unfilled tonnage in May, 580,719 tons, was equal to 44 per cent. of the corporation's capacity for the month, and estimating the shipments at 68 per cent., production having been perhaps 85 per cent., the bookings appear to have been about 112 per cent., or 12 per cent. over capacity and 65 per cent. or so over shipments.

The steel market is quiet, but is plainly carrying out the program one would expect. The mills previously getting the highest prices, because able to make prompt shipment on account of having but little business on books, have had to come down in prices. The mills sold up for several months have not had occasion to do so, and presumably will maintain their prices as long as they have unfilled orders on books at those prices.

Pig iron is dull and unchanged.

D. M. McLean, of the Canadian Ingersoll-Rand Company, Sherbrooke, Que., is again back in his office after a period of several weeks in a Montreal hospital, where he underwent an operation.



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For Gears up to 120" dia.

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If It's Machinery---Write "Williams"

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Gray Iron and Semi Steel Castings of all Descriptions

From 5 lbs. up to 4 tons

Foundry capacity, 15 tons per day.

Difficult castings our specialty.

Mixtures regulated by chemical analysis and all castings sandblasted.

Estimates from blue prints submitted promptly.

If desired, we can make patterns to your drawings.

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If interested tear out this page and place with letters to be answered.

ASKING FOR BONUS ON SHIP BUILDING

Several Interests at Ottawa to Present Case for the Yards of Canada

Ottawa.—A delegation of about forty representatives of the Maritime Provinces, Quebec, Ontario and Pacific coast shipping interests was introduced to Premier Borden and members of his Cabinet by H. Stevens of Centre Vancouver, and urged that either of two forms of assistance to shipbuilding be extended by the Government. The first form of assistance asked was the granting of a subsidy of $10 per ton of displacement and $10 per indicated horsepower. The second suggestion was that the Government should assist in the financing of foreign contracts.

The Prime Minister promised that the representations of the deputation would be accorded most careful consideration.

It is understood that a very large foreign shipbuilding contract has actually been offered, provided that the Government will assist in financing it during the present adverse conditions of exchange. It is stated that the foreign interests affected are willing to put up a very large proportion of the cost, but that they desire that the Government make some advances in the circumstances. The proposal is believed to be before the Cabinet.

St. John, N. B.—At the annual meeting of the shareholders and directors of the St. John Drydock & Shipbuilding Company, James Playfair, of Midland, Ont., was elected president; D. S. Pratt, of Midland, vice-president and managing director, and Col. Thomas A. Duff, of Toronto, secretary. Other directors were elected as follows: D. L. White, jun., Midland; W. P. Phin, Hamilton, Ont.; W. J. Sheppard, Waulbaushene, Ont.; and James B. Craven, New York. It was announced at the meeting that the company had purchased a hydraulic dredge of Canadian register to work here.

MONTREAL NOTES

Gates Refractories, Ltd., of Montreal, have recently obtained some good contracts for boiler installations and special firebrick.

The Interprovincial Manufacturing Company of St. Pie, Bagot, Que., are going to build an extension of 145 ft. x 50 ft. to their present plant for the making of casket coffins. Mr. Chaneux is the general manager.

At the conclusion of a tour of inspection of Canadian shipyards Sir James McKenzie, managing director of Vickers Ltd., of England, stated: "I am surprised at the magnitude of these yards and also at the economic layout of the plants, and I have seen the most modern machinery in these plants that exists anywhere today, and for the first time in my life I am ready to admit that there is a great future for the shipbuilding industry of Canada. I have no hesitation in saying that the acquisition of the companies owning these plants is absolutely essential, in my opinion, to the existence of the British Empire Steel Corporation. It will only be following out the same lines as have been adopted by the United States Steel Corporation and our big steel interests in England, where they have control of their shipping and shipbuilding plants."

INTERESTING BULLETINS

The Wellman-Seaver-Morgan Company, Cleveland, Ohio, have published a very thorough and attractive line of bulletins, covering some of their varied field of activities. The booklets show some interesting installations made by this company and are highly instructive. Following are the subjects which we have so far received:

Bulletin No. 41 deals with coal and ore handling machinery. The W-S-M. unloaders, travelling bridges with grab buckets, car dumpers, car haulages, transfer cars, boat loaders, bucket handling cranes, excavating buckets and weighing lorries are shown.

In Bulletin No. 42, special cranes are illustrated, pontoon cranes for marine work, dock cranes, shipbuilding cranes, cranes for concrete handling, and also some special purpose cranes.

The other bulletins received take up in detail the following subjects: No. 43 goes into the subject of hydraulic turbines; No. 44 shows hoisting and mining machinery; No. 45, steel works equipment; No. 46, coke oven machinery; No. 47, port and terminal equipment; No. 48, rubber machinery; No. 30, W.-S.-M. charging boxes; No. 26, tire running press; No. 18, the operation of a gas producer, and No. 19, superseding No. 13, illustrates their tire applying press.

Bulletin No. 22 gives the relations between power, shaft diameter, torsional stress, and speed of any shaft, and we hope in this latter case to present the charts for our readers' benefit.

All of these bulletins are prepared in splendid style, and we have been informed that they will be sent to anyone interested.

SPONSORS FOR SAFETY CODES SELECTED

Definite arrangements have been made for the formulation of a considerable number of safety codes under the auspices and rules of procedure of the American Engineering Standards Committee. The subjects of the codes for which arrangements have been completed, together with the organizations which have been designated by the committee to act as sponsors, and who have accepted such responsibility, are as follows: Abrasive Wheels.—The Grinding Wheel Manufacturers of the United States and Canada, and the International Association of Industrial Accident Boards and Commissions. Explosives.—The Institute of Makers of Explosives. Foundries.—The American Foundrymen's Association and the National Founders' Association. Gas Safety Code.—The U. S. Bureau of Standards and the American Gas Association. Head and Eye Protection.—The U. S. Bureau of Standards. Paper and Pulp Mills.—The National Safety Council. Power Presses.—The National Safety Council. Pressure Vessels, Non-fired.—The American Society of Mechanical Engineers.

Refrigeration, Mechanical.—The American Society of Refrigeration Engineers. Woodworking Machinery.—The International Association of Industrial Accident Boards and Commissions and the National Workmen's Compensation Service Bureau.

A number of additional codes are under consideration. A large representative advisory committee of specialists, organized by the National Safety Council, the National Workmen's Compensation Service Bureau, and the Bureau of Standards, at the request of the Committee, to act as its advisor, is actively working on the question of what additional codes are most urgently required and what organizations are in the best position to undertake sponsorship for such codes.

HYDRO-ELECTRIC ENTERPRISE

One of the largest electrical manufacturing groups in Great Britain has made efficient preparations for undertaking complete contracts for Hydro-Electric enterprises. The business of a prominent firm of water-power engineers and contractors has been acquired in order to provide facilities for making the largest sizes of water turbines, while the resources of the group are available for the electric generators, the construction work, the transmission of power, and all the other sections of Hydro-Electric work in any part of the world. Valuable patents have been acquired in connection with this development. A French company associated with the group is undertaking the construction of water turbines with a total output of 300,000 kilowatts, two hundred electrical locomotives, and other electrical machinery required in an important scheme of railway electrification.

* * *

The influence of the purity of oxygen on the cost of welds is investigated by a writer in "Autogene Metallbearbeitung." The author emphasizes the great importance of having pure oxygen for acetylene welding. Below 60 per cent. it is impossible to weld plates of 1-16 inch in thickness, and experiments have shown the cost of welds is increased by 2½ per cent. for every 1 per cent. decrease in the degree of purity of the oxygen. The paper is accompanied by two tables, one showing the consumption, the speed of welding, and the cost of welds, the other showing the comparative cost of welds made with different degrees of purity of the oxygen. The author concludes by stating that it is imperative to analyze the oxygen.

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Adjustable Collapsing Taps

Have overcome all the expense and annoyance of tapping screw threads with a solid tap.

Anyone doing thread tapping knows what backing out a solid tap each time means. It usually means low production, poor threads, and worn out taps. The mechanism of the Geometric Taps takes care of adjustment to correct diameter each time a thread is tapped, it collapses the chasers automatically, leaving a thread clean cut and perfect.

The chasers are readily reground, and when finally used up, are renewed at comparatively small cost, leaving the tap as efficient as when new.

The manufacturers of the Geometric line of Collapsing Taps and Self-opening Die Heads are justly proud of the distinction which is theirs:—

The Originators

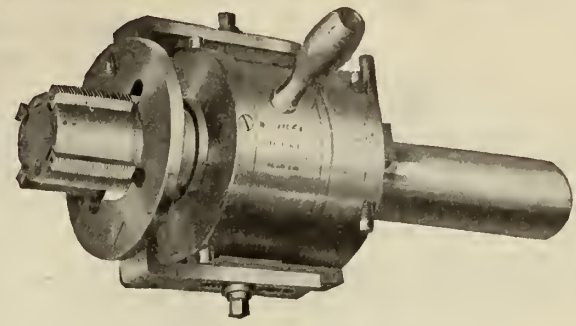
and the

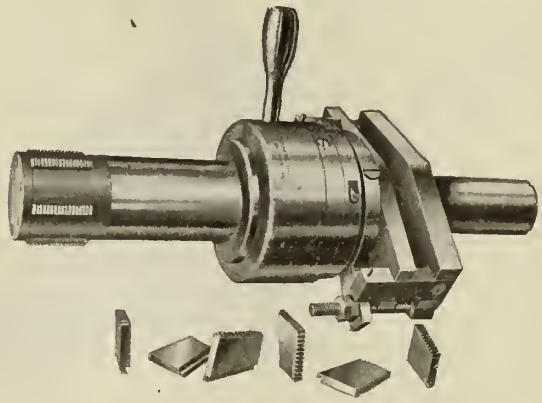
Largest and Best Known Manufacturers

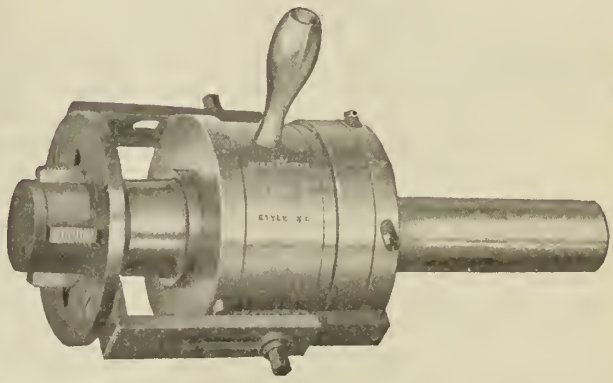
of

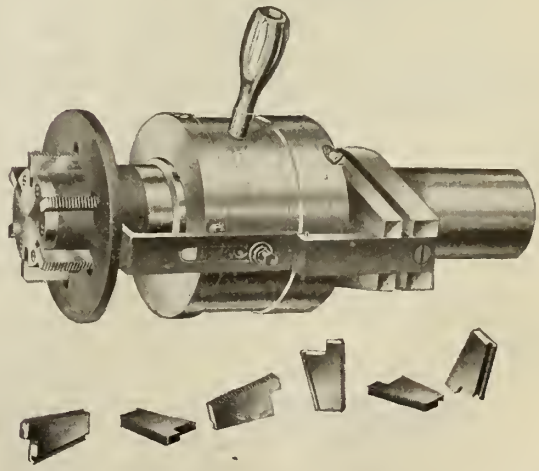
Automatic Threading Tools

For cutting all classes of screw threads, internal and external, of any diameter and form.









The Geometric Tool Company

New Haven, Conn., U.S.A.

CANADIAN AGENTS:

Williams & Wilson, Ltd., Montreal; The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg and St. John, N.B.; Canadian Fairbanks-Morse Co., Ltd., Manitoba, Saskatchewan, Alberta.

If interested tear out this page and place with letters to be answered.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$42 40
Lake Superior, charcoal, Chicago.	57 00
Standard low phos., Philadelphia.	50 00
Bessemer, Pittsburgh	43 00
Basic, Valley furnace	42 90
Toronto price:—	
Silicon, 2.25% to 2.75%	52 00
No. 2 Foundry, 1.75 to 2.25%	50 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 50
Steel bars, base, Toronto	5 50
Iron bars, base, Montreal	5 50
Steel bars, base, Montreal	5 50
Reinforcing bars, base	5 00
Steel hoops	7 00
Norway iron	11 00
Tire steel	5 75
Spring steel	10 00
Band steel, No. 10 gauge and 3-16 in. base	6 00
Chequered floor plate, 3-16 in.	8 40
Chequered floor plate, ¼ in.	8 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	4 00
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 67 to 5 50
Small shapes under 3"	3 62
	C.L. L.C.L.

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points		
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

	Gross. Montreal	Toronto
Lake copper	$25 00	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	66 00	65 00
Spelter	12 00	12 00
Lead	11 50	11 00
Antimony	14 50	14 00
Aluminum	34 00	36 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$ 7 25	$ 7 25
Plates, ¼ up	6 50	6 50

PIPE—WROUGHT

Price List No. 44—April, 1920.

STANDARD BUTTWELD S/C

	Steel Black	Steel Galv.	Gen. Wrot. Iron Black	Gen. Wrot. Iron Galv.
⅛ in.	$6 50	$ 8 50	....	....
¼ in.	5 13	7 26	$ 5 43	$ 7 56
⅜ in.	5 13	7 26	5 43	7 56
½ in.	6 84	8 42	7 27	8 84
¾ in.	8 45	10 58	9 03	11 16
1 in.	12 50	15 64	13 35	16 49
1¼ in.	16 91	21 16	18 06	22 31
1½ in.	20 21	25 30	21 59	26 68
2 in.	27 20	34 04	29 05	35 89
2½ in.	43 00	53 82	....	....
3 in.	56 23	70 38	....	....
3½ in.	71 30	88 32	....	....
4 in.	84 48	104 64	....	....

STANDARD LAPWELD S/C

	Steel Black	Steel Galv.	Gen. Wrot. Iron Black	Gen. Wrot. Iron Galv.
2 in.	$30 90	$37 74	$34 60	$41 44
2½ in.	45 34	56 16	51 19	62 01
3 in.	59 29	73 44	66 94	81 09
3½ in.	73 14	90 16	82 34	99 36
4 in.	86 66	106 82	97 56	117 72
4½ in.	0 98	1 23	1 24	1 49
5 in.	1 15	1 44	1 44	1 73
6½ in.	1 49	1 86	1 87	2 25
7 in.	1 94	2 43	2 42	2 90
8-L in.	2 04	2 55	2 54	3 05
8 in.	2 35	2 94	2 92	3 51
9 in.	2 81	3 52	3 50	4 21
10-L in.	2 61	3 26	3 25	3 90
10 in.	3 36	4 20	4 18	5 03

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.

4½" and larger, 50%.

4" and under, running thread, 30%.

Standard couplings, 4-in. and under, 30%.

Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds. Montreal	Toronto
Copper, light	$15 00	$14 00
Copper, crucible	18 00	18 00
Copper, heavy	18 00	18 00
Copper wire	18 00	18 00
No. 1 machine composition	16 00	17 00
New brass cuttings	11 00	11 75
Red brass cuttings	14 00	15 75
Yellow brass turnings	8 50	9 50
Light brass	7 00	7 00
Medium brass	8 00	7 75
Scrap zinc	6 50	6 00
Heavy lead	7 50	7 75
Tea lead	4 50	5 00
Aluminum	19 00	20 00
	Per Ton	Gross
Heavy melting steel	18 00	18 00
Boiler plate	15 50	15 00
Axles (wrought iron)	22 00	20 00
Rails (scrap)	18 00	18 00
Malleable scrap	25 00	25 00
No. 1 machine east iron.	32 00	33 00
Pipe, wrought	12 00	12 00
Car wheel	26 00	26 00
Steel axles	22 00	20 00
Mach. shop turnings	11 00	11 00
Stove plate	26 50	25 00
Cast boring	12 00	12 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜-in. and less	10
Carriage bolts, 7-16 and up	Net
Coach and lag screws	25
Stove bolts	55
Wrought washers	45
Elevator bolts	Net
Machine bolts, 7/16 and over	Net
Machine bolts, ⅜-in. and less	15
Blank bolts	Net
Bolt ends	Net
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square, blank	add $2 0
Nuts, square, tapped	add 2 2
Nuts, hex., blank	add 2 2
Nuts, hex., tapped	add 2 5
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and
Boiler rivets, base ¾" and larger	$8 5
Structural rivets, as above	8 4
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	25 and 5
Sq. and hex. hd. cap screws	22½
Rd. and fil. hd. cap screws	plus 17½
Flat but. hd. cap screws	plus 30
Fin. and semi-fin. nuts up to 1-in.	20
Fin. and Semi-fin. nuts, over 1 in., up to 1½-in.	10
Fin. and Semi-fin. nuts over 1½ in., up to 2-in.	Net
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 0
Cold pressed nuts over 1½ in.	add 2 0

BILLETS

	Per gross to
Bessemer billets	$60 0
Open-hearth billets	60 0
O.H. sheet bars	76 0
Forging billets	56 00-75 0
Wire rods	52 00-70 0

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 7
Cut nails	5 8
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 5
Spikes, ¼ and 5-16 in.	8 0

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 35½
British Manila rope	0 28
New Zealand hemp	0 28
Transmission rope, Manila	0 47
Cotton rope, ¼-in. and up	0 88

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net

Canada's Leading Tool House

Aikenhead's

Quality Tools for All Purposes

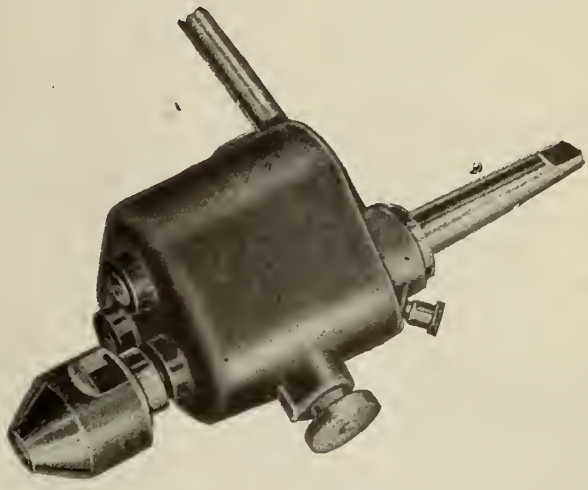
Johansson Adjustable Limit Snap Gages

Reduce Operating Expenses

Introduce the Limit System into your shop with a set of Johansson Limit Snap Gages. They are the accepted method of producing interchangeable work on a commercial basis. They incorporate in their design and construction every feature that sound engineering and mechanical sense dictate.

In these days when production costs are extremely high, every minute wasted by a mechanic, and every piece of work spoiled through inaccurate gaging eats up the profit. The fact that they eliminate both these wastes and that they get equal results even in the hands of unskilled operators accounts for their unusual success and hearty endorsation wherever introduced.

The Johansson book tells all about them. Write for your copy to-day.



Wahlstrom Automatic Tapping Attachment

A Cure for Tap Breakage

If the lands are freed from chips the tap won't jam in the hole. Consequently there will be no tap breakage. With the Wahlstrom tapping attachment the chips are freed by the oscillating motion which is a close reproduction of the simple to-and-fro motion of hand tapping. This reduces the tap breakage to a minimum.

The oscillating motion is changeable to a continuous revolution for tapping in soft materials. The spindle reverses when the tap is raised.

The Wahlstrom has nothing to get out of order and it fits any drill press. Made in two sizes: No. 1 takes taps of all sizes from 5-40 to ½ inch standard. No. 2 takes taps from ¼ inch. Sent on 10 days trial.

AIKENHEAD HARDWARE LIMITED

17, 19, 21 TEMPERANCE STREET, TORONTO

If interested tear out this page and place with letters to be answered.

MISCELLANEOUS

Solder, strictly	$ 0 40
Solder, guaranteed	0 43
Babbitt metals	18 to 70
Soldering coppers, lb.	0 62
Lead wool, per lb.	0 16
Putty, 100-lb. drums	8 30
White lead, pure, cwt.	20 00
Red dry lead, 100-lb. kegs, per cwt.	16 50
Glue, English	0 40
Tarred slater's paper, roll	1 30
Gasoline, per gal., bulk	0 35
Benzine, per gal., bulk	0 35
Pure turp., single bbls., gal.	3 60
Linseed oil, raw, single bbls.	3 00
Linseed oil, boiled, single bbls.	3 03
Sandpaper, B. & A.	List plus 43
Emery cloth	List plus 37½
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin, "D," per lb.	0 14
Borax crystal and granular	0 14
Wood alcohol, per gal.	2 70
Whiting, plain, per 100 lbs.	2 75

CARBON DRILLS AND REAMERS

S.S. drills, wire sizes	32½
Can. carbon cutters, plus	20
Standard drills, all sizes	32½
3-fluted drills, plus	10
Jobbers' and letter sizes	32½
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	net
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus 20 to	40
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At warehouse]

Rounds and squares	$7 base
Hexagons and flats	$7.75 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	60	75
Class B	27	37
Class C	18	27

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 8 50	$ 9 50
Sheets, Blue ann., No. 10	8 50	9 00
Canada plates, dull, 52 sheets	8 50	10 00
Can. plates, all bright	8 60	9 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	11 00	....
Fleur-de-Lis, 28 B.W.G.	10 50	....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28.	....	....
Premier, No. 28, U.S.	11 50	10 50
Premier, 10¾-oz.	11 50	10 90
Zinc sheets	16 50	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	29 50
1¾ in.	31 50	30 00
2 in.	35 00	30 00
2¼ in.	35 00	29 00
2½ in.	42 00	37 00
3 in.	50 00	48 00
3¼ in.	.. ..	48 50
3½ in.	63 00	51 50
4 in.	85 00	65 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	24½
Palacine	27½
Machine oil, per gal.	43½
Black oil, per gal.	18½
Cylinder oil, Capital	82
Cylinder oil, Acme	70
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	$2 60
Union thread cutting oil, antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil, bbls., net	13½

BELTING—No 1 OAK TANNED

Extra heavy, single and double	10%
Standard	10%
Cut leather lacing, No. 1	2 75
Leather in side	2 40

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 60
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	09
Pumice, ground	06
Emery glue	30
Tripoli composition	09
Crocus composition	12
Emery composition	10
Rouge, silver	60
Rouge, powder, nickel	45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE

XXX Extra	.24	Atlas	.20
Peerless	.22½	X Empire	.19½
Grand	.22½	Ideal	.19
Superior	.22½	X Press	.17½
X L C R	.21		

Colored

Lion	.17	Popular	.13
Standard	.15	Keen	.11
No. 1	.15		

Wool Packing

Arrow	.35	Anvil	.22
Axle	.28	Anchor	.17

Washed Wipers

Select White	.20	Dark colored	.09
Mixed colored	.10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades ... 15%

ANODES

Nickel	.58 to .65
Copper	.38 to .45
Tin	.70 to .70
Zinc	.18 to .18

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10.		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6 x 4 base	45 00	44 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 75	$14 50
Sheets, 3½ lbs. sq. ft.	10 50	14 00
Sheets, 4 to 6 lbs. sq. ft.	10 25	13 50

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .23
Acid, hydrochloric	.03¼
Acid, nitric	.10
Acid, sulphuric	.03¼
Ammonia, aqua	.15
Ammonium, carbonate	.20
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.14
Copper, carbonate, anhy.	.41
Copper, sulphate	.16
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.08
Nickel carbonate	.32
Nickel sulphate	.19
Potassium sulphide (substitute)	.42
Silver chloride (per oz.)	1.25
Silver nitrate (per oz.)	1.20
Sodium bisulphate	.11
Sodium carbonate crystals	.06
Sodium cyanide, 127-130%	.38
Sodium hyposulphite per 100 lbs	8.00
Sodium phosphate	.18
Tin chloride	1.00
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated

COAST TO COAST

STEEL & IRON PRODUCTS OF EVERY DESCRIPTION

THE STEEL COMPANY OF CANADA LIMITED

HAMILTON **MONTREAL**

If interested tear out this page and place with letters to be answered.

FOREMAN IN THE PLANT IS THE KEYMAN IN ACCIDENT PREVENTION

R. M. Little, of the National Safety Council, gave several addresses last week to various sections of the Steel Co. of Canada staff at Hamilton. He went fully into the history of the movement, and gave many facts and figures.

The safety measures, he declared, must be looked at from a human point of view, in order that the men might be preserved in good health and free from injury and impairment, to their wives and children. The worker, unless he was protected, was subjected to all kinds of dangers, due to the amount of machinery used in the modern plants now, and many of which dangers he did not formerly have to contend with. At this point the speaker gave a number of actual figures of accidents in plants in the States and these were very interesting. He said that 2,000,000 lost time accidents had been reported during one year, of which 75,000 would be off work for two weeks or more, and 22,500 would never return to their jobs, while from 15,000 to 18,000 suffered impairment for life, thus reducing their economic efficiency 50 per cent. This was the human toll taken by accidents. A tremendous need for the safety movement had sprung from these incredible losses, and it was necessary to form practical methods of combatting the menace.

"Everyone should be interested in the safety movement," he said. "It is a mutual benefit movement. It bears close semblance to a crusade." It object was definite improvement, and in the States alone some $77,000,000 had been expended in various ways by the National Council which had been the means of saving 25,863 men from injury and death. He then told of the safety system as it has been adopted by plants in the States, and laid particular emphasis upon the remarkable decrease in accidents following their adoption. Mr. Little advocated the adoption of a supervisor, the distribution of safety literature, the spreading of careful instruction and the holding of safety meetings. He emphasized the value of team play and co-operation, and spoke of the success of the movement in Akron, Ohio.

"These accidents can and will be prevented, and I feel confident that this plant will make a reduction of from 30 to 35 per cent. in the number of its accidents in the next year. The movement will bring further harmony in the plant."

He stated that the foreman in a plant is the keyman and that it is his duty to take a personal interest in each employee, and his concluding statement was to the effect that the time has come for us to recognize the value of safety, especially following the great loss of life in the war.

STEEL CORPORATION HAS SPENT OVER $71,000,000 IN ITS WELFARE ACTIVITIES

Some idea of the extent to which welfare work has been carried on by the U. S. Steel Corporation, and the wide scope covered, can be gathered from the following resume, given by the director of that department.

Sanitation, including the furnishing of pure drinking water, the expenditure for this work last year amounting to over $3,000,000.

Plant restaurants, where wholesome food is provided at moderate cost and other benefits are enjoyed.

Clubs, including dormitories, reading room and library, gymnasium and swimming pool, baths, auditorium and dance hall, billiard and pool rooms, bowling alleys, basket ball, halls with motion pictures, lectures, concerts, smokers, etc. Good Fellowship clubs organized by employees help members who are in need.

Gardens where flowers are cultivated and vegetables are raised.

Visiting nurses who tend the sick, give instructions in personal and domestic hygiene and domestic science, help families to deal with financial, physical and marital and other domestic troubles, and conduct day nurseries.

Practical housekeeping centres where there are classes for children in sewing, cooking and housekeeping, meetings for the instruction of women, clubs for small girls and boys, and clubs or associations for women employees.

Playgrounds, which are enjoyed by thousands of little folks.

Picnics, which are attended by very large numbers, one at Duquesne, Pa., by 20,000 people.

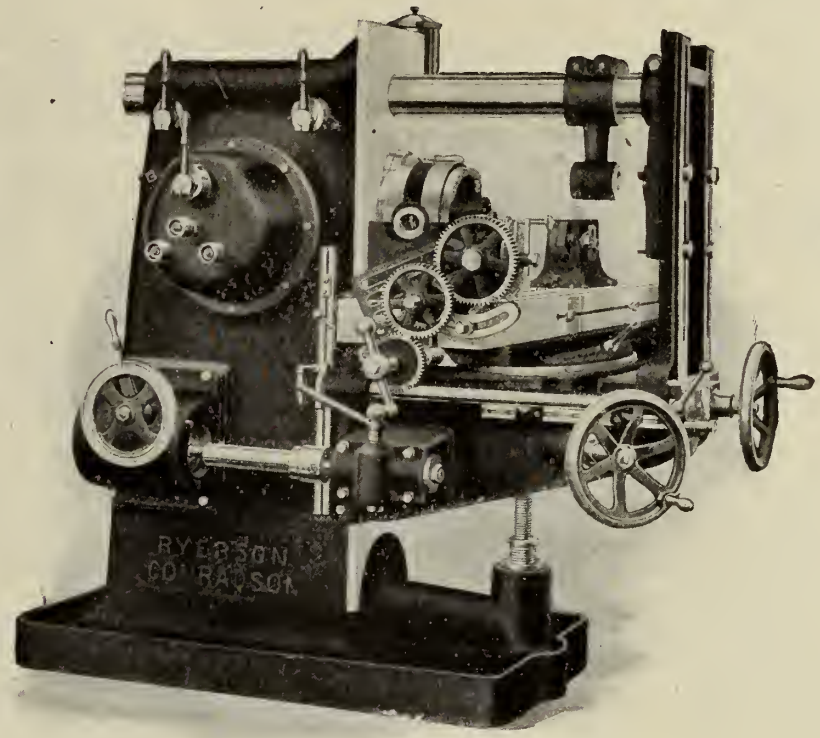
Musical organizations, including the famous Liberty Chorus, composed of employees from two plants of one of the Western subsidiary companies. This chorus appeared many times for war activities, and made a special trip at its own expense to New York to sing at meetings at the Carnegie Music Hall, on the steps of the Sub-Treasury Building, and other places.

Dental clinics, where the teeth of children are properly treated and the tooth-brush drill is made the opening exercise every day in school. Service is

HE'S GOTTA COME DOWN
—Talburt in the Toledo "News-Bee."

High Power Milling Machines

In Stock for Immediate Shipment



No. 3 Universal Milling Machine

U.S. and Foreign Patents

We have a number of Ryerson-Conradson High Power Milling Machines (both plain and universal) in stock at our Chicago Plant, ready for immediate shipment.

In designing the Ryerson-Conradson Millers our main object was to provide a tool with great power, rigidity, convenience of operation and adapted to light and heavy manufacturing and jobbing work.

Twelve spindle speeds, ranging from 17 to 290 R. P. M. in practically geometrical progression and sixteen feed changes ranging from .6 to 22.3 in. per minute can be obtained.

Write for Bulletin No. 5015

ESTABLISHED 1842 INCORPORATED 1888

JOSEPH T. RYERSON & SON

CHICAGO, ILL., U.S.A.

Canadian Representatives: MACHINERY

GARLOCK-WALKER MACHINERY CO., 32-34 Front Street, TORONTO

MONTREAL WINNIPEG

If interested tear out this page and place with letters to be answered.

also provided for adult employees at reduced costs.

The stock subscription plan which last year resulted in 66.311 employees subscribing for stock in the corporation.

Pensions, which are granted to retiring employees.

Since the inception of this work the following amounts have been spent on it:

	Totals
Welfare	$11,751,428.02
Sanitation	11,732,666.20
Accident prevention	6,530,706.43
Relief for injured men and the families of men killed	22,652,237.68
The employees' stock subscription plan (approximate)	9,160,000.00
For pension fund payments in excess of income provided by permanent fund	1,824,692.56
Note—Total pension payment to employees for additional benefit payments and administration cost	4,819,357.63 / 294,212.57
For the creation of a permanent fund	8,000,000.00
Total	$71,651,731.89

PLANNING FOR NEW FREIGHT SERVICE

Canadian Government Railways Have Several Schemes Under Way to Extend Trade

The Canadian Government Mercantile Marine has a further extensive programme of expansion under way, though delivery of ships now on the stocks on time will decide the rapidity with which it can be put into effect.

The first new services will be to the Orient from both Atlantic and Pacific ports, and R. C. Vaughan, assistant to President D. B. Hanna, stated that the Atlantic service had practically been decided upon. It will be inaugurated next August with the sailing of a steamship from Montreal to India, via the Suez canal, calling in all probability at Karachi, Bombay and Columbia. If a sufficiency of freight offers, it is probable that a regular service will be maintained from Montreal in summer and a maritime port in winter.

A number of new services are under consideration, Mr. Vaughan states. Data are being compiled at the present time and much depends on the prompt delivery of new bottoms, for C. G. M. plans have been more or less interfered with by delay in delivery of new ships, due largely to labor troubles in the shipyards.

The second new service will also be to the Orient and will run from Vancouver, calling probably at one or two Chinese ports, then on to Singapore, Straits Settlements, then to Calcutta. Rangoon may also be a port of call. Still other services are contemplated, but no definite decision has been reached.

NEW EQUIPMENT ORDERED FOR 1920

National Railways Have Placed Orders For Additions to Their Present Outfit

The Canadian National Railways have ordered their new equipment for the year 1920. The new contracts call for 117 locomotives of various types, freight cars, refrigerators, cabooses and ballast cars to the number of 5,556; passenger coaches, sleepers, diners and baggage cars, 100. During the past year 985 passenger cars of all types were delivered, including colonist and baggage cars; 2,200 freight cars, including 750 steel-frame box cars, and 82 passenger cars with diners and observation cars. Of the 1919 contracts there remain to be delivered 13 observation buffet compartment sleepers and 13 first-class coaches of steel construction.

DON'T GET CAUGHT NAPPING OFF BASE

What Hamilton Man Thinks of the Present Situation in Sheets and Plates

In the memory of some of the oldest merchants, iron and steel sheets and plates were never so scarce or deliveries more uncertain for such a period of time as at present.

A. T. Enlow, president of the Dominion Sheet Metal Corporation, Ltd., Hamilton, Ont., in discussing the sheet and plate situation, stated:—

The whole world is short of sheets, but particularly are stocks in Canada depleted now. The automobile interests have had their fill while others waited. and now a better supply may reasonably be expected to flow again in accustomed channels, but at what price is a matter of conjecture.

It is, perhaps, a somewhat trite statement to make, but nevertheless true. that one cannot with any accuracy foretell coming tendencies in the steel world, and particularly as to black and galvanized sheets.

The market will undoubtedly be most largely influenced and governed by events occurring in the United States, and if there was any considerable production for a decent period I am quite confident that United States sheet prices would recede.

The question remains—Will production resume in large volume, or will strikes, embargoes, laziness, politics, and innate "cussedness" continue to hamper and reduce it?

I am still of the opinion that at present "topnotch" prices one should buy only for immediate and reasonably sure resale and let the future take care of stock at prices which will certainly be much less than at present.

It is not wise, however, to miss a sale and a profit, however high the price may be, and people must have a certain amount of steel sheets to enable them to "carry-on." Play the game, but don't get "caught napping" off the base.

TRADE GOSSIP

Given Increase. — Official announcement has been made to the effect that all the employees of the Canadian Locomotive Works at Kingston, commencing June 15th, receive an increase of fifteen per cent. in wages. About ten days ago there was a report that the company had decided to increase the wages 10 per cent., in fact some of the unions had accepted the proposed increase and had signed up for a period of one year. It is stated that the increase was not acceptable to all the unions as some had asked for an increase of 25 per cent. The 15 per cent. has been accepted.

Building Additions. — Three big contracts, totalling probably half a million dollars, are said to have been awarded by Canadian National Railway directors at a meeting in the central offices, Toronto St., Toronto. One of the largest pieces of Canadian National Railway work pending, the Prince Albert north extension, was not dealt with, no tenders having been received. The three awards are: Acadian Valley extension, to John Timothy, at a unit price; Turtleford extension, to J. W. Miller, Western Construction Co.; McGiveny Junction, N.B., revision contract, to H. R. Stewart. In each instance the contract was awarded to the lowest tenderer. Each of the construction works involves an expenditure of over $100,000.

TENDERS

The Naval Service, at Ottawa, is receiving tenders up to August 2 for the following ships: Niobe, steel cruiser, armored; Rainbow, steel cruiser, which could be used as a cargo vessel with slight alterations; The Grilse, oil burning steel pleasure yacht; Canada, steel, built in 1904. The Rainbow is lying at Esquimalt, B. C., and the others at Halifax.

Big Order Received.—The rolling of a 7,500-ton rail order was started at the rail mill of the steel company at Sydney. This order has been received from the Canadian National Railways, and will keep the rail mill running for a period of six weeks. A conference was held between representatives of the striking machinists, 115 of whom have been out now for two months, but nothing definite was arrived at. The company offered a compromise wage advance, but refused to grant them a nine-hour day.

Incorporation has been granted to Dominion Motor Car Co., Winnipeg, for making, buying. selling, etc., motors, bicycles, etc. The capital is $400,000.

A man is paid back in precisely the same coin he pays out. If he plants weeds or mean impulses, the harvest will be weeds and mean impulses. If he plants seed of good deeds he will harvest good deeds.

MAKE MORROW DRILLS STANDARD IN YOUR SHOP

Try Your Jobber First

You can't successfully compete if you have inferior tools, antiquated machines or lazy workmen. Get up-to-date everywhere. Supply each drill operator with **"Morrow"** drills and he'll easily keep up his end.

JOHN MORROW SCREW & NUT CO., LIMITED

INGERSOLL, CANADA

MONTREAL
St. Paul Street

WINNIPEG
Confederation Life Bldg.

VANCOUVER
1290 Homer St.

7 Hop Exchange, Southwark St., London, England

If interested, tear out this page and keep with letters to be answered.

THE "FLU" Stayed out of this PLANT

PURO SANITARY DRINKING FOUNTAIN

(MADE IN CANADA)

The only fountain with a bowl that prevents lips touching the bubbler paid its moderate cost over and over in all those well ordered plants whose precautionary measures successfully barred the Spanish influenza. PURO saves lives, time and water. Write

Puro Sanitary Drinking Fountain Co.

147 University Ave. Toronto, Canada

LIMITED BLEEKER 138 Yonge St. TORONTO

WHEN WRITING TO ADVERTISERS KINDLY MENTION THIS PAPER

INTERESTING ITEMS TO BE FOUND IN THIS WEEK'S ADVERTISING SECTION

Are you getting production proportional to your wage increase? If not, one answer is to be found in this issue.

A city that boasts of its industrial advantages.

An important announcement regarding a new book which can be procured free.

A tool manufacturer who claims he has enjoyed 15 years of satisfied users.

A machine that takes the kinks out of wire.

Something that reduces the cost of maintenance.

A machine that turns out axle bands for wheeled floor toys at the rate of 1,000 per hour.

A goggle that has a non-twisting front.

How to overcome the summer slump.

Why a workman is the best judge of a file.

A device that holds either straight or taper work.

When it is not wise to experiment.

A big thing to watch in ball-bearings.

The fact that reamer blades must be accurate.

A metal that is claimed to be the master of steel.

Something that's known from coast to coast.

Incorporations

written √— or √— as the case may

The Autostrop Safety Razor Co. has increased its capital from $20,000 to $125,000.

Incorporation has been granted to Collingwood Shipbuilding Corporation, with capital stock of $100.000. The chief place of business is to be at Montreal. The powers of the company are very wide and take in a large number of future possibilities.

Port Arthur Shipbuilding Co. has been incorporated, the operations to be carried on throughout the Dominion of Canada. Capital stock $100,000. Head office at Montreal.

The Kemp Metal Auto Wheel Co. has been granted incorporation to buy, sell, make, etc., auto and metal wheels in all their branches, etc. Capital stock, $100,000, and the head office in Toronto.

The C. P. H. Gas Engine Co. of Canada has been incorporated at Ottawa, with capital at $100,000, and head office at Montreal. The company is empowered to make, operate, sell, etc., meters or engines bearing the trade mark "C. P. H."

Higher Prices for Gas.—The Brantford city council protested against the increased price of gas from 45 cents to 85 cents per thousand, but on account of the agreement which the city drafted in 1904, and which gave the gas company the right to the increase, the city will not be able to fight it.

Trade Gossip

Meeting of Nova Scotia.—A meeting of the shareholders of the Nova Scotia Steel & Coal Company has been called for June 25th. The meeting will be held in New Glasgow, and the chief business will be the ratification of the merger with the Dominion Steel and other concerns which will make up the British Empire Steel Corporation.

Coming From Germany.—According to an Ottawa despatch the articles being imported from Germany into Canada at the present time are chiefly metal, for use inclusively in mining or metallurgical operations, machinery composed wholly or in part of iron or steel, and iron or steel integral parts thereof, musical instruments and precious stones, while the importation frem Austria is practically confined to electric insulators. This information was given in answer to a question by Fernand Rinfret (St. James, Montreal), in the House of Commons.

New Cockshutt Warehouse. — The Cockshutt Plow Co., Ltd., who for the past four years have had their offices over the C. N. R. Telegraph office in Edmonton, are erecting a two-story brick building with a full concrete basement on 9909,102 A. on Rice street, opposite the city market square. The building will be fifty feet wide and eighty-five fet long. The main floor will be used as a display room, while the second floor will be used entirely for offices, from which all of the company's work for central and northern Alberta will be directed. Manager Fred Pickles says that business in the machine line this year is better than ever, and that the prospects for the future are better than at any time during the five years that the company have had their offices located here. With a display room in the centre of the city he expects that they will be able to more efficiently handle the local trade.

ARMOR PLATE SCRAP AT SANDY HOOK

The Oxweld Acetylene Company, of Newark and Chicago, which was recently awarded the Government contract for cutting 4,000 tons of armor plate scrap to charging box size at Sandy Hook, now has a crew of oxy-acetylene cutter on the job. The plates, 3 in. thick by about 9 ft by 13 ft., weigh between seven and eight tons each, and are being cut into sections 13 in. by 25 in., each weighing around 300 pounds. The weights vary somewhat owing to the necessity for cutting through the shell holes, each plate having been punctured six times by heavy artillery shells for which they were made the targets in the big gun tests conducted at Sandy Hook during the war.

This is one of the largest jobs of the kind that has ever been undertaken and several weeks will be necessary to complete the work.

A B C OF WELDING

(Continued from page 577)

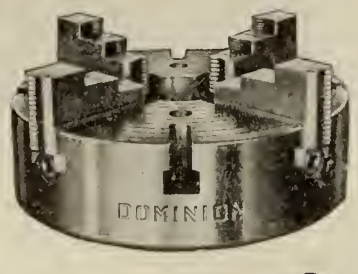
ordinarily required. This is because of the severity of this test—the natural tendency being for the break between the plates to continue in the same direction.

The applications of the fillet weld in its varied forms are unending. When properly executed it forms a perfect bond that will endure strain from whatever direction it may be applied.

As ordinarily executed penetration even of the 90 degree angle between the two sections of metal is seldom secured. The amount of filler added should be kept at a minimum, the chief function of the rod being to protect the vertical piece of metal A. It is held at all times near the top of the weld, and tends by its capillary action to support the melted metal in the position shown.

The chief difficulty to be eliminated is the tendency to speed up the weld at the expense of lack of penetration, and a certain tendency to form "craters" or "blow holes" in the weld. When these are formed they can be eliminated only by going continually around them with the flame. Any attempt to melt them out by holding the flame within the crater will prove but waste of effort.

In making tests of welds of this character all efforts should be directed toward hammering the vertical plate A down over and across the weld. It will be found as soon as the operator is able to secure proper penetration and form a line of beads on the reverse side of this plate that the weld cannot be broken open by hammering.



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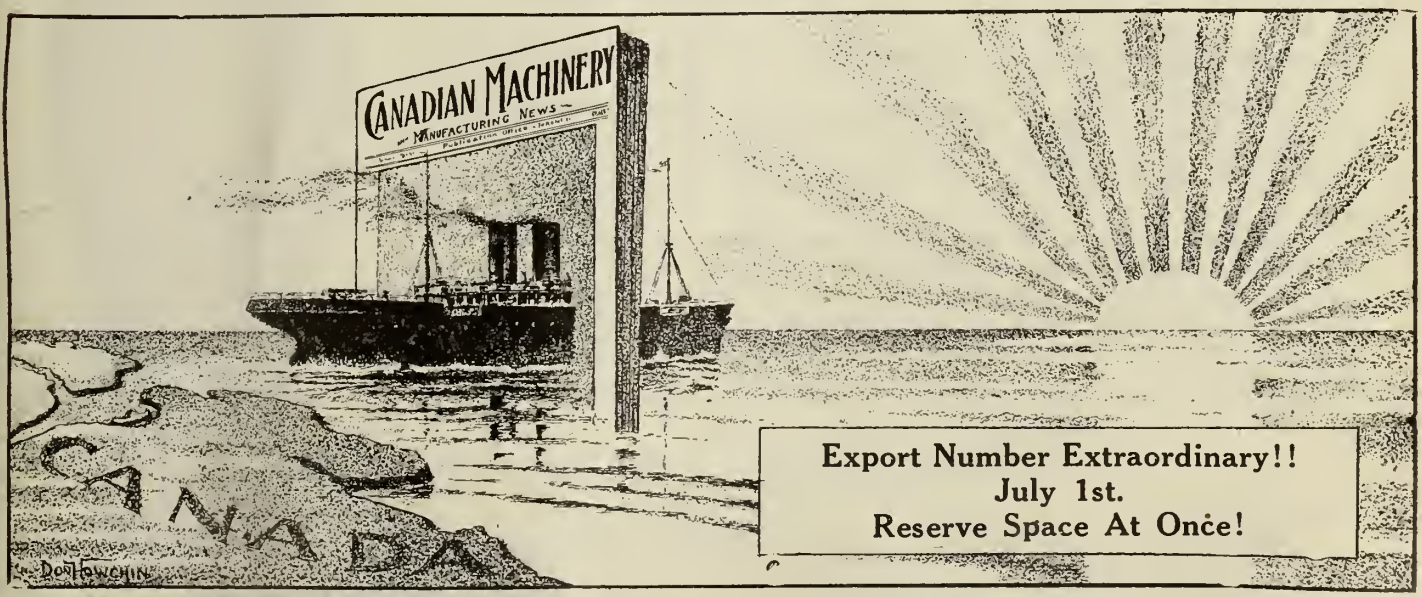

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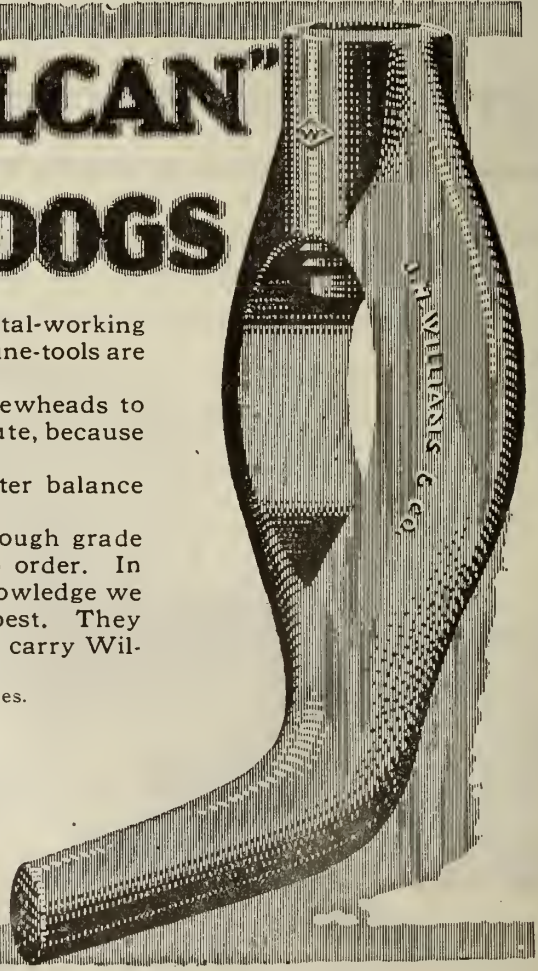

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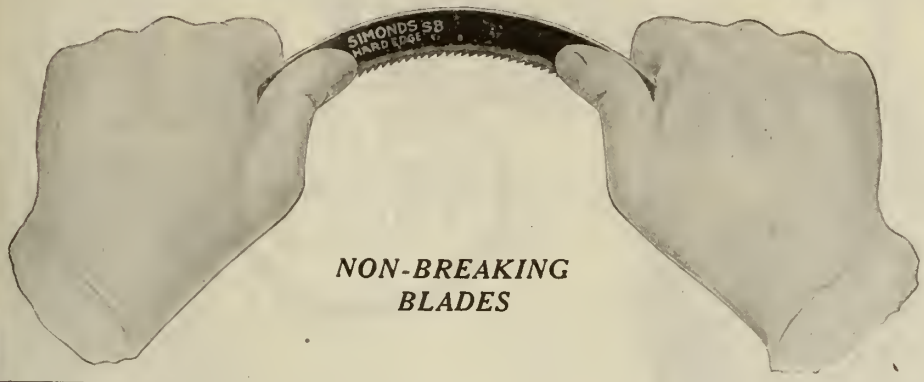

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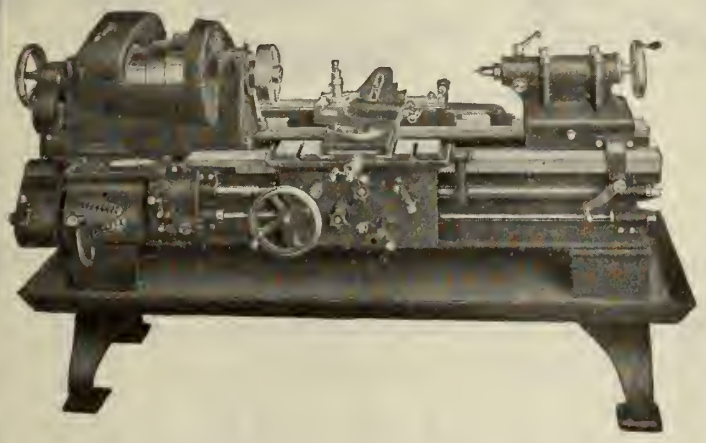

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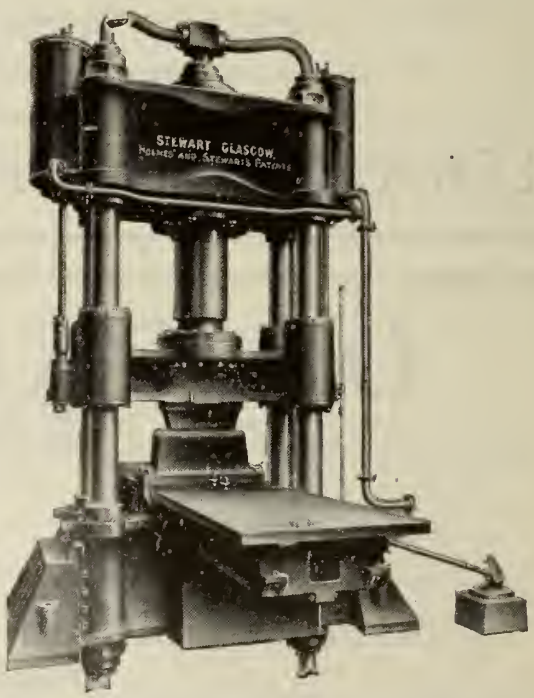

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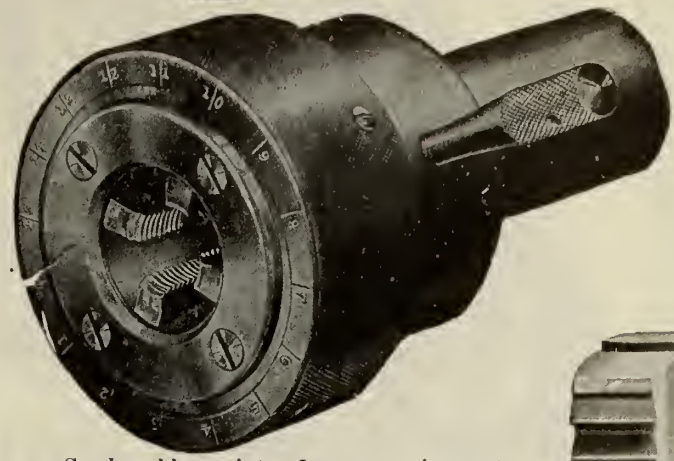

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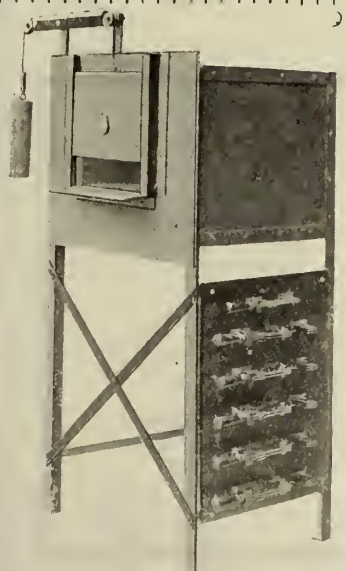

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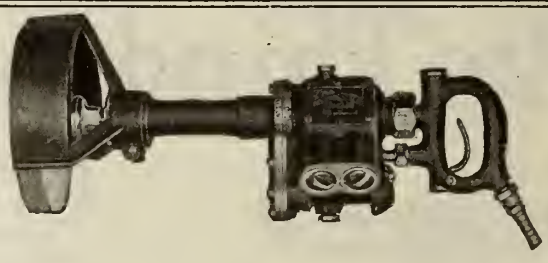

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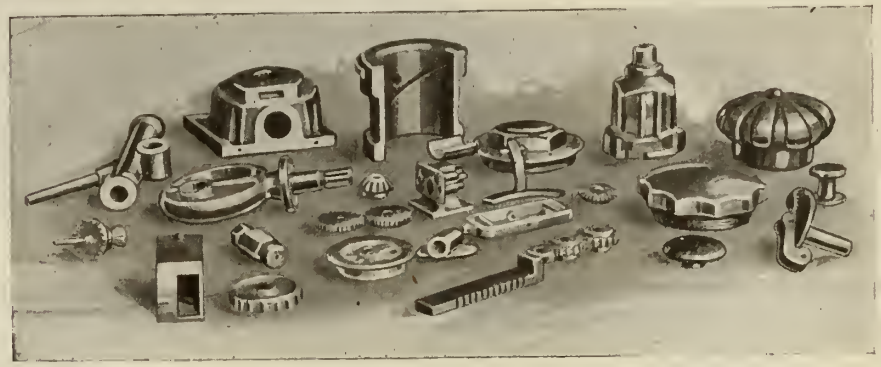

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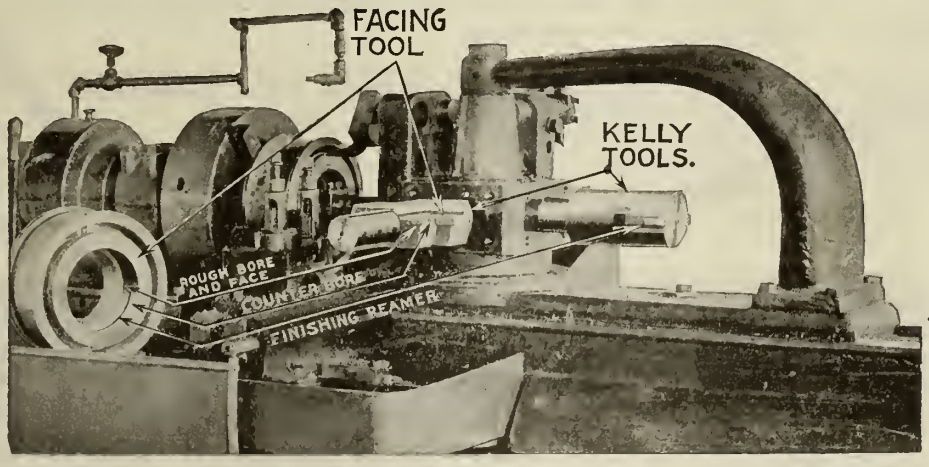

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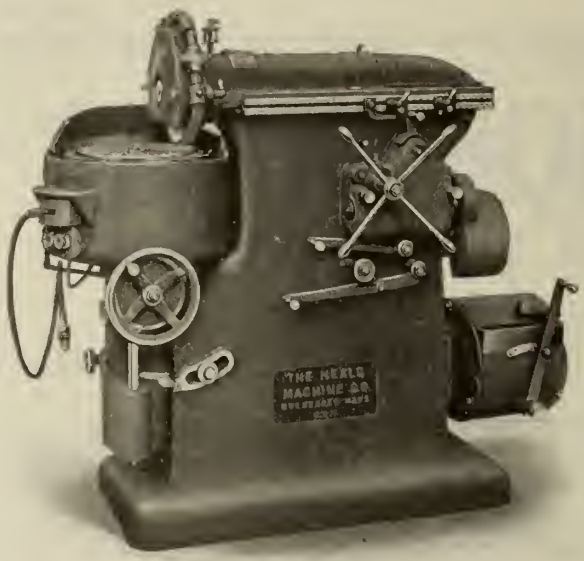

Front view of Style No. 22 with 12-in. Magnetic Chuck.
Machine of similar construction can be furnished with 8-in. chuck.

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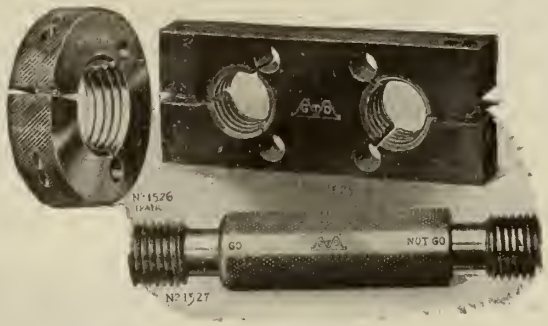

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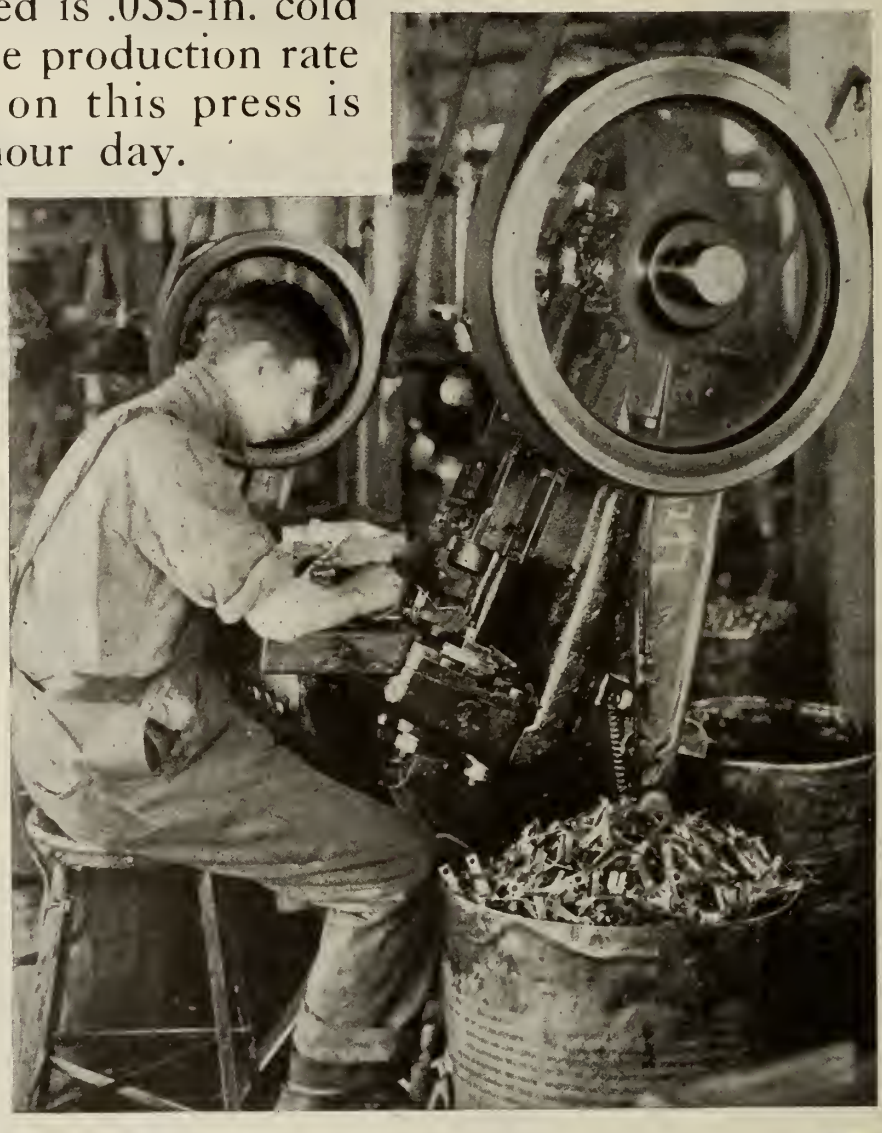
The material used is .035-in. cold rolled steel. The production rate for this article on this press is 10,000 per 10-hour day.



The press was installed about six years ago, it has been working continuously ever since, giving excellent service, and it looks to be good for many more years' use.

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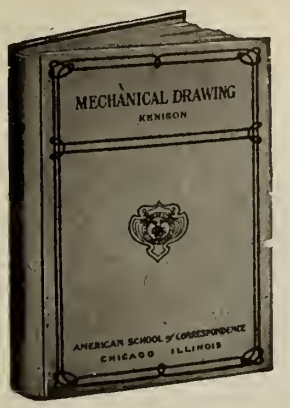

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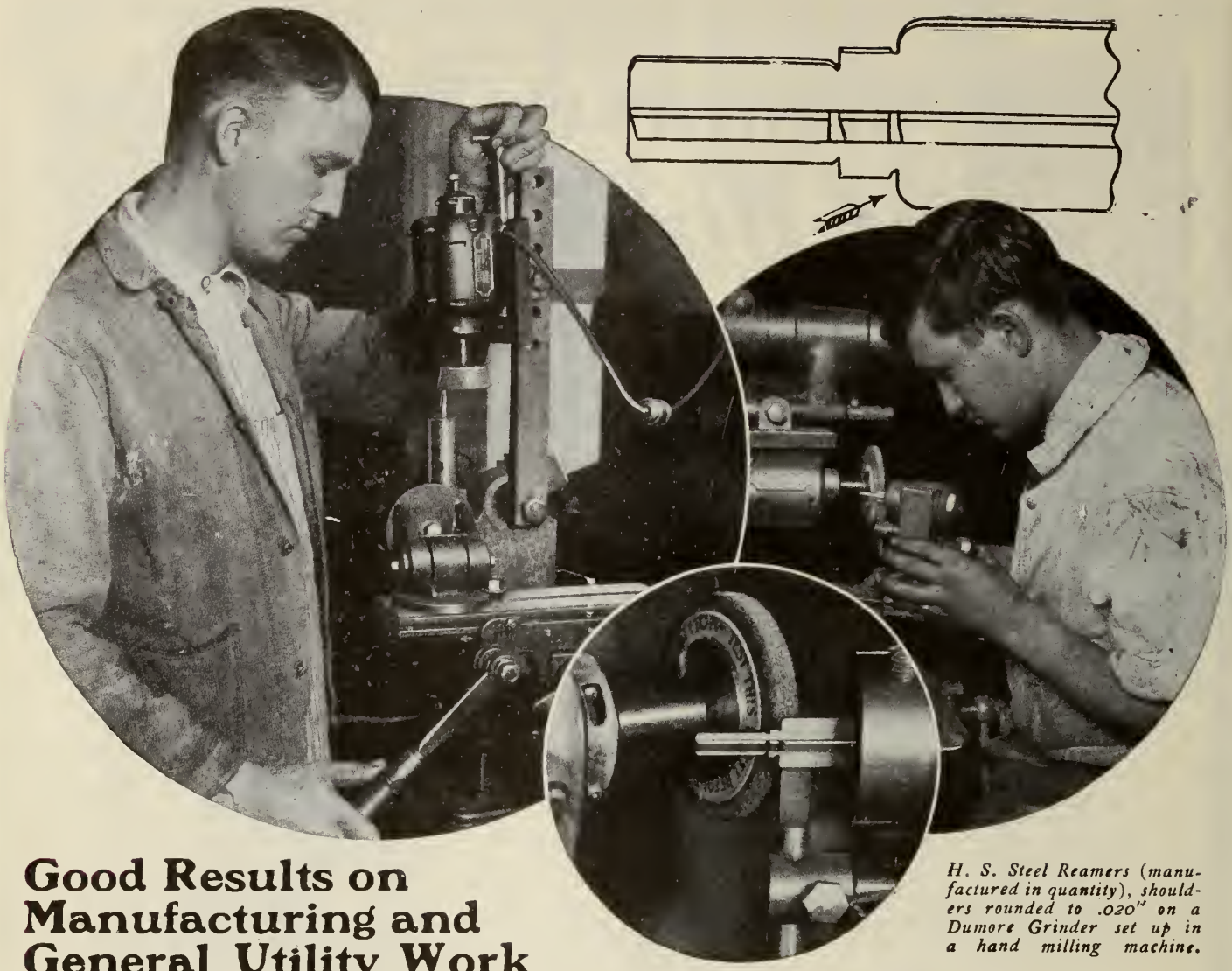

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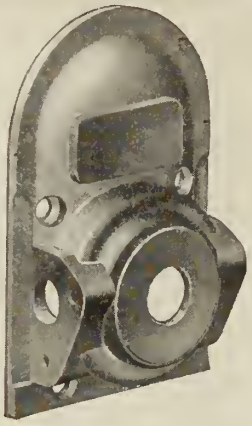

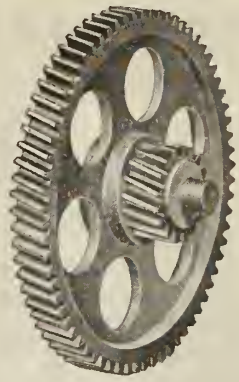

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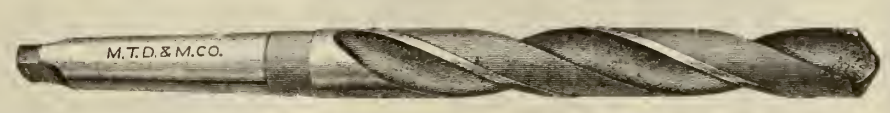

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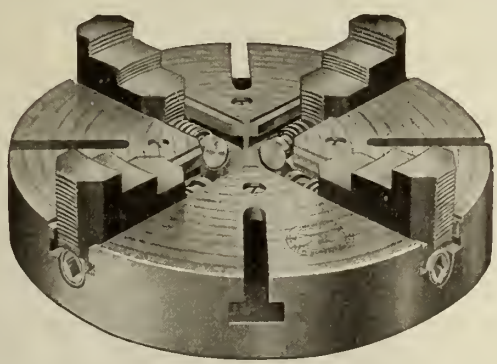

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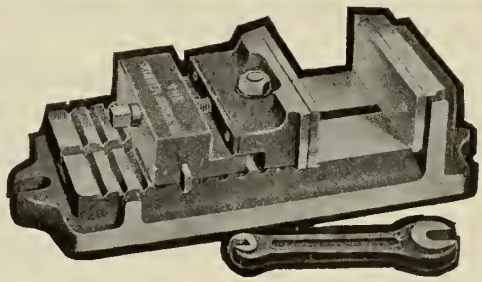

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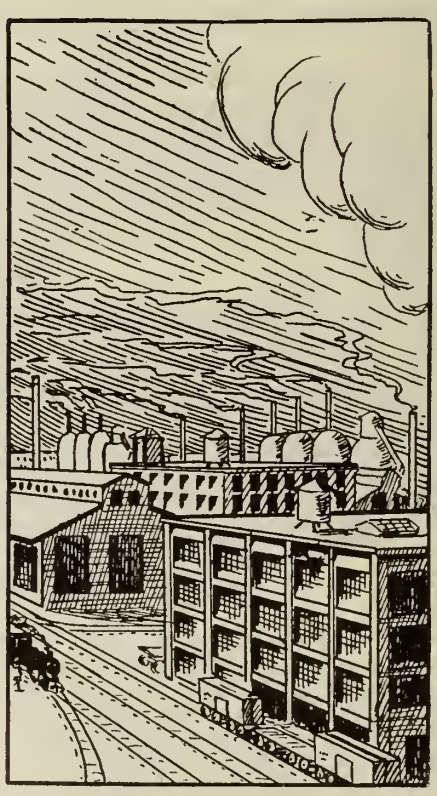

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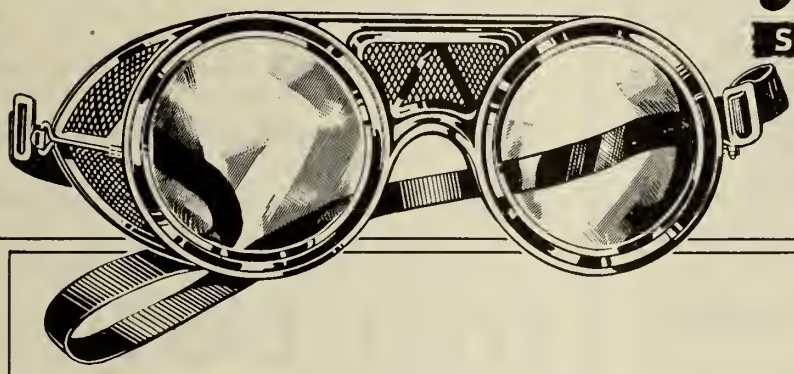

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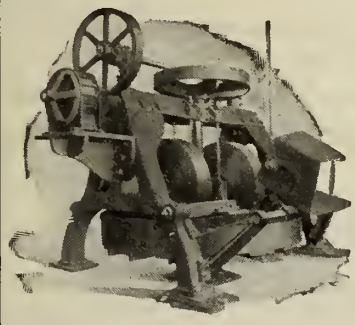

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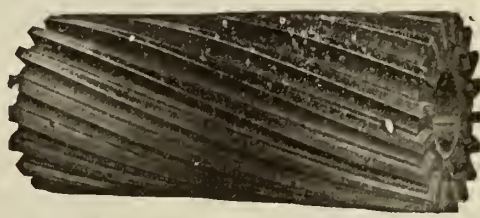

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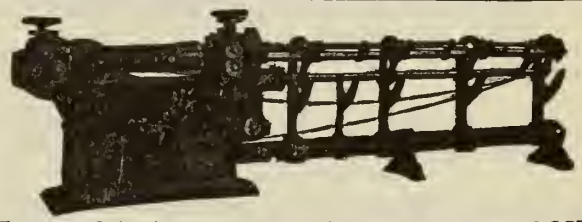

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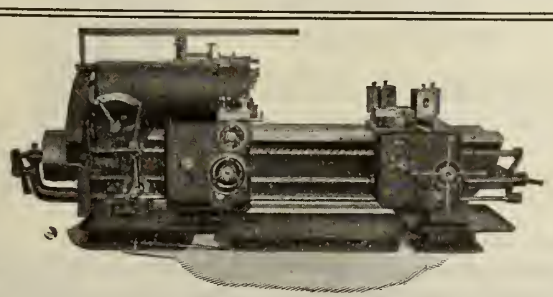

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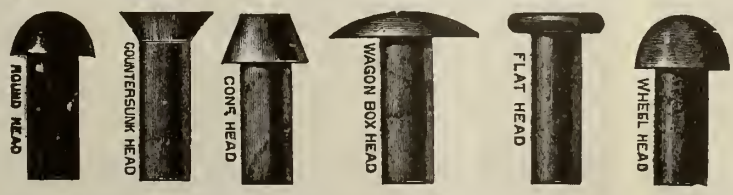

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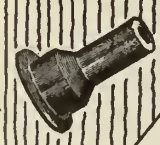

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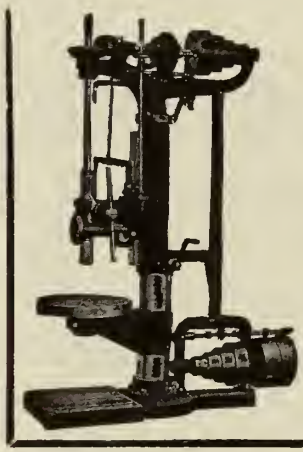

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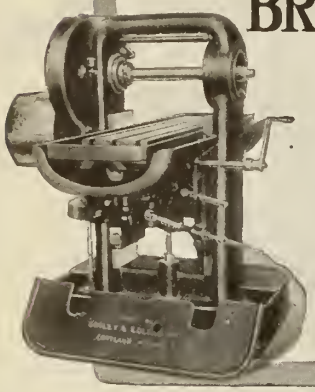

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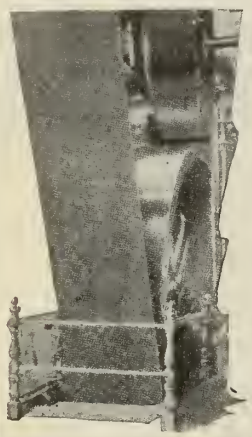

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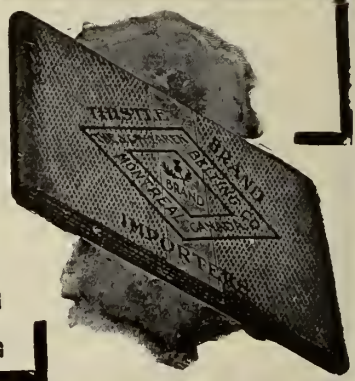

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Bertram & Sons Co., John, Dundas
Brown-Boggs Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Kitchener.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Mach. Co., Toronto.
Petrie, Ltd., H. W., Toronto.

BLAST GATES
W. S. Rockwell Co., New York, N.Y.

BLASTING MACHINES, SAND
Garlock-Walker Machinery Co., Toronto.
Jardine, A. B., & Co., Hespeler, Ont.
National Mach. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont

BILLET MARKERS
Matthews & Co., Jas. H., Pittsburgh, Pa.

BILLETS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Swedish Steel & Importing Co., Ltd., Montreal.
Algoma Steel Corp., Sault Ste. Marie
Kayser-Ellison & Co., Ltd., Montreal
Marshall, Son & Bunney, Toronto
United States Steel Corp., Canton, Ohio.

BILLETS, FORGING
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal

BINS, STEEL
Dennis Wire & Iron Works, London, Ont
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Toronto Iron Works, Ltd., Toronto, Ont.
Willis's Hamilton Co., Peterboro, Ont.

BLACKSMITH WORK
The Thos. Pink Co., Ltd., Pembroke.

BLOCKS, CHAIN
Oliver Engineering Co., Montreal.

BLOOMS AND SLABS
Algoma Steel Corp., Sault Ste. Marie
United States Steel Corp., Canton, Ohio.

BLOWERS
Can. Blower & Forge Co., Kitchener, Ont.
Garlock-Walker Machinery Co., Toronto.
MacGovern & Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
U.S. Ordnance, Toronto, Ont.

BLOWING ENGINES
General Combustion Co., Ltd., Montreal, Que.

BLOW PIPES AND REGULATORS
Carter Welding Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

BLUE PRINTING MACHINERY
Commercial Camera Co., Providence, R.I.

BLUE PRINT PAPER
Hughes, Owens Co., Ltd., Montreal, Que.

BOARDS, GLASS CUTTING
Lufkin Rule Co., of Can., Windsor, Ont.

BOARTZ
Joyce, Koebel & Co., Inc., New York.

BOLT CUTTERS
Greenfield Tap & Die Corp., Greenfield Mass

BOILER TUBES
Lyman Tube & Supply Co., Montreal, Que.

BOILER BREECHINGS
Que.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
St Lawrence Welding Co, Ltd., Montreal
William Hamilton Co., Peterboro, Ont.

BOLT CUTTERS
Fellows Gear Shaper Co., Springfield, Vt.
Greenfield Tap & Die Corp., Greenfield Mass.
Wells Bros., of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.

BOILERS, RANGE
Can. John Wood Mfg. Co., Ltd., Toronto Ont.

BOILERS
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.

BOLT CUTTERS AND NUT TAPERS
Aikenhead Hardware Co., Toronto, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Landis Machine Co., Waynesboro, Pa.
A.B. Jardine & Co., Ltd., Hespeler Ont.
Rice Lewis & Son, Toronto, Ont.
Wells Bros. Co. of Canada, Galt, Ont.
Petrie, Ltd., H. W., Toronto.

BOLTS
Aikenhead Hardware Co, Toronto, Ont.
London Bolt & Hinge Wks., London, Ont.
Morrow Screw & Nut Co., John, Ingersoll.
Rice, Lewis & Son, Toronto, Ont.
Steel Co., of Canada, Ltd, Hamilton.
Wilkinson & Kompass, Hamilton, Ont.
Williams & Co., J. H. Brooklyn, N.Y.

BOLTS, COUPLING
Gest Machine Screw Co., Ltd., Galt, Ont.

BOLTS, STAY
Morrow Screw & Nut Co., John, Ingersoll.

BOLTS, SPRING SHAKLE
Can. Winkley Co., Ltd., Windsor, Ont.
Morrow Screw & Nut Co., John, Ingersoll

BOLTS, PATCH
Morrow Screw & Nut Co., John, Ingersoll.

BOLT AND NUT MACHINERY
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto
Gardner & Son, Robt., Montreal.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Universal Mach, Co., Bowling Green, O.
Williams Machinery Co., A. R., Toronto

BOLT THREADING MACHINERY
Jardine & Co., Ltd., B., Hespeler.
Landis Machine Co., W esboro, Pa.
National Acme Co. Cleveland, Ohio.
Victor Tool Co., Waynesboro, Pa.

BONDING MACHINES (Electric Railway)
The Lincoln Electric Co., Toronto, Ont.

BORING MACHINES, PNEUMATIC CYLINDER
Cleveland Pneumatic Tool Co., Toronto.
Canadian Fairbanks-Morse Co., Montreal
Can. Ingersoll-Rand Co., Sherbrooke Que
Garlock-Walker Mach. Co., Toronto.

BORING MACHINES, UPRIGHT AND HORIZONTAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto
Oliver Mach'y Co., Grand Rapids, Mich.
Gisholt Machine Co., Madison, Wis.
Hoefer Mfg., Co., Freeport, Ill.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Rockford Drilling Mchs. Co, Rockford, Ill

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Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
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Oliver Mach. Co., Grand Rapids, Mich.
Niles-Bement-Pond Co., New York.

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Canada Metal Co., Toronto.
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BRASS PIPE AND TUBE
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Barber Mchy. Co., Ltd., Toronto, Ont.
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Garlock-Walker Machinery Co., Toronto.
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Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Prest-O-Lite Co., Inc., Toronto, Ont.
Wood Turret Machine Co., Brazil, Ind.
Williams Machy. Co., A. R., Toronto.
Brown's Copper and Brass Rolling Mills, New Toronto.

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Canada Metal Co., Toronto.
Tallman Brass and Metal Co., Hamilton.

BRONZE COPPER
Canada Metal Co., Toronto,

BRUSHES, CARBON
Lyman Tube & Supply Co., Montreal, Que.

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Ford-Smith Mach. Co., Hamilton.
Foss Mchy. & S'ply Co., Geo. F. Montreal
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.

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MacKinnon Steel Co., Sherbroooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
St Lawrence Welding Co, Ltd , Montreal

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Can. Link-Belt Co., Toronto, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
nce Welding Co. Ltd., Montreal

BUCKETS, CLAM SHELL, CRAB, DUMP
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Ltd, Walkerville.

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Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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W. S. Rockwell Co., New York, N.Y.

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Parmenter & Bulloch Co., Gananoque,.

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Morrow Screw & Nut Co., John, Ingersoll.
St Lawrence Welding Co, Ltd., Montreal

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Pangborn Corporation, Hagerstown, Md.

CABINETS, SAND BLAST
Pangborn Corporation, Hagerstown, Md.

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International Machinery & Supply Co., Ltd., Montreal, Que.

CABLES, TRANSMISSION AND TELEPHONES
Northern Electric Co., Ltd., Montreal.

CALKS, BOOT
Lufkin Rule Co., of Can., Windsor, Ont.

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Brown, Boggs & Co., Hamilton, Can.

CANNERS' CONVEYORS
Can. Link-Belt Co., Toronto, Ont.

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Carter Welding Co., Ltd., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.
Union Carbide Co., of Canada, Limited, Weland, nt.

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Can. Driver-Harris Co., Ltd., Walkerville
Katie Foundry, Galt, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
Swedish Crucible Steel Co. Windsor.

CARRIERS, PNEUMATIC TUBE
Jones & Glassco, Montreal.

CARS, INDUSTRIAL
Can. Blower & Forge Co., Kitchener, Ont
Can. Fairbanks-Morse Co., Ltd, Montreal
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

CASES, FILING
Economy Drawing Table Co., Adrian, Mich.

CASTINGS, ALUMINUM, BRASS BRONZE, COPPER, AND GUN METAL
Algoma Steel Corp., Sault Ste. Marie.
Franklin Mfg. Co., Syracuse, N.Y.
Canada Metal Co., Ltd., Toronto, Ont.

CASTINGS, DIE CAST
Canada Metal Co., Ltd., Toronto, Ont.
Franklin Mfg. Co., Syracuse, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Tallman Brass & Metals Ltd., Hamilton, Ont.

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Canada Electric Castings, Ltd., Orillia, Ont.
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Electric Steel & Metals Co., Welland.
Mesta Machine Co., Pittsburgh, Pa.

CASTINGS, ELECTRIC AND ALLOY STEEL
Can. Elec. Castings Co. Ltd., Orillia, Ont
Dominion Foundries & Steel Ltd., Hamilton, Ont.

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John Morrow Screw & Nut Co., Ingersoll
Alexander Fleck Ltd., Ottawa.
Tallman Brass & Metal Co., Hamilton.

CASTINGS, BENCH LEG.
Brown & Sharpe Mfg. Co., Providence, R.I.

CASTINGS, BRASS AND IRON
Algoma Steel Corp., Sault Ste. Marie.
International Machinery and Supply Co., Ltd., Montreal, Que.

CASTINGS, BUILDING
Katie Foundry, Galt. Ont.

CASTINGS, GRAY IRON
Bernard Industrial Co., A., Fortierville, Q.
Brown & Sharpe Mfg. Co., Providence, R.I.
Brown, Boggs Co., Ltd., Hamilton.
Can. Elec. Castings Co, Ltd., Orillia, Ont
Alexander Fleck, Ltd., Ottawa.
Gardner & Son, Robt., Montreal.
Hull Iron & Steel Foundries, Ltd., Hull
International Malleable Iron Co., Guelph
Kennedy & Sons, Ltd., Wm., Owen Sound.
Katie Foundry, Ltd., Galt, Ont.
Hamilton Co., Wm., Peterboro.
McFarlane Engineering Ltd., G. W., Paris, Ont.

CASTINGS, PLUMBERS'
Katie Foundry, Galt, Ont.

CASTINGS, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville

CASTINGS, HARDWARE
Katie Foundry, Galt, Ont.

CASTINGS, STEEL CHROME AND MANGANESE STEEL
Thos. Davidson Mfg. Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hull Iron & Steel Foundries, Ltd., Hull.
Kennedy & Sons, Ltd, Owen Sound.

CASTINGS, MALLEABLE
International Malleable Iron Co., Guelph

CASTINGS, NICKEL STEEL
Hull Iron & Steel Foundries, Ltd., Hull.

CEMENT MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gardner, Robt., & Son, Montreal.

CEMENT HANDLING MACHINERY
Can. Link-Belt Co., Toronto, Ont.

CEMENT TOOLS
Atkins & Co., E. C., Hamilton, Ont.

CENTERING MACHINES
Victoria Foundry Co., Ottawa, Ont.

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Bertram & Sons Co., John, Dundas.
Butterfield & Co., Inc., Rock Island, Que.
Gardner, Robt. & Son, Montreal.
Hurlburt, Rogers Mch. Co., South Sudbury, Mass.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co., of Canada, Galt, Ont.

CHAIN, WELDED COIL
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

CHAIN BLOCKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford Chain Block & Mfg. Co., Phila., Pa.
Garlock-Walker Machy. Co., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & HoistCo., Herbert, Niagara Falls, Ont.
Oliver Engineering Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Jones & Glassco, Montreal, Que.

CHAINS, AGRICULTURAL
Canadian Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.

CHAINS, AUTOMOBILE ENGINE
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.

CHAINS, BICYCLE, DRIVE AND BLOCK
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAINS, FOR ELEVATORS AND CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAIN, MALLEABLE, DETACHABLE AND RIVETED
Can. Link-Belt Co., Toronto, Ont.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAINS, POWER TRANSMISSION
Canadian Link-Belt Co., Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, New York.
Glasgow, N.S.

CHAINS, SPROCKET WHEEL
Can. Link-Belt Co., Ltd., Toronto, Ont.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAIN DRIVES
Can. Link-Belt Co., Toronto, Ont.
Coventry Chain Co., Coventry, England.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHASERS
National Acme Co., Cleveland, Ohio.
Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont.

CHEMISTS
Toronto Testing Lab'tory, Ltd., Toronto

CHUCKS, AERO, AUTOMATIC
Garvin Machine Co., New York.

CHUCKS, CENTERING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKS, COLLET, AIR
Elliott & Whitehall Mach. & Tool Co. Galt, Ont.
Smalley-General Co., Inc., Bay City, Mich.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, LATHE AND UNIVERSAL
Aikenhead Hardware Co., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt., & Son, Montreal.
Garlock-Walker Mach'y Co., Toronto.
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Chicago, Ill.
Jacobs Mfg. Co., Hartford, Conn.
Ker & Goodwin Machine Co., Ltd., Knight Metal Products, Toronto.
Modern Tool Co., Erie, Pa.
Rice Lewis & Son, Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, AUTOMATIC AND KEYLESS
Aikenhead Hardware Co., Toronto, Ont
Can. Blower & Forge Co., Kitchener.
McCrosky Tool Corp., Meadville, Pa., U. S. A.

CHUCKS, FRICTION AND TAP
Victor Tool Co., Waynesboro, Pa.

CHUCKS, MAGNETIC
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

CHUCKS, RING WHEEL
Ford-Smith Mach. Co., Hamilton, Ont.
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CHUCKS, WHEEL, CAR
Hoggson & Pettis Mfg. Co., New Haven Conn.

CHUCKING MACHINES
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Windsor, Vt.
Niles-Bement-Pond Co., New York.
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Warner & Swasey Co., Cleveland, O.
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Williams Mchy Co., A. R., Toronto, Ont.

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Crane, Ltd., Montreal, Que.

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Bernard Industrial Co., A., Fortierville, Q.
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Jones & Glassco, Montreal, Que.
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Morris Crane & Hoist Co., Herbert Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
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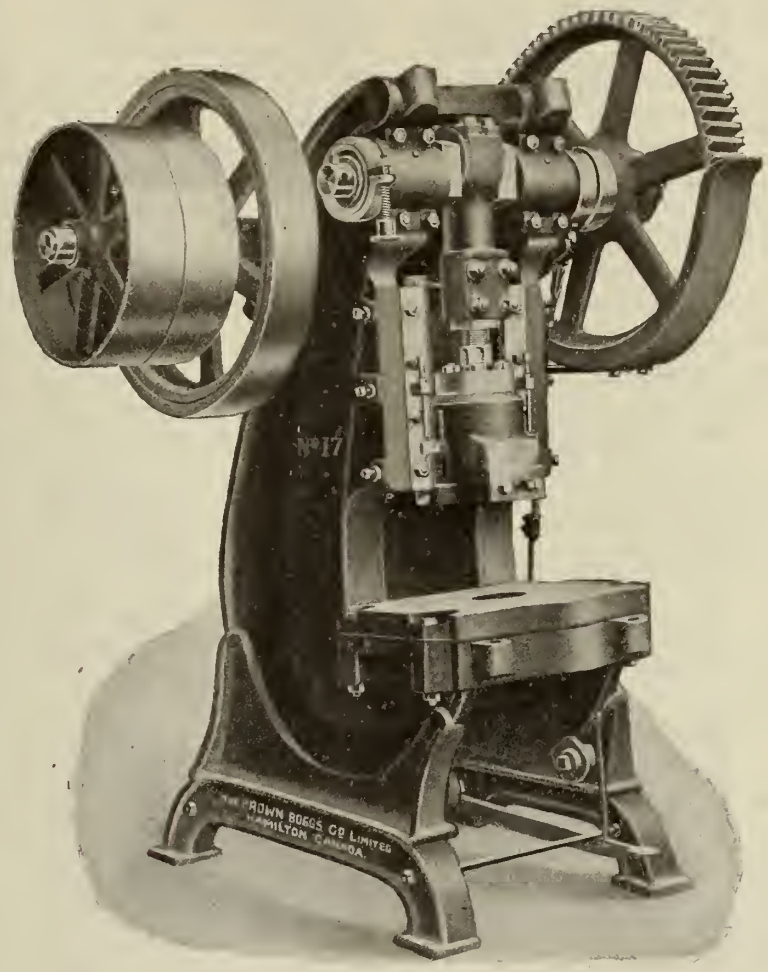

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Brown's Copper and Brass Rolling Mills, New Toronto.
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Williams Mchy Co, Ltd., A. R., Montreal
Williams Mchy Co., A. R., Toronto, Ont.
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Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.
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COKE AND COAL
Hanna & Co., M. A., Cleveland, O.
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Gardner, Robt. & Son, Montreal.
Independent Pneumatic Tool Co., Chicago
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Can. Link-Belt Co., Toronto, Ont.
Northern Crane Works, Walkerville.
ELECTRIC
Volta Manufacturing Co., Welland, Ont.
CUPS, OIL
Can. Winkley Co., Ltd., Windsor, Ont.
COVERS, OIL HOLE
Can. Winkley Co., Ltd., Windsor, Ont.
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Dominion Bridge Co., Montreal.
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Lyman Tube & Supply Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Niles-Bement-Pond Co., New York.
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Williams & Co., J. H., Brooklyn, N.Y.
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Williams Mchy Co., A. R., Toronto, Ont.
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Graton & Knight Mfg. Co., Worcester, Mass.
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Fellows Gear Shaper Co., Springfield, Vt.
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CUTTER HEADS
Oliver Machinery Co. Grand Rapids, Mich
CUTTERS, PIPE (See Pipe Cutters)
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Niles-Bement-Pond Co., New York, N.Y.
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Petrie, Ltd., H. W., Toronto.
Tabor Mfg. Co., Philadelphia, Pa.
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Williams Mchy Co., A. R., Toronto, Ont.
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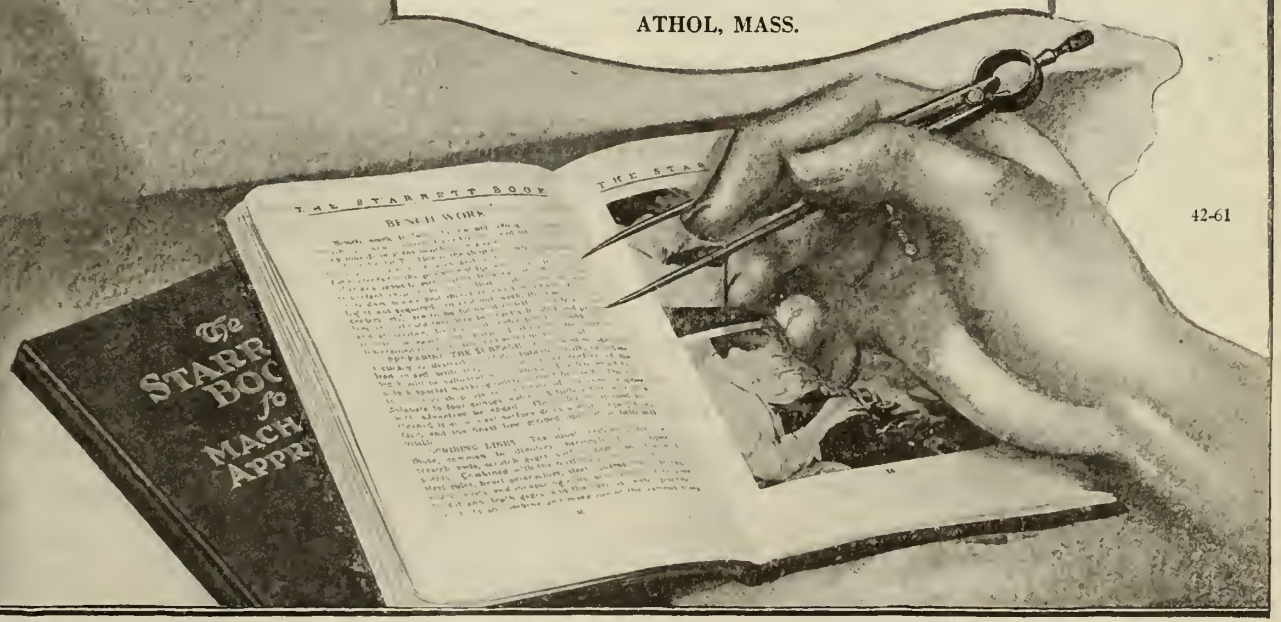

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Garvin Machine Co., New York.
Canadian Fairbanks-Morse Co., Montreal.
Canada Emery Wheels Co., Hamilton.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Wilkinson & Kompass, Hamilton, Ont.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.

EMERY WHEEL DRESSINGS
Dominion Abrasive Co., Ltd., Mimico, Ont.
Wheel Trueing Tool Co., Windsor Ont.

ENAMELWARE
Crane, Ltd., Montreal, Que.

END MILLS
John Morrow Screw & Nut Co., Ingersoll

ENGINEERS—INDUSTRIAL CLEANING (Free Consultation)
Oakley Chemical Co., New York, N.Y.

ENGINEERS
Samuel Osborne (Canada) Ltd., Montreal.

ENGINES—HOISTING, PILE DRIVING, BRIDGE ERECTING, MINING
Canadian Mead-Morrison Co., Limited, Montreal, Que.

ENGINES, STEAM, GAS, GASOLINE
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Canadian Fairbanks-Morse Co., Montreal.
Johnson Mach. Co., Carlyle, Manchester, Conn.
MacGovern & Co., Montreal, Que.
Sturtevant Co., B. F., Galt, Ont.

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Hamilton Co., Ltd., Wm., Peterborough, Ont.
Johnson Mach. Co., Carlyle, Manchester, Conn.
Petrie, Ltd., H. W., Toronto.
A. R. Williams Machy. Co., Toronto.

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Ker & Goodwin Machine Co., Ltd., Brantford, Ont.

ENGINES, HEAVY OIL, DIESEL TYPE
Dom. Steel Products Co., Ltd., Brantford

ENGINES, MARINE
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Sturtevant Co., B. F., Galt, Ont.

ESCUTCHEON PINS
Parmenter & Bulloch, Gananoque, Ont.

EXHAUST HEADS AND HOODS
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Sturtevant Co., B. F., Galt, Ont.

EXHAUSTERS
Can. Blower & Forge Co. Kitchener, Ont.
Pangborn Corporation, Hagerstown, Md.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.

EXTRACTORS, TAP
Walton Co., The, Hartford, Conn.

EYE BOLTS AND NUTS
Can. Foundries & Forgings, Ltd., Welland, Ont.

EYE PROTECTORS
Standard Optical Co., Geneva, N.Y.

FACTORY GATES
Page Steel & Wire Co., Adrian, Mich.

FACTORY LOCATIONS
City of St. Johns, Quebec.

FACTORY SITES
City of St. Johns, Quebec.

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Baird Machine Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont.
Sturtevant Co., B. F., Galt, Ont.

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Page Steel & Wire Co., New York, N.Y.

FENCE, IRON AND FACTORY
Can. Wire & Iron Goods, Hamilton, Ont.
Page Steel & Wire Co., Adrian, Mich.

FERRO-TUNGSTEN
Vanadium-Alloys Steel Co., Pittsburgh, Pa

FIBRE, RODS AND SHEETS
Diamond State Fibre Co., Bridgeport, Pa.

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Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., Wm., Sheffield, Eng.
Ingersoll File Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Marshall, Son & Bunney, Toronto, Ont.
Nicholson File Co., Port Hope, Ont.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
Whitman & Barnes Mfg. Co., Akron, O.
Wilkinson & Kompass, Hamilton, Ont.

FILES, COMMUTATOR SLOTTING
Lyman Tube & Supply Co., Montreal, Que.

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Barry Mfg. Co., Chicago, Ill.

FILTERING AND CIRCULATING SYSTEMS FOR LUBRICATING OIL
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Can. Wire & Iron Goods, Hamilton, Ont.

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Elk Fire Brick Co., Hamilton, Ont.
General Combustion Co., Ltd., Montreal, Que.

FIRE CLAY
Elk Fire Brick Co., Can., Ltd., Hamil.
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Crescent Mche. Co., Ltd., Montreal, Que.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Toronto Tool Co., Toronto, Ont.

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William Hamilton Co., Peterboro, Ont.

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Rice Lewis & Son, Toronto, Ont.
Sturtevant Co., B. F., Galt, Ont.

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FORGES, OIL
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Can. Found. & Forgings, Ltd., Welland
Nova Scotia Steel & Coal Co., New Glasgow, N.S.

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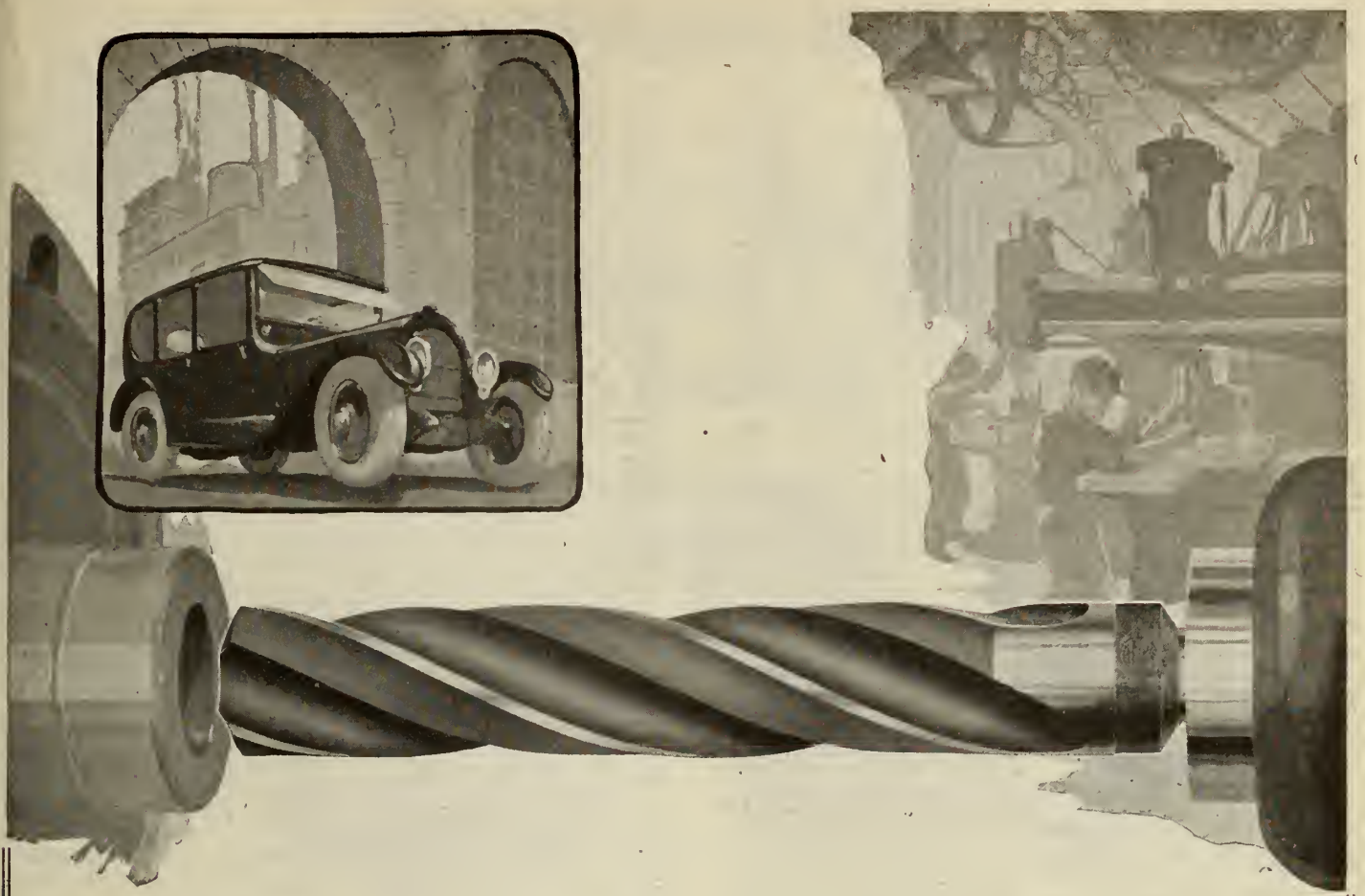
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Ont
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machy. Co., Toronto, Ont
National Machy. Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
Chicago Flexible Shaft Co., Chicago, Ill



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Wisconsin Electric Co., Inc., Racine, Wis
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Garlock-Walker Machinery Co., Toronto.
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Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
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Ford-Smith Mach. Co, Hamilton.
Gardner Machine Co., Beloit, Wis.
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Wisconsin Electric Co., Inc., Racine, Wis.
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Fitchburg Grinding Mach. Co., Fitchburg, Mass.

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Cleveland Pneumatic Tool Co., Toronto.
Garlock-Walker Machinery Co., Toronto.
Heald Machine Co., Worcester, Mass.
Independent Pneumatic Tool Co., Chicago
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GRINDERS, ROTARY SURFACE
Brown & Sharpe Mfg. Co., Providence, R.I
Bristol Machine Tool Co., Bristol, Conn.
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W. F. & John Barnes Co., Rockford, Ill.
Blount & Co., J. G., Everet, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I
Ford-Smith Machine Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield.
National-Acme Co., Cleveland, Ohio.
Tabor Mfg. Co., Philadelphia, Pa.
Wells Bros. of Canada, Galt, Ont.

GRINDERS, UNIVERSAL, PLAIN
Barber Mchy. Co., Ltd., Toronto, Ont.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Modern Tool Co., Erie, Pa.
Norton Co., Worcester, Mass.
Williams Mchy Co. Ltd., A. R., Montreal

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Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Co., Montreal.
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Norton Co., Worcester, Mass.
Williams Mchy Co., A. R., Toronto, Ont.

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Gardner & Son, Robt., Montreal.
Garvin Machine Co., New York.
Garlock-Walker Machy. Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Haskins & Co., R. C., Chicago, Ill.
Hall & Sons, John H., Brantford, Ont.
Niles-Bement-Pond Co., New York, N.Y.
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
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Carborundum Co., Niagara Falls, N.Y.
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Ford-Smith Machine Co., Hamilton, Ont.
Foss Mchy. & S'ply Co. G. F., Montreal.
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Kayser-Ellison & Co., Ltd., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
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Foss Mchy. & S'ply Co., G. F., Montreal.
Plewes, Ltd., Winnipeg, Man.
Pilot Steel & Tool Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Racine Tool & Machine Co., Racine, Wis.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
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Standard Machy. & Supplies, Montreal.
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Can. Fairbanks-Morse Co., Montreal.
Ford-Smith Machine Co., Hamilton, Ont.
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Victor Saw Works, Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.

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Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Wks., Buffalo.
Foss Mchy. & S'ply Co., G. F., Montreal.
Ford-Smith Machine Co., Hamilton.
Perfect Machine Co., Galt, Ont.
Starrett Co., L. S., Athol, Mass.
Victor Saw Works, Hamilton, Ont.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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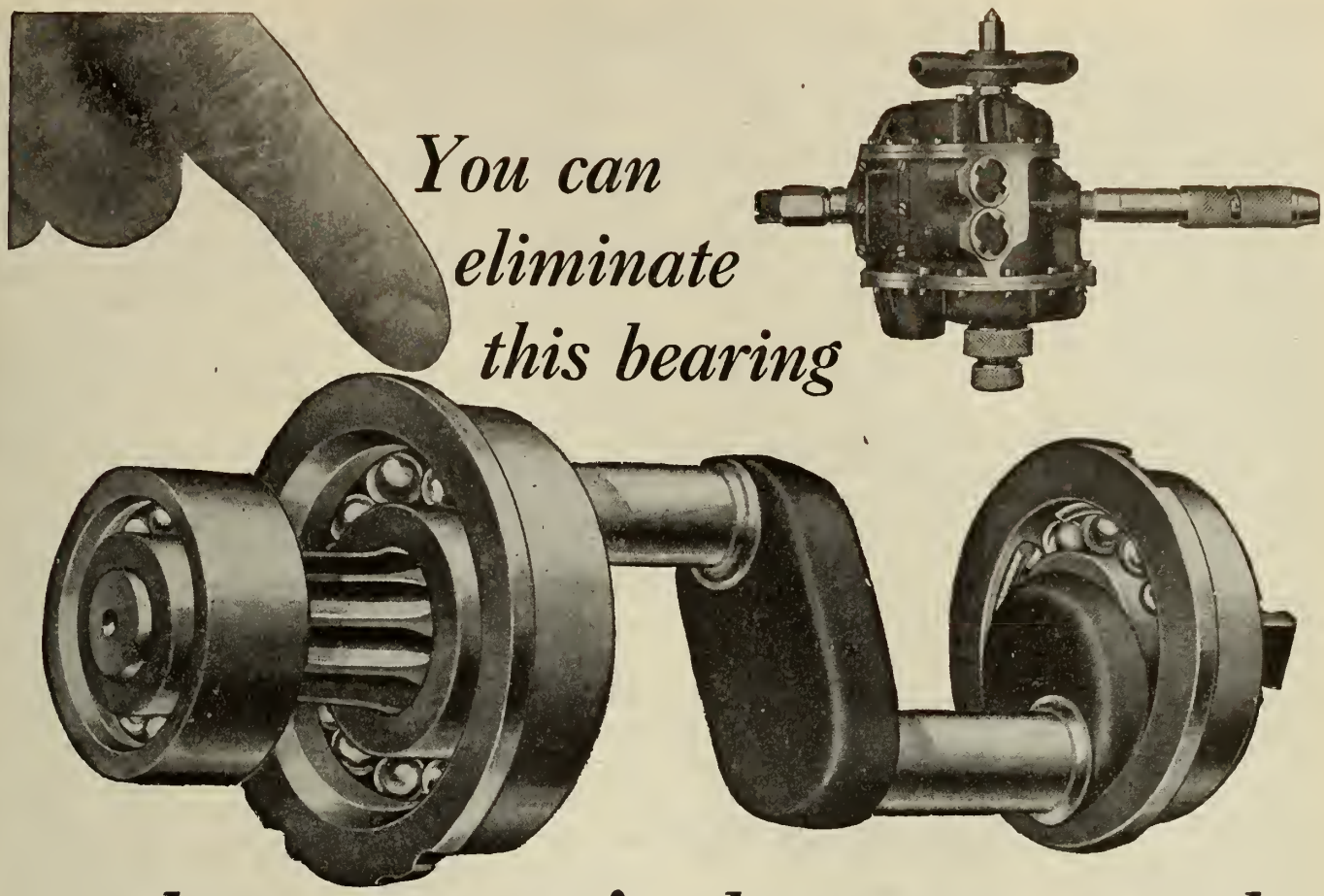
Nazel Eng. & Mach. Wks., Philadelphia.

HAMMERS, ELECTRIC
Haskins & Co., R. C., Chicago, Ill.



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Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton.
Can. Billings & Spencer, Ltd., Welland.
Canada Machinery Corp., Galt, Ont.
High Speed Hammer Co., Rochester, N.Y.
Jardine & Co., A. B., Hespeler, Ont.
Niles-Bement-Pond Co., New York, N.Y.
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
United Hammer Co., Boston, Mass.
Williams Mchy Co, Ltd., A. R., Montreal

HAMMERS, HELVE POWER
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
West Tire Setter Co., Rochester, N.Y.
Williams Mchy Co, Ltd., A. R., Montreal

HAMMERS, CHIPPING, CAULKING, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Nazel Eng. & Mach. Wks., Philadelphia.

HAMMERS, MARKING
Matthews & Co., Jas. H., Pittsburgh, Pa.

HAMMERS, NAIL MACHINE
Rice Lewis & Son, Toronto, Ont.
United Hammer Co., Boston, Mass.

HAMMERS, POWER
Nazel Eng. & Mach. Wks., Philadelphia.

HAMMERS, STEAM
Canada Machinery Corp., Galt, Ont.
Niles-Bement-Pond Co., New York.

HAND PLANERS
Oliver Mchry. Co., Grand Rapids, Mich.

HAND PLANING AND JOINTING MACHINERY
Oliver Engineering Co., Montreal, P.Q.

HAND LEATHERS OR PADS
Graton & Knight Mfg. Co., Montreal.

HANDLES, FIBRE
Diamond State Fibre Co., Bridgeport, Pa.

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Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian Link-Belt Co., Ltd., Toronto, Ont.

HANGERS, SHAFT
Algoma Steel Corp., Sault Ste. Marie.
Chapman Double Ball Bearing Co., Toronto.
Gray Ball Bearing Co., Ltd., Toronto.
Baird Machine Co., Bridgeport, Conn.
Can. S K F Co., Toronto, Ont.
Gardner & Son, Robt., Montreal.
Jones & Glassco, Montreal.
Williams Mchy Co, Ltd., A. R., Montreal

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Shore Instrument & Mfg. Co., New York.

HEAD, AUXILIARY
Hoefer Mfg. Co., Freeport, Ill.

HEATING AND VENTILATING ENGINEERS
Can. Blower & Forge Co., Kitchener, Ont.
Sturtevant Co., B. F., Galt, Ont.

HEAT GAUGES, HARDENING AND ANNEALING
Shore Instrument & Mfg. Co., New York

HELMETS, SANDBLAST, AMMONIA
Strong, Kennard & Nutt Co., Cleveland

HIGH SPEED STEEL
See Steel.

HINGE MACHINERY
Baird Machine Co., Bridgeport, Conn.

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Butterfield & Co., Inc., Rock Island, Que.
London Bolt & Hinge Wks., London, Ont.

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Greenfield Tap & Die Co., Greenfield, Mass
Pratt & Whitney Co., Dundas, Ont.
Taylor, J. A. M., 318 Stair Bldg., Toronto
Wells Bros. of Canada, Galt, Ont.

HOISTING MACHINERY
Canadian Mead-Morrison Co., Limited, Montreal, Que.

HOISTS, AIR
Can. Ingersoll-Rand Co., Ltd., Sherbrooke
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

HOISTS, CHAIN AND PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Ford Chain Block & Mfg., Philadelphia.
Independent Pneumatic Tool Co., Chicago
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

HOISTS, ELEC., STATIONARY, MONO RAIL
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
A. Beatty & Sons, Ltd., Welland, Can
Oliver Engineering Co., Montreal.
Volta Mfg. Co., Welland, Ont.

HOISTS, ELECTRICAL
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Montreal, Que.
Electric Steels & Metals Ltd., Welland.
Kennedy & Sons, Owen Sound, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

HOLDERS, ADJUSTABLE LENGTH
Eclipse Counterbore Co., Ltd., Walkerville, Ont.

HOLDERS, STEEL DIE FOR MARKING
Matthews & Co., Jas. H., Pittsburgh, Pa.

HOLDERS, ELECTRIC
Electric Steels & Metals, Ltd., Welland

HOOKS, BELT LACING
Clipper Belt Lacer Co., Grand Rapids.

HOPPERS
MacKinnon Steel Co., Ltd., Sherbrooke.
Dominion Bridge Co., Montreal, Que.
William Hamilton Co., Peterboro, Ont.
Toronto Iron Works, Ltd., Toronto, Ont.

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Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal

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Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Gutta Percha & Rubber, Ltd., Toronto.
Independent Pneumatic Tool Co., Chicago.
Quaker City Rubber Co., Philadelphia, Pa.
Wells Bros. Co. of Canada, Galt, Ont.

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Goodyear Tire & Rubber Co., of Canada, Ltd., Toronto.
Gutta Percha & Rubber, Ltd., Toronto.
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.

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Goodyear Tire & Rubber Co. of Can., Ltd. Toronto
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Sturtevant Co., B. F., Galt, Ont.

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HYDRAULIC MACHINERY
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
West Tire Setter Co., Rochester, N.Y.
Victoria Foundry Co., Ottawa.

HYDRAULIC TURBINES
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

HYDROMETERS, HYGROMETERS, HYGRODNIKS
Taylor Instrument Co., Rochester, N.Y.

INDICATORS, SPEED
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol, Mass.

INDEX CENTRES
Brown & Sharpe Mfg. Co., Providence, R.I.
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Ford-Smith Machine Co., Hamilton, Ont.
Garvin Machine Co., New York.
Petrie, Ltd., H. W., Toronto.

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Taylor Instrument Co., Rochester, N.Y.

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Can. Kron Scale Co., Montreal.

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Thomas Moore & Son, Montreal.

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Hanna & Co., M. A. Cleveland, O.

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Swedish Steel & Impt. Co., Ltd., Montreal

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Can. Fairbanks-Morse Co., Montreal.
Canada Engineering Co.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Norton, A. O., Coaticook, Que.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.

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Canadian Fairbanks-Morse Co., Montreal
Lyman Tube & Supply Co., Montreal, Que.
Northern Crane Works, Walkerville.

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Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford.
Skinner Chuck Co., New Britain, Conn.

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Crescent Mach. Co., Ltd., Montreal, P.Q.
Elliott & Whitehall Mach. & Tool Co., Galt.
Gisholt Machine Co., Madison, Wis.
Globe Engineering Co., Ltd., Hamilton.
Homer & Wilson, Hamilton, Ont.
Jones & Lamson, Springfield, Vt.
Toronto Tool Co., Toronto, Ont.

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Canada Foundries & Forgings, Welland.
Dominion Foundries & Steel Ltd., Hamilton, Ont.

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Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Morton Mfg. Co., Muskegon Heights, M.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.

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Whitney Mfg. Co., Hartford, Conn.
Williams & Co., J. H., Brooklyn, N.Y.

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General Combustion Co., Ltd., Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Sturtevant Co., B. F., Galt, Ont.

KNIVES, MACHINE
Atkins & Co., E. C., Hamilton, Ont.

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Northern Crane Works, Walkerville.

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Clipper Belt Lacer Co., Grand Rapids, M.

LAG SCREW GIMLET POINTERS
National Machy. Co., Tiffin, Ohio.

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Robertson Ltd., H. H., Sarnia, Ont.

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Acme Machine Tool Co., Cincinnati, Ohio.
Petrie, Ltd., H. W., Toronto.
Wood Turret Machine Co., Brazil, Ind.

LATHE CHUCKS (See Chucks)

LATHE DOGS AND ATTACHMENTS
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Hendey Machine Co., Torrington, Conn.
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Gisholt Machine Co., Madison, Wis.
Wood Turret Machine Co., Brazil, Ind.

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Canada Machinery Corp., Galt, Ont.

LATHES, BORING
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Bridgeford Mach. Tool Works, Rochester.
Canada Machinery Corp., Galt, Ont.
Lodge & Shipley, Cincinnati, O.
Petrie, Ltd., H. W., Toronto.

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J. G. Blount & Co., Everett, Mass.
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Geo. F. Foss Machy. & Supply Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Hardinge Bros., Chicago, Ill.
Pratt & Whitney Co., Dundas, Ont.
Seneca Falls Mfg Co., Seneca Falls, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

LATHES, BRASS
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Hardinge Bros., Chicago, Ill.
Wood Turret Machine Co., Brazil, Ind.
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Williams Mchy Co., A. R., Toronto, Ont.

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Barber Mchy. Co., Ltd., Toronto, Ont.
John Bertram & Sons, Co., Dundas.
Canada Machy. Corp., Galt, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cisco Machine Tool Co., Cincinnati, O.
G. F. Foss, Mchy. & Sply Co., Montreal
Garlock-Walker Machinery Co, Toronto.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
Kennedy & Sons, Wm., Owen Sound, Ont.
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Niles-Bement-Pond Co., New York.
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Williams Mchy Co., A. R., Toronto, Ont.

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Seneca Falls Mfg. Co., Seneca Falls, N.Y.

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Wood Turret Machine Co., Brazil, Ind.

LATHES, JOURNAL TRUEING
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.

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Can. Machinery Corp., Galt.
Wood Turret Machine Co., Brazil, Ind.
G. F. Foss Mchy. & Sply Co., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.

LATHES, POLISHING
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Wells Bros. of Canada, Galt, Ont.

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Bertram & Sons Co., John, Dundas, Ont.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Cisco Machine Tool Co., Cincinnati, O.
Foss Mchy. & Sply Co., G. F., Montreal
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Toronto, Ont.
Hardinge Bros., Inc., Chicago, Ill.
Hepburn Ltd., John T., Toronto, Ont.
Lehman Machine Co., St. Louis, Mo.
Niles-Bement-Pond Co, New York.
Rae Mach. Tool Co., Hamilton.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.
Williams Machy. Co., A. R., Toronto.
Wood Turret Machine Co., Brazil, Ind.

LATHES, SPINNING
Bliss Co., E. W., Brooklyn, N.Y.

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Cisco Machine & Tool Co., Cincinnati, O
Canada Machinery Corporation, Galt, Ont.
Knight Metal Products, Toronto.
Lehman Machine Co., St. Louis, Mo.
Rae Mach. Tool Co., Ramilton.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.

LATHES, QUICK CHANGE
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Atkins & Co., E. C., Hamilton, Ont.

LATHES, TURRET
Hardinge Bros., Chicago, Ill.
Acme Machine Tool Co., Cincinnati, Ohio

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British Smelting & Refining Co., Ltd., Montreal, Que.

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Turner Brass Works, Sycamore, Ill.

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Can. Winkley Co., Ltd., Windsor, Ont.

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See Belting, Chain.

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Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Williams Machy. Co., A. R., Toronto.

MACHINERY GUARDS (See Guards)

MACHINERY SUPPLIES
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Globe Engineering Wks., Hamilton, Ont.
Knight Metal Products, Toronto.

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Cincinnati Milling Machine Co., Cincinnati
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Hall & Son, J. H., Brantford, Ont.
Jardine & Co., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Marshall, Son & Bunney, Toronto.
Petrie, Ltd., H. W., Toronto.
Wilt Twist Drill Co., Walkerville, Ont.

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Standard Equipment & Tool Wks., Montreal, P.Q.

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Brown & Sharpe Mfg. Co., Providence.
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Canada Machinery Corp., Galt, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis
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Niles-Bement-Pond Co., New York.
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Canada Machinery Corp., Galt, Ont.
Cleveland Milling Machine Co., Cleveland.
Cincinnati Milling Machine Co., Cincinnati
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
National Machy. Co., Tiffin, Ohio.
Gooley & Eddund, Inc., Cortland, N.Y.
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Pratt & Whitney Co., Dundas, Ont.
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Geometric Tool Co., New Haven, Conn.
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Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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MacKinnon Steel Co., Sherbrooke, Que.
Modern Tool Co., Erie, Pa.
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Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Elec. Steel & Metals, Welland, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Frost Mfg. Co., Chicago, Ill.

MORTISING MACHINES
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
Gray Ball Bearing Co., Ltd., Toronto.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
MacGovern & Co., Montreal, Que.
Northern Elec. Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
U. S. Ordnance, Toronto, Ont.
Volta Mfg. Co., Welland, Ont.
Williams Mach'y Co., A. R., Toronto.

MOTOR SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

MOTORCYCLE FRAME AND FORK
The Dunbar Brothers Co., Bristol, Conn.

MOTORS, PNEUMATIC
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto.

MOULDS, RUBBER
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

MULTIPLE INDEX CENTRES
Garvin Machine Co., New York.
Graton & Knight Mfg. Co., Worcester, M.

MULTI-DRILLING, MULTI-BORING, MULTI-TAPPING MACHINERY,
Nat. Automatic Tool Co., Richmond, Ind.

MUNICIPALITIES
City of St. John, Quebec.

NAIL SETS
Morrow Screw & Nut Co., J., Ingersoll, Ont

NAME PLATES, BRONZE, ETCHED AND STAMPED
Matthews & Co., Jas. H., Pittsburgh, Pa.
Turner Brass Works, Sycamore, Ill.

NICHROME CASTINGS
Can. Driver-Harris Co., Ltd., Walkerville.

NICKEL
Pilot Steel & Tool Co., Montreal, Que.

NICKEL STEEL
See Steel.

NICKEL SILVER—SHEETS, ROLLS, PLATES and RODS
Brown's Copper and Brass Rolling Mills, New Toronto.

NIPPLE THREADING MACHINES
Hall & Sons, Ltd., John H., Brantford.
Landis Machine Co., Waynesboro, Pa.

NITROGEN
Carter Welding Co., Toronto, Ont.

NUTS, STEEL, CASTELLATED AND COLD PRESSED
Galt Machine Screw Co., Ltd., Galt, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Williams & Co., J. H., Brooklyn, N.Y.

NUTS, SEMI-FINISH AND FINISHED
Galt Machine Screw Co., Galt, Ont.
National-Acme Co., Cleveland, Ohio.
Wilkinson & Kompass, Hamilton.

NUT LOCKS
Edw. W. Robinson Co., Ltd., Montreal.

NUT BURRING AND NUT MACHINES (HOT)
National Machy. Co., Tiffin, Ohio.

NUT FACING AND BOLT SHAVING MACHINES
Garvin Machine Co., New York.
National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
Victor Tool Co., Waynesboro, Pa.

NUT TAPPERS
Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
Hall & Son, J. H., Brantford, Ont.
Jardine & Co., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.

OILERS
All-Way Oiler Mfg. Co., Toronto, Ont.

OIL SEPARATORS
Can. Fairbanks-Morse Co., Montreal.

OIL STONES
Aikenhead Hardware Co., Toronto, Ont.
Carborundum Co., Niagara Falls, N.Y.
Norton Co., Worcester, Mass.
Rice Lewis & Son, Toronto, Ont.

OIL STONE GRINDERS
Oliver Machy. Co., Grand Rapids, Mich

OIL STORAGE SYSTEMS
Bowser Co., Ltd., S. F., Toronto, Ont.
St. Lawrence Welding Co., Ltd., Montreal.

OPENING DIE HEADS
Greenfield Tap & Die Corp, Greenfield.
Wells Bros. of Canada, Galt, Ont.

OPTICAL SUPPLIES
Consolidated Optical Co., Toronto, Ont.

ORE HANDLING EQUIPMENT
Brown Hoisting Machinery Co., Cleveland, Ohio.
Canadian Link-Belt Co., Ltd., Toronto, Ont.
Canadian Mead-Morrison Co., Limited, Montreal, Que.

OSCILLATING VALVE GRINDERS (PNEUMATIC)
Cleveland Pneumatic Tool Co. of Canada, Toronto.

OVENS FOR BAKING, BLUING, DRYING, ENAMELING, JAPANNING AND LACQUERING
Brantford Oven & Rack Co., Brantford.

OVEN TRUCKS, STEEL
Brantford Oven & Rack Co., Brantford.
MacKinnon Steel Co., Sherbrooke, Que.

OVENS FOR DRYING, TEMPER AND OXYGEN, ELECTROLYTIC CELLS UNDER TRUCKS
Welding & Supplies Co., Montreal, Que.
Brantford Oven & Rack Co., Brantford.

OXY-ACETYLENE WELDING AND CUTTING AND OUTFITS
Carter Welding Co., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.
Prest-o-Lite Co., Inc. Toronto, Ont.
Davis-Bournonville Co., Toronto, Ont.

OXYGEN
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto, Ont.
Nat. Electro Products Ltd., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.

OXYGEN PLANTS (ELECTROLYTIC)
Davis-Bournonville Co., Toronto, Ont.

PACKINGS, ASBESTOS
Cleveland Wire Spring Co., Cleveland.

PACKING, ROD AND SHEET
Dunlop Tire & Rubber Goods Co., Ltd. Toronto.
Goodyear Tire & Rubber Co., Can., Ltd. Toronto
Gutta Percha & Rubber, Ltd., Toronto.
International Mach. Spls., Ltd., Montreal
Petrie, Ltd., H. W., Toronto.
Quaker City Rubber Co., Philadelphia, Pa

PANS, WET AND DRY
Frost Mfg. Co., Chicago, Ill.

PAPER MILL CONVEYORS AND DRIVES
Bertrams, Ltd., Edinburgh, Scotland.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Gutta Percha & Rubber, Ltd., Toronto.
MacKinnon Steel Co., Sherbrooke, Que.

PARTITIONS, WIRE
See Guards

PAPER MILL MACHINERY
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Machinery Co., Toronto.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

PATTERN SHOP EQUIPMENT
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Oliver Machy. Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto.

PATTERN MAKERS' LATHES
See Lathes.

PATENT SOLICITORS
Budden, Hanbury A., Montreal.
Fetherstonhaugh & Co., Ottawa.
Marion & Marion, Montreal.
Ridout & Maybee, Toronto.

PECK CARRIERS FOR POWER PLANTS
Can. Link-Belt Co., Toronto, Ont.

PENSTOCKS
William Hamilton Co., Peterboro, Ont.

PERFORATED METALS AND ORNAMENTAL IRON GOODS
Canada Wire & Iron Goods Co., Hamilton

PHOSPHOR TIN, COPPER AND BRONZE
British Smelting & Refining Co., Ltd., Montreal, Que.

PHOTOSTATS
Commercial Camera Co., Providence, R.I.

PIG IRON
Hanna & Co., M. A., Cleveland, O.
Steel Co. of Canada, Ltd., Hamilton, Ont.

PINS, TAPER
Morrow Screw & Nut Co., J., Ingersoll, Ont

PINS, BELT-LACING
Clipper Belt Lacer Co., Grand Rapids.

PIPE, BLACK & GALVANIZED
Crane, Ltd., Montreal, Que.

PIPE FITTINGS, MALLEABLE AND CAST IRON
International Malleable Iron Co., Guelph.

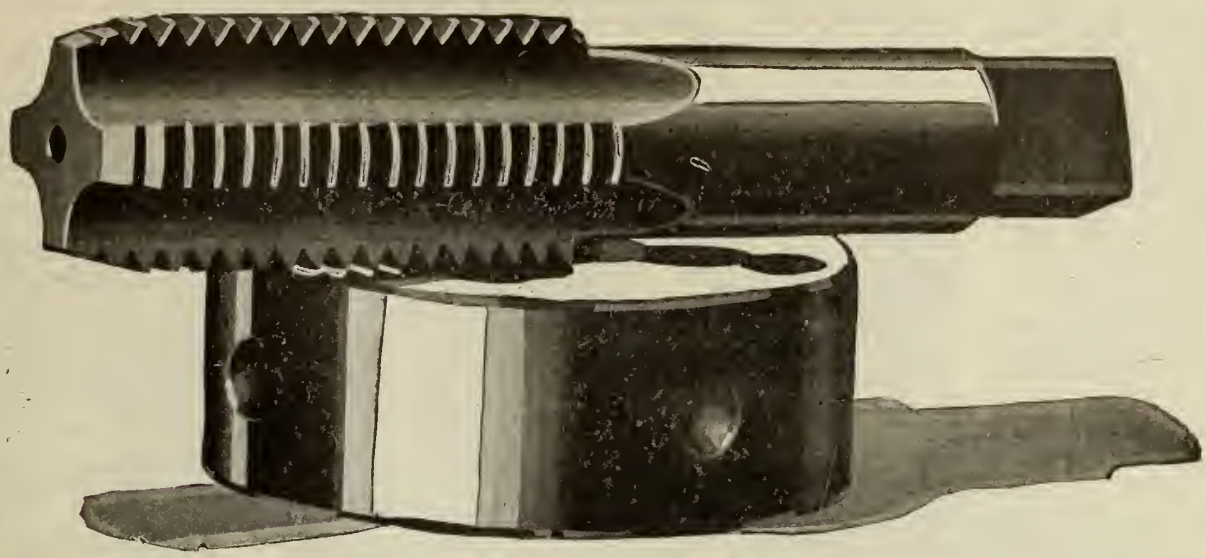
PIPE CUTTING AND THREADING MACHINES
Barber Mchy. Co., Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Curtis & Curtis Co., Bridgeport, Conn.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield.
Hall & Sons, John H., Brantford.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
McDougall Co., R., Galt.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt, Ont.
Williams Tool Co., Erie, Pa.
Williams Machy. Co., A. R., Toronto.

PIPE, JOINT COMPOUNDS
Crane, Ltd., Montreal, Que.

PIPE RIVETED STEEL
Toronto Iron Works, Ltd., Toronto.
William Hamilton Co., Peterboro, Ont.

PIERCING
Oliver Machy. Co., Grand Rapids, Mich.

PIPE CUTTERS, ROLLING
Curtis & Curtis Co., Bridgeport, Conn.
Greenfield Tap & Die Corp., Greenfield.
Hall & Sons, Ltd., John H., Brantford.
Wells Bros. Co. of Canada, Galt, Ont.



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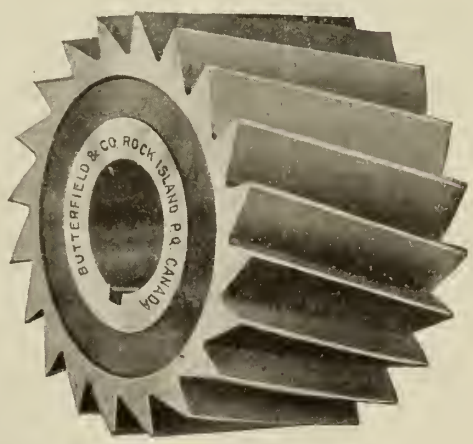

If interested tear out this page and place with letters to be answered.

PIPE TOOLS AND DIES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE CUTTERS AND REAMERS
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE STOCKS AND THREADERS
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE TAPS AND VISES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE WRENCHES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PISTON AND PISTON RING MACHINES
National Acme Co., Windsor, Vt.

PLANER BOLTS
Atkins & Co., E. C., Hamilton, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont.

PLANER JACKS
Armstrong Bros. Tool Co., Chicago.

PLANERS, STANDARD AND ROTARY
Betts Machine Co., Rochester, N.Y.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Oliver Machy. Co., Grand Rapids, Mich.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal
Gardiner & Son, Robt., Montreal.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Morton Mfg. Co., Muskegon Heights, Mich
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Whs., Montreal.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.

PLANING AND SHAPING MACHINERY
Barber Mchy. Co., Ltd., Toronto, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Niles-Bement-Pond Co., New York.
Ohio Mach. Tool Co., Kenton, Ohio.
Perrin, Ltd., William, Toronto.
Williams Mchy Co. Ltd., A. R., Montreal

PLANER-SHAPER, COMBINED OPEN SIDE
Lynd-Farquhar Co., Boston.
Petrie, Ltd., H. W., Toronto.

POWER HAMMERS
Quickwork Co., St. Marys, Ohio.

PLANING MILL EXHAUSTERS
Can. Blower & Forge Co., Kitchener, Ont
MacGovern & Co., Montreal, Que.
Niles-Bement-Pond Co., New York.
Sturtevant Co., B. F., Galt, Ont.

PLATES, Q.M., SHEARED AND CHEQUERED
Peckovers, Ltd., Toronto, Ont.

PLATING, PLANTS & SUPPLIES
Can. Hanson Van Winkle Co., Ltd., Toronto, Ont.

PLIERS
Aikenhead Hardware Co., Toronto.
Can. Billings & Spencer, Ltd., Welland.
Rice Lewis & Son, Toronto, Ont.

PNEUMATIC TOOLS
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Can., Toronto.
Curtis Pneumatic Machy. Co., St. Louis.
Garlock-Walker Machy. Co., Toronto.
Int. Mach. & Supply Co., Ltd., Montreal.
Independent Pneumatic Tool Co., Chicago.

POWER CRANES, HAND
MacKinnon Steel Co., Sherbrooke, Que.

POLISHING MACHINES
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto.

POLISHING PLATES
Greenfield Tap & Die Corp., Greenfield.
Petrie, Ltd., H. W., Toronto.
Wells Bros. of Canada, Galt, Ont.

POLISHING PAPER
H. H. Barton & Son Co., Philadelphia.

POTS AND KETTLES, CAST STEEL
Elec. Steel & Metals, Welland, Ont.

POWER HOUSE CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Herbert. Niagara Falls, Ont.

PORTABLE MACHINERY
Haskins & Co., R. C., Chicago, Ill.

POWER TRANSMISSION MCHY
Canadian Link-Belt Co., Ltd., Toronto, Hamilton Co., Ltd., Wm., Peterborough, Ont.
Petrie, Ltd., H. W., Toronto.

PRESSED STEEL PARTS
Gray Ball Bearing Co., Ltd., Toronto.

PRESSERS, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Metalwood Mfg. Co., Detroit, Mich.
Petrie, Ltd., H. W., Toronto.

PRESSES, BROACHING, FORGING AND FLANGING
Atlass Press Co., Kalamazoo, Mich.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Dom. Steel Products Co., Ltd., Brantford.
Metalwood Mfg. Co., Detroit, Mich
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
Stoll Co., D. H., Buffalo, N.Y.
Williams Mchy Co., Ltd., A. R., Montreal

PRESSES, CAM, TOGGLE, EYELET
Baird Machine Co., Bridgeport, Conn.
Bliss Co., E. W., Brooklyn, N.Y.
Toledo Machine & Tool Co., Toledo.
Stoll Co., D. H., Buffalo, N.Y.

PRESSES, FILTER
Perrin, Ltd., William R., Toronto.
Smalley-General Co., Inc., Bay City, Mich.

PRESSES, PNEUMATIC
Barber Mchy. Co., Ltd., Toronto, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Metalwood Mfg. Co., Detroit, Mich.
Toledo Machine & Tool Co., Toledo.

PRESSES, DROP AND FORGING
Barber Mchy. Co., Ltd., Toronto, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton.
Can. Fairbanks-Morse Co., Montreal.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co, Toledo.

PRESSES, HYDRAULIC
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke.
Dom. Steel Products Co., Ltd., Brantford.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
Stoll Co., Inc., D. H., Buffalo, N.Y.
Williams Machy. Co., A. R., Toronto.

PRESSES, HYDRO-PNEUMATIC
Eastern Production Co., Detroit, Mich.

PRESSES, BALING
Perrin, Ltd., William R., Toronto.

PRESSES, POWER
Baird Machine Co., Bridgeport, Conn.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo.
Williams Machy. Co., A. R., Toronto.

PRESSES, SPRING FOOT
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Ont.
Toledo Machine & Tool Co., Toledo.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal

PRESSES, SCREW
Barnes & Co., W. F. & Jno., Rockford, Ill
Bliss Co., E. W., Brooklyn, N.Y.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.

PRESSES, TIRE
Can. Ingersoll-Rand Co., Ltd., Sherbrooke.

PRESSES, TRIMMING
Bliss Co., E. W., Brooklyn, N.Y.
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.

PROJECTORS, FLOOD LIGHTING
Lyman Tube & Supply Co., Montreal, Que

PROPELLERS
Kennedy & Sons, Wm., Owen Sound.

PROTECTIVE COATINGS
H. H. Robertson, Ltd., Sarnia, Ont.

PSYCROMETERS, SLING
Taylor Instrument Co., Rochester, N.Y.

PULLEYS
Algoma Steel Corp., Sault Ste. Marie, Ont
American Pulley Co., Philadelphia.
Baird Machine Co., Bridgeport, Conn.
Bernard Industrial Co., Fortierville, Que.
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Diamond State Fibre Co., Bridgeport, Pa.
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Kennedy & Sons, Ltd., W., Owen Sound.
Positive Clutch & Pulley Works Ltd., Toronto.
Petrie, Ltd., H. W., Toronto.

PULLEYS, STEEL SASH, STEEL BELT
American Pulley Co., Philadelphia, Pa.

PULLEYS, FRICTION, CLUTCH
American Pulley Co., Philadelphia, Pa.
Baird Machine Co., Bridgeport, Conn.
Bernard Industrial Co., A., Fortierville, Q
Can. Link-Belt Co., Toronto, Ont.
Carlyle Johnson Mch. Co., Manchester, Ct.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Jones & Glassco, Montreal.
Positive Clutch & Pulley Works, Toronto.
Petrie, Ltd., H. W., Toronto.

PULP MILL MACHINERY
Can. Ingersoll-Rand Co., Ltd., Sherbrooke.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

PUMPS, AIR LIFT
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,

PUMPS, BOILER FEED
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,

PUMPS, CENTRIFUGAL
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Ingersoll-Rand Co., Montreal, Que
Darling Bros., Ltd., Montreal, Que.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

PUMPS, FUEL OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Darling Bros., Ltd., Montreal, Que.
Trahern Pump Co., Rockford, Ill.

PUMPS, GEARED
Darling Bros., Ltd., Montreal, Que.
Globe Engineering Co., Hamilton, Ont.

PUMPS, HIGH PRESSURE
Perrin, Ltd., William R., Toronto.

PUMPS, HYDRAULIC
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Clarke & Co., Furniss, Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Darling Bros., Ltd., Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
Metalwood Mfg. Co., Detroit, Mich.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

PUMPS, LUBRICATING, OIL STORAGE
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, RETURN AIR
Can. Ingersoll-Rand Co. Ltd., Sherbrooke,

PUMPS, SPECIAL
Elec. Steel & Metals, Welland, Ont.

PUMPS, RUBBER CEMENT
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, KEROSENE, OIL, SELF-MEASURING
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, LUBRICANT, OIL, WATER
Darling Bros., Ltd., Montreal, Que.
Trahern Pump Co., Rockford, Ill.

PUMPS — ROTARY
General Combustion Co., Ltd., Montreal, Que.

PUMP LEATHERS
Graton & Knight Mfg. Co., Worcester.

PUNCHES AND DIES
Atkins & Co., Ltd., Wm., Sheffield, Eng
E. W. Bliss Co, Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Can.
Can. Blower & Forge Co., Kitchener, Ont.
Crescent Mach. Co., Ltd., Montreal, P.Q.
Can. Fairbanks-Morse Co., Montreal.
Elliott & Whitehall Machine and Tool Co., Galt, Ont.
Gardiner & Son, Robert, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Marshall, Son & Blunney, Toronto.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Williams Mchy Co., A. R., Toronto, Ont.

PUNCHES, POWER
John Bertram & Sons Co., Dundas, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd, Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
A. B. Jardine & Co., Hespeler, Ont.
Long & Allstatter, Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
D. H. Stoll Co., Buffalo, N.Y.
Williams Mchy Co., A. R., Toronto, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertrams, Ltd., Edinburgh, Scotland.
Bertrams & Sons, John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton, Ont.
Garlock-Walker Mach'y. Co., Toronto.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

PYROMETERS
Bristol Co., Waterbury, Conn.
Shore Instrument & Mfg. Co., New York
Taylor Instrument Co., Rochester, N.Y.

QUARTERING MACHINES
Bertram & Sons, John, Dundas, Ont
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Niles-Bement-Pond Co., New York.

QUARRY HOISTS
Canadian Mead-Morrison Co., Limited, Montreal, Que.

RAIL BENDERS
Algoma Steel Corp., Sault Ste. Marie, Ont.

PUNCHES, HAND
Niles-Bement-Pond Co., New York.

RAILROAD TOOLS
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Petrie Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

RASPS
Atkins & Co., Ltd., Wm., Sheffield, Eng
Marshall, Son & Bunney, Toronto.

RAWHIDE PINIONS (See Gears)

REAMERS
Butterfield & Co., Inc., Rock Island, Que.

REAMERS, ADJUSTABLE
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Elliott & Whitehall Machine and Tool Co., Galt, Ont.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Machy. Co., Ingersoll, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Pierce, Ltd., Winnipeg, Man.
Pratt & Whitney Co., Dundas, Ont.
The Kelly Reamer Co., Cleveland, O.
J. A. M. Taylor, 118 Stair Bldg., Toronto
Wells Bros. of Can., Galt, Ont

REAMERS, BRIDGE, EXPANDING AND HIGH SPEED
Atkins & Co., Ltd., Wm., Sheffield, Eng
Aikenhead Hardware Co., Toronto.
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Elliott & Whitehall Machine and Tool Co., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Lyman Tube & Supply Co., Montreal, Que
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., J., Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford Mass.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Samuel Osborne, Ltd., Montreal, P.Q.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, STEEL TAPER AND SELF-FEEDING
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
A. B. Jardine & Co., Hespeler, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

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Butterfield & Co., Inc., Rock Island, Que.
Elliott & Whitehall Machine and Tool Co., Galt, Ont.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Machy. Co., Ingersoll, Ont.
Marshall, Son & Bunney, Toronto.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wells Bros. of Canada, Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, HAND
Butterfield & Co., Inc., Rock Island, Que.
Elliott & Whitehall, Galt, Ont.
Greenfield Tap & Die Corp., Greenfield.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wells Bros. of Can., Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

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Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Morrow Screw & Nut Co., John, Ingersoll.
Wells Bros. of Can., Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

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Garvin Machine Co., New York.

REAMING MACHINES, PNEUMATIC
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Garlock-Walker Machinery Co., Toronto.

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Gisholt Machine Co., Madison, Wis.
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REGULATORS, PRESSURE, TEMPERATURE
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Taylor Instrument Co., Rochester, N.Y.

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REPAIR WORK, ALL KINDS
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Parmenter & Bulloch Co., Gananoque.
Rice, Lewis & Son, Toronto.
Steel Co. of Canada, Ltd., Hamilton.

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Can. Ingersoll-Rand Co., Montreal.
Cleveland Pneumatic Tool Co, of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
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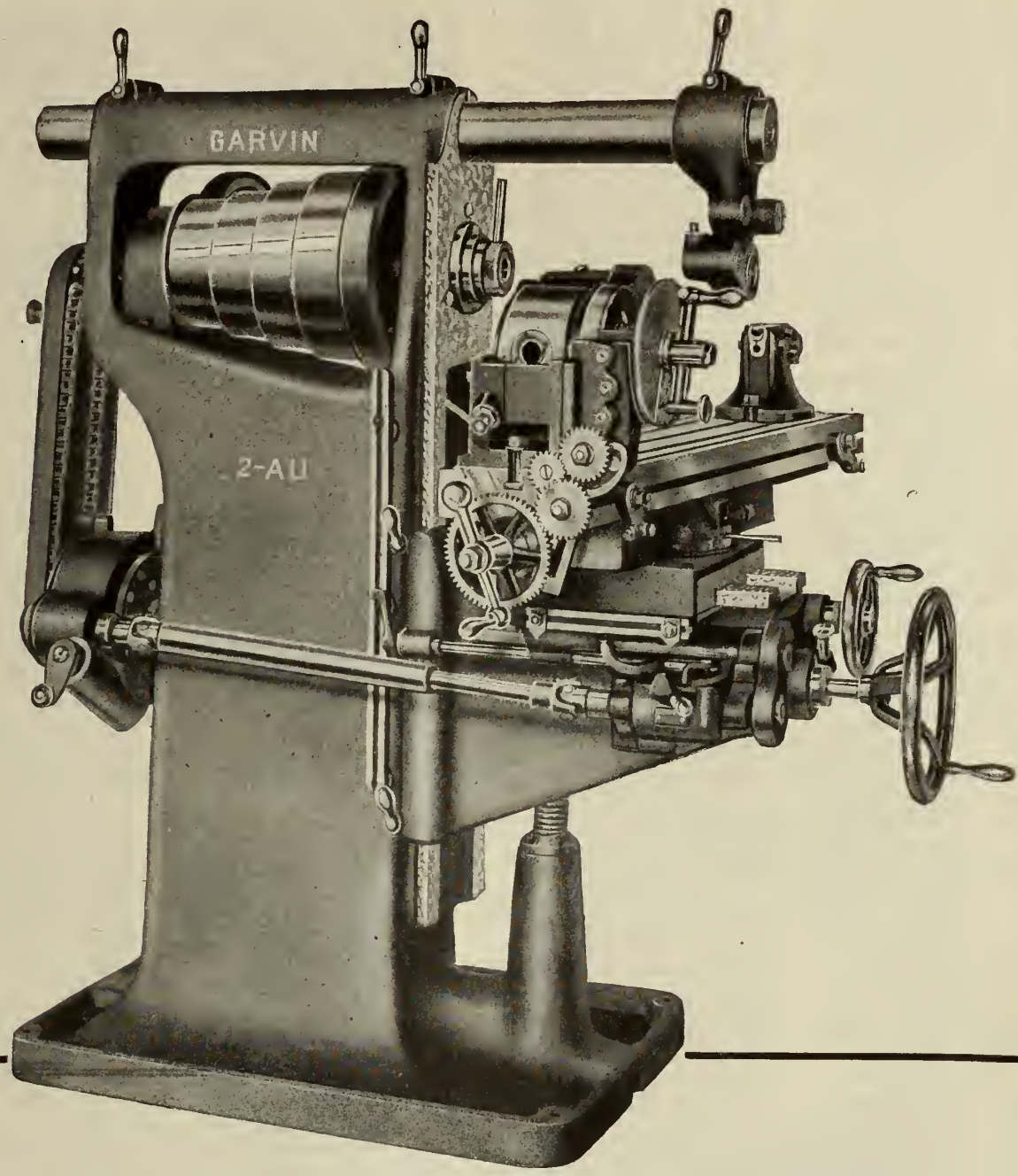
RODS, PURE NICKEL, MONEL METAL, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville.

GARVIN MACHINE TOOLS



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GARVIN

BUILDER OF BETTER MACHINE TOOLS

G-46

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Jones & Glasco, Montreal.
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Dom. Steel Products Co., Ltd., Brantford.
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Toledo Machine & Tool Co., Toledo, O.

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ROLLS, CRUSHING
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Garvin Machine Co., New York,
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Rice Lewis & Son, Toronto.
J. A. M. Taylor, Stair Bldg., Toronto.
Wells Bros. of Can., Galt.
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Niles-Bement-Pond Co., New York.
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Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas.
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Wilkinson & Kompass, Hamilton, Ont.
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Rice, Lewis & Son, Toronto.

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Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
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Long & Allstatter Co., Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo, O.

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Brown, Boggs Co, Ltd., Hamilton.
Can Blower & Forge Co, Kitchener.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Long & Allstatler, Hamilton, Ohio.
A. B. Jardine & Co., Hespeler, Ont.
National Machy. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
H. D. Stoll Co., Inc., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Williams, White & Co., Moline, Ill.
Williams Mchy Co., A. R., Toronto, Ont.

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The Quickwork Co., St Mary's, Ohio.

SHEARS, PNEUMATIC
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SHEARS, PLATE CUTTING, SLITTING
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SHEARS, SPLITTING
Dom. Steel Products Co., Ltd., Brantford.

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D. H. Stoll Co., Inc., Buffalo, N.Y.

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J. H. Williams & Co., Brooklyn, N.Y.

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Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
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Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

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Rice Lewis & Son, Toronto, Ont.

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Tallman Brass & Metal Co., Hamilton.

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Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
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Hamilton Co., Ltd., Wm., Peterborough,
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Katie Foundry, Galt, Ont.
Ker & Goodwin Machine Co., Ltd., Brantford Ont
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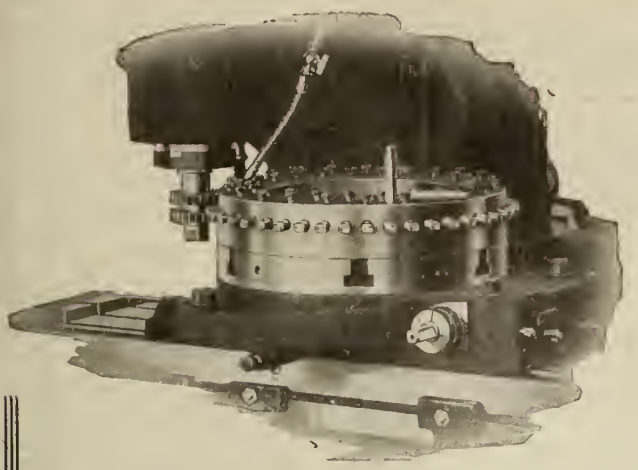

A Typical Vertical Milling Operation

To the left is shown a Milwaukee Milling Machine straddle milling, ½ in. deep and ⅜ in. wide, cold rolled steel pins, ½ in. diameter, 2⅝ in. long, by the continuous milling process.

The main construction principles of the Milwaukee Vertical Milling Machine do not differ from our horizontal type, *i.e.*, the heavily-ribbed, box-section column, the solid top knee, the constant speed drive, the automatic flooded lubrication system—these are embodied as being characteristics of Milwaukee Milling Machines in general

On our Vertical Milling Machines, we have departed from the usual practice of making the spindle adjustable, except for wear. All adjustments for practical purposes can be made by the knee alone, the same as on horizontal milling machines. The non-adjustable spindle construction is decidedly rigid and will maintain alignment through many years of service. The automatic flooded lubrication system is extended to the head of the machine.

Our Catalogue will be sent on request. Write for a copy, to-day.

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SAWS SWING
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Homer & Wilson, Hamilton, Ont.

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Canada Machinery Corp., Galt, Ont.
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Canadian Mead-Morrison Co., Limited, Montreal, Que.

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Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
Marshall, Son & Bunney, Toronto.
Peckovers, Ltd., Toronto, Ont.
Samuel Osborne (Can.), Ltd., Montreal.
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Norton, Ralph B., Agent, Montreal.
Atkins & Co., Ltd., Wm. Sheffield, Eng.
Marshall, Son & Bunney, Toronto
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Marshall, Son & Bunney, Toronto
United States Steel Corp., Canton, Ohio.

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Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co. Ltd., Montreal.
Union Drawn Steel Co., Hamilton, Ont.

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H. A. Drury Co., Ltd., Montreal.
Firth & Sons, Thos., Montreal, Que.
Illingworth Steel Co., J., New York.
Kayser Ellison & Co., Sheffield, Eng.
Latrobe Electric Steel Co., Latrobe, Pa
Marshall, Son & Bunney, Toronto, Ont.
Osborne, Samuel, Montreal, P.Q.
Plewes, Ltd. Winnipeg, Man.
Pilot Steel & Tool Co., Montreal, Que.
Ralph B. Norton, Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co., Ltd., Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL, CHROME, MANGANESE
Joliette Steel Co., Montreal, Que.

STEEL, OPEN HEARTH
Illingworth Steel Co., John New York
United States Steel Corp., Canton, Ohio.

STEEL PLATES
Dominion Foundries & Steel Ltd., Hamilton, Ont.

STEEL PRODUCTS AND MACHINERY
Dom. Steel Products Co., Ltd., Brantford

STEEL, ROCK DRILL
Armstrong, Whitworth of Canada, Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.

STEEL, SPECIAL ANALYSIS
United States Steel Corp., Canton, Ohio.

STEEL, SPRING AND REINFORCING
Peckovers, Ltd., Toronto, Ont.
United States Steel Corp., Canton, Ohio.

STEEL, STRUCTURAL
Algoma Steel Corp., Sault Ste. Marie
Dom. Iron & Steel Co., Sydney, N.S.
MacKinnon Steel Co., Sherbrooke, Que.
Peckovers, Ltd., Toronto, Ont.

STEEL, TOOL
Armstrong, Whitworth of Can., Montreal
Atkins & Co., Wm., Sheffield, Eng.
Baines & David, Toronto.
Can. Fairbanks-Morse Co., Montreal.
Drury Co., H. A., Montreal, Que.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.
Firth & Sons, Thos., Montreal, Que.
Hawkridge Bros. Co., Boston, Mass.
Kayser-Ellison & Co., Ltd., Montreal.
Lincoln Electric Co., of Canada, Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Ltd., Montreal
Marshall, Son & Bunney, Toronto, Ont.
Latrobe Electric Steel Co., Latrobe, Pa.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son Toronto, Ont.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL TUBING
Tube Co. of Canada, Ltd,, Toronto, Ont.

STEEL, VANADIUM
Wm. Atkins & Co., Ltd., Sheffield, Eng.
Armstrong, Whitworth of Can., Montreal.
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Drury, H. A., Co., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.
Wells Bros. of Can., Galt, Ont.

"STELLITE"
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.

STOCK RACKS FOR BARS, PIPING, ETC.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

STOCKS AND DIES
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros., of Can., Galt, Ont.

STOCKS, PIPE
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Wells Bros., Co., of Canada, Galt, Ont.

STONES, COMMUTATORS
Lyman Tube & Supply Co., Ltd., Montreal

STRAIGHTENING MACHINERY
Baird Machinery Co., Bridgeport, Conn.
Bertrams, Ltd., Edinburgh, Scotland.

STRAND
Dom. Steel Products Co., Ltd., Brantford.
Page Steel & Wire Co., Adrian, Mich.

SURFACE PLATES
Brown & Sharpe Mfg. Co., Providence, R.I.

STRUCTURAL STEEL WORKS
William Hamilton Co., Peterboro, Ont.

SWITCHBOARDS
Northern Electric Co., Ltd., Montreal Que

SWITCHES, RAILWAY
Can. Steel Foundries, Ltd., Montreal.

TABLES, DRAWING
Economy Drawing Table Co., Adrian, Mich.

TABLES, SAND-BLAST
Pangborn Corporation, Hagerstown, Md.

TAPPING MACHINES (PNEUMATIC)
Cleveland Pneumatic Tool Co., Toronto.

TANKS, AIR, EXPANSION
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, GASOLINE, KEROSENE AND OIL
Bowser Co., Ltd., S. F. Toronto, Ont.
Can. John Wood Mfg. Co., Ltd., Toronto
Dominion Bridge Co., Montreal, Que.
Dom. Forge & Stamping Co., Walkerville.
MacKinnon Steel Co., Sherbrooke, Que.
Marshall, Son & Bunney, Toronto.

TANKS, LEAD LINED
Can. Hanson Van Winkle Co., Ltd.,

TANKS, LUBRICATING, OIL STORAGE
Bowser Co., Ltd., S. F. Toronto, Ont.
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, PNEUMATIC AND CLOSET
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, RUBBER CEMENT
Bowser Co., Ltd., S. F., Toronto, Ont.

TANKS, STEEL, WATER PRESSURE
Bowser Co., Ltd., S. F., Toronto, Ont.
Dominion Bridge Co., Montreal, Quebec.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Toronto Iron Works, Ltd. Toronto.

TANK WAGONS
MacKinnon Steel Co., Sherbrooke, Que.
Toronto Iron Works, Ltd., Toronto.

TANKS, WELDED
Can. John Wood Mfg. Co., Ltd., Toronto
Can. Hanson Van Winkle Co., Ltd., Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.

TANKS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke
Flier Steel & Metals, Welland Ont.
MacKinnon Steel Co., Sherbrooke, Que.
William Hamilton Co., Peterboro, Ont.

TAPER PINS
Galt Machine Screw Co., Ltd., Galt, Ont.

TAPES, MEASURING
James Chesterman & Co., Ltd., Sheffield, Eng.
Rice Lewis & Son, Toronto, Ont.

TAPPING MACHINES AND ATTACHMENTS
Bertram, John & Sons Co., Dundas.
Canada Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garvin Machine Co., New York.
The Geometric Tool Co., New Haven.
J. H. Hall & Sons, Brantford, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Niles-Bement-Pond Co., New York.
Rickert-Shafer Co., Erie, Pa.
National-Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto.
L. S. Starrett Co., Athol, Mass.
Whitney Mfg. Co., Hartford, Conn.

TAPS, ADJUSTABLE
Butterfield & Co., Rock Island, Que.
Geometric Tool Co., New Haven.
Ingersoll Mach. Co., Ingersoll, Ont.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Pilot Steel & Tool Co., Montreal, Que.
Victor Tool Co., Waynesboro, Pa.

TAPS, GUN, HAND, BOILER
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, MACHINE RELIEVED
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can. Galt, Ont.

TAPS, MACHINE SCREW
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, PIPE
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield
Ingersoll Mach. Co., Ingersoll, Ont.
Marshall, Son & Bunney, Toronto.
Wells Bros. of Can., Galt, Ont.

TAPS, SPECIAL
Elliott & Whitehall Galt, Ont.

TAPS, STAYBOLT, TAPPER
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

TAPS, DIES AND WRENCHES
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Foss Mchy. & Spty. Co., G. F., Montreal.
Geometric Tool Co., New Haven.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Mach. Co., Ingersoll, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Morse Twist Drill & Mchy. Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Rice Lewis & Son, Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Taylor, J. A. M., 318 Stair Bldg., Toronto.
Wells Bros. of Canada, Galt, Ont.

TAP EXTRACTORS
Walton Co., The, Hartford, Conn.

THERMOMETERS, INDUSTRIAL ENGRAVED TEMPERATURE AND PRESSURE
Taylor Instrument Co., Rochester, N.Y.

THERMOMETERS, RECORDING AND INDEX
Bristol Co., Waterbury, Conn., U.S.A.
Taylor Instrument Co., Rochester, N.Y.

TESTING INSTRUMENTS, METALLURGICAL
Shore Instrument & Mfg. Co., New York.

TENOVERS
Oliver Machy. Co., Grand Rapids, Mich.

TESTING LABORATORIES
Toronto Testing Laboratory, Toronto.

THREAD-CUTTING MACHINES
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Mach. Co., Ltd., Toronto.
Geometric Tool Co., New Haven.
Jardine & Co., Ltd., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National-Acme Co., Cleveland, Ohio.
National Machy. Co., Tiffin, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt., Ont.

THREADING TOOLS
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Landis Machine Co., Waynesboro, Pa.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. of Canada, Galt, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

THREADING MACHINES FOR BOLTS, NUTS AND PIPES
Greenfield Tap & Die Corp., Greenfield.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt., Ont.

THREAD MILLING MACHINES
Taft-Pierce Mfg. Co., New York, N.Y.
Smalley-General Co., Bay City, Mich.

THUMB SCREWS AND NUTS
See Screws.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

TIN—PIG AND BAR
British Smelting & Refining Co., Ltd., Montreal, Que.

TINSMITHS' TOOLS
Brown, Boggs & Co., Hamilton, Can.
Petrie, Ltd., H. W., Toronto.

TIRE BENDERS
Jardine & Co., Ltd., A. B., Hespeler.

TIRE SETTING MACHINES, HYDRAULIC
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Perrin, Ltd., William R., Toronto.
West Tire Setter Co., Rochester, N.Y.

TOOL CASES
Rice Lewis & Son, Toronto, Ont.

TOOL HOLDERS
Aikenhead Hardware Co., Toronto, Ont.
Armstrong Bros. Tool Co., Chicago.
Cleveland Twist Drill Co., Cleveland.
Deloro Smelting & Refining Co., Ltd. Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

TOOL MAKERS
Samuel Osborne (Can.), Ltd., Montreal

TOOL POSTS, LATHE
Armstrong Bros. Tool Co., Chicago.
Williams & Co., J. H., Brooklyn, N.Y.

TOOL ROOM PARTITIONS
Canada Wire & Iron Goods Co., Hamilton.

TOOLS, BLACKSMITHS'
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son Toronto, Ont.

TOOLS, ADJUSTABLE BORING
Kelly Reamer Co., Cleveland, O.
Petrie, Ltd., H. W., Toronto.

TOOLS, ELECTRIC
Independent Pneumatic Tool Co., Chicago.
Williams Machy. Co., A. R., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.
U. S. Electrical Tool Co., Cincinnati, O.

TOOLS, FORMING
Davidson Tool Mfg. Co., New York, N.Y.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.

TOOLS, LUMBERING
Thos. Pink & Co., Pembroke, Ont.

TOOLS, LATHE, PLANER, SLOTTER
Armstrong Bros. Tool Co., Chicago.
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Williams & Co., J. H., Brooklyn, N.Y.

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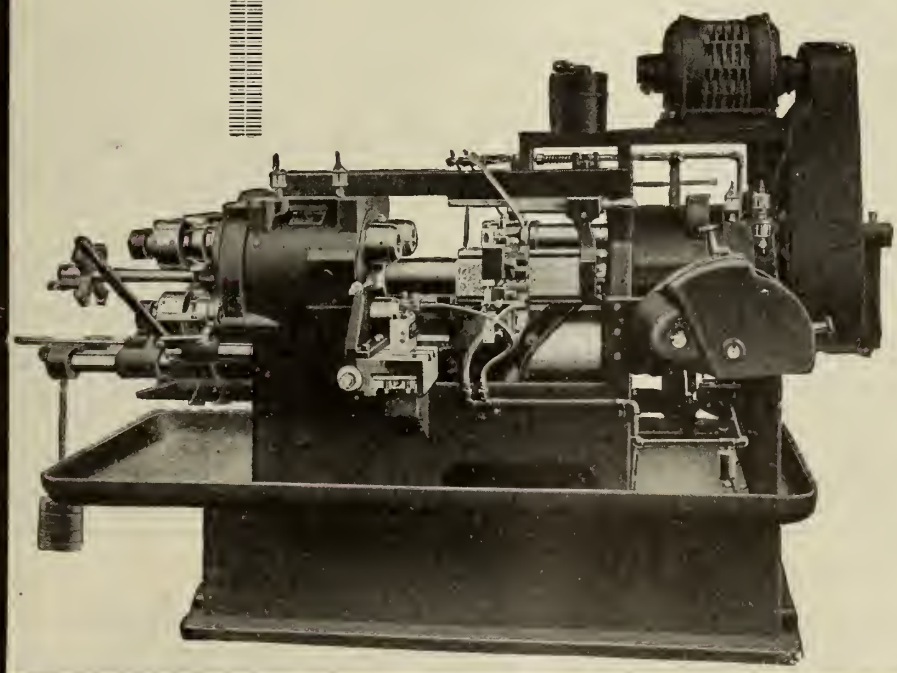

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If interested tear out this page and place with letters to be answered.

TOOLS, SPECIAL
Crescent Machine Co., Ltd., Montreal, Que.
McClean Machine & Tool Co., Ltd., Hamilton, Ont.
McCrosky Tool Corp., Meadville, Pa., U. S. A.

TORCHES, BLOW
Int. Mach. & Supply Co., Ltd., Montreal.

TORCHES, GASOLINE, KEROSENE AND ALCOHOL
Turner Brass Works, Sycamore, Ill.

TORCHES, STEEL
Armstrong, Whitworth of Can., Montreal.
Prest-O-Lite Co., Inc., Toronto, Ont.

TRACK SYSTEMS
Brown Hoisting Machinery Co., Cleveland, Ohio.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.

TRAM RAIL SYSTEMS (Overhead)
Brown Hoisting Machinery Co., Cleveland, Ohio.

TRAMWAYS, BRIDGE
Brown Hoisting Machinery Co., Cleveland, Ohio.

TRANSFORMERS
Can. General Electric Co., Toronto, Ont
MacGovern & Co., Montreal, Que.
Northern Electric Co., Ltd., Montreal.

TRANSITS
Hughes, Owens Co., Ltd., Montreal, Que.

TRANSMISSION CHAIN
Lyman Tube & Supply Co., Ltd., Montreal
Morris Chain Co., Ithaca, New York.

TRANSMISSION MACHINERY
American Pulley Co., Philadelphia, Pa.
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Coventry Chain Co., Coventry, England.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Hamilton Gear & Machine Co., Toronto.
Jones & Glassco, Montreal.
Kennedy & Sons, Wm., Owen Sound, Ont.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Machinery Co., A. R., Toronto.

TRANSMISSION ROPE
Jones & Glassco, Montreal, Que.
MacKinnon Steel Co., Ltd., Sherbrooke.

TRANSMISSION TOWERS
Curtis Pneumatic Machy. Co., St. Louis.
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Northern Crane Works, Walkerville.
Tallman Brass & Metal Co., Hamilton.

TROLLEYS
Brown Hoisting Machinery Co., Cleveland, Ohio.
Lyman Tube & Supply Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

TRUCKS, FACTORY, FREIGHT, ETC
Canada Machinery Corp., Galt, Ont.
Chapman Double Ball Bearing, Toronto.
Cowan Truck Co., Holyoke, Mass.
Holyoke Truck Co., Holyoke, Mass.
MacKinnon Steel Co., Sherbrooke, Que.
Rice Lewis & Son, Toronto, Ont.

TRUCKS, ELECTRIC
Cowan Truck Co., Holyoke, Mass.
Good Engineering Co., Toronto, Ont.

TRUCKS, FLOOR
Cowan Truck Co., Holyoke, Mass.
Holyoke Truck Co., Holyoke, Mass.

TRUCKS, HAND
Can. Kron Scale Co., Montreal, P.Q.
Cowan Truck Co., Holyoke, Mass.

TRUCKS, LUMBER AND KILN
Holyoke Truck Co., Holyoke, Mass.
Swedish Steel & Importing Co., Montreal.
Northern Crane Works, Walkerville.

TRUCKS, LIFT, ELEVATING & TRANSFER
Cowan Truck Co., Holyoke, Mass.
Holyoke Truck Co., Holyoke, Mass.

TUBES, BOILER
Lyman Tube & Supply Co., Montreal, Que.

TUBING ELECTRIC WELDED OR OXYACETYLENE WELDED
Tube Co. of Can., Ltd., Toronto, Ont.

TUBE PROUCTS
Tube Co. of Can., Ltd., Toronto, Ont.

TUBING, SEAMLESS, BRASS AND COPPER
Lyman Tube & Supply Co., Montreal, Que.
Standard Tube & Fence Co., Woodstock.
Tallman Brass & Metal Co., Hamilton.

TUBING, FLEXIBLE METALLIC
Lyman Tube & Supply Co., Montreal, Que.

TUBING, SEAMLESS STEEL
Tube Co. of Can., Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.

TUBING, WELDED STEEL
Lyman Tube & Supply Co., Montreal, Que.
Tube Co. of Can., Ltd., Toronto, Ont.

TURRET MACHINES, LATHES
Acme Mach. Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence.
Garlock-Walker Machinery Co., Toronto.
Greenfield Tap & Die Corp., Greenfield.
Hardinge Bros., Chicago, Ill.
Oliver Mchy. Co., Grand Rapids, Mich.
Pratt & Whitney, Hartford, Conn.
Petrie, Ltd., H. W., Toronto.
Steinle Turret Mach. Co., Madison, Wis.
Warner & Swasey Co., The, Cleveland, O

TURBO GENERATOR UNITS
MacGovern & Co., Montreal, Que.
Warner & Swasey, Cleveland, O.
Garvin Machine Co., New York.

TURNBUCKLES
Canada Fdrs. & Forg. Ltd., Welland.
Morrow Screw & Nut Co., Ingersoll, Ont.
Rice Lewis & Son, Toronto, Ont.

TURNTABLES
Can. Link-Belt Co., Toronto, Ont.
Dom. Bridge Co., Ltd., Montreal, P.Q
Elec. Steel & Metals, Welland, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

TWIST DRILLS
Butterfield & Co., Inc., Rock Island, Que

UPSETTING AND BENDING MACHINERY
Bertram & Sons Co., John, Dundas.
Brown, Boggs Co., Ltd., Hamilton, Can.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Machinery Co., Toronto.
Jardine & Co., A. B., Hespeler, Ont.
National Machy. Co., Tiffin, O.
Canada Machinery Corp., Galt, Ont.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.

VALVE LEATHERS
Graton & Knight Mfg. Co., Montreal.

VALVES, MIXING
Crane, Ltd., Montreal, Que.

VALVES (IRON) STANDARD AND EXTRA HEAVY
Crane, Ltd., Montreal, Que.

VALVE GRINDERS (PNEUMATIC)
Cleveland Pneumatic Tool Co., Toronto.

VALVES, HYDRAULIC
Metalwood Mfg. Co., Detroit, Mich.

VALVES, RUBBER PUMP
International Mach. Spls., Ltd., Montreal
Quaker City Rubber Co., Philadelphia

VENTILATORS
H. H. Robertson, Lt., Sarnia, Ont.

VENTILATING APPARATUS
Brantford Oven & Rack Co., Brantford.
Can. Blower & Forge Co., Kitchener, Ont
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
Williams Machy. Co., A. R., Toronto.

VISE STANDS, PORTABLE
Williams & Co., J. H., Brooklyn, N.Y.

VISES, BENCH
Aikenhead Hardware Co., Toronto, Ont.
Becker Milling Machine Co., Boston, Mass.
Foss Machy. & Spls. Co., G. F., Montreal.
Petrie, Ltd., H. W., Toronto.
Superior Machinery Co., London, Ont.

VISES, DRILL
Superior Machinery Co., London, Ont.

VISES, PIPE
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Rock Island, Que.
Marshall, Son & Bunney, Toronto.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

VISES, MILLING MACHINE
Brown & Sharpe Mfg. Co., Providence, R.I.
Superior Machinery Co., London, Ont.

VISES, PLANER AND SHAPER
Aikenhead Hardware Co., Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Petrie, Ltd., H. W., Toronto.
Superior Machinery Co., London, Ont.

VOLMETERS & AMMETERS
Northern Electric Co., Ltd., Montreal Que

WASHER MACHINES
National Machy. Co., Tiffin, Ohio.

WASHERS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Barnes, Wallace, Co., Bristol, Conn.
Graton & Knight Mfg. Co., Worcester.
Kayser-Ellison & Co., Ltd., Montreal.
London Bolt & Hinge Wks., London, Ont.
Marshall, Son & Bunney, Toronto.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Norton, Ralph B., Agent, Montreal.
Steel Co. of Canada, Ltd., Hamilton, Ont.

WASTE
Wilkinson & Kompass, Hamilton, Ont.
Wood Turret Machine Co., Brazil, Ind.

WASTE CLEANER AND OIL RECLAIMER
Oakley Chemical Co., New York, N.Y.

WATER-INTAKE SCREENS
Can. Link-Belt Co., Toronto, Ont.

WATER TOWERS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Toronto Iron Works, Ltd., Toronto.

WATER WHEELS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Hamilton Co., Ltd., Wm., Peterborough,

WELDED TANKS
Can. John Wood Co., Toronto, Ont.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.

WELDERS, ELECTRIC, SPOT AND BUTT
Knight Metal Products, Toronto.

WELDERS, ELECTRIC ARC
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.

WELDING, ELECTRIC, SPOT, BUTT, ETC.
McClean Machine & Tool Co., Ltd., Hamilton, Ont.
Tabor Mfg. Co., Philadelphia, Pa.

WELDING MASKS
Carter Welding Co., Ltd., Toronto, Ont.
Davis-Bournonville Co., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.

WELDING GOGGLES
Carter Welding Co., Ltd., Toronto, Ont.
Davis-Bournonville Co., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.
Willson Goggles Inc., Reading, Pa.

WELDING RODS AND WIRE
Carter Welding Co., Ltd., Toronto, Ont.
Davis-Bournonville Co., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
Page Steel & Wire Co., Adrian, Mich.

WELDING SUPPLIES
Carter Welding Co., Ltd., Toronto, Ont.
Davis-Bournonville Co., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.
Lincoln Electric Co. of Canada, Limited, Toronto, Ont.
Nat. Electro Products Ltd., Toronto, Ont.
Union Carbide Co., Toronto, Ont.

WELDING AND CUTTING OUTFITS
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co., Ltd., Toronto, Ont.

WELDLESS BOILER TUBES
Furniss, Clarke & Co., Montreal, Que.

WHEELS, BALL BEARING
Lyman Tube & Supply Co., Montreal, Que

WHEELS, CAR, STEEL
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Elec. Steel & Metals, Welland, Ont.

WHEELS, SPROCKET AND TRACTION
Can. Link-Belt Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.

WHEELS, TURBINE, WATER
Elec. Steel & Metals, Welland, Ont.

WHEELS, PRESSED STEEL
American Pulley Co., Philadelphia, Pa.

WHEEL TRUEING TOOLS
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Wheel Trueing Tool Co., Windsor, Ont.

WINCHES
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Hall & Sons, John H., Brantford.
Kennedy & Son, Wm., Owen Sound, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.

WINCHES, MOTOR TRUCK
Canadian Mead-Morrison Co., Limited, Montreal, Que.

WINCHES, POWER DRIVEN
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Hamilton Co., Ltd., Wm., Peterborough, Ont.

WIRE, CAST STEEL AND MUSIC
Kayser-Ellison & Co., Ltd., Montreal.
Norton, Ralph B., Agent, Montreal.

WIRE COILING AND POINTING MACHINERY
Baird Machine Co., Bridgeport, Conn.

WIRE STRAIGHTENERS AND CUTTERS
Shuster Co., he F. B., New Haven, Conn.

WIRING MACHINES
Quickwork Co., St. Marys, Ohio.

WIRE GUARDS
B. Greening Wire Co. Hamilton, Ont.

WIRE CLOTH AND PERFORATED METALS
Canada Wire & Iron Goods, Hamilton.
Page Steel & Wire Co., New York, N.Y.

WIRE FENCING

WIRE, COPPER, CLAD STEEL WIRE, LINK FABRIC
Page Steel & Wire Co., Adrian, Mich.

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Brown, Boggs Co., Ltd., Hamilton, Can.

WIRE GUARDS
Can. Wire & Iron Goods Co., Hamilton, Ont.

WIRE NAILS
Page Steel & Wire Co., New York, N.Y.
Parmenter & Bulloch Co., Gananoque.
Steel Co. of Canada, Ltd., Hamilton, Ont.

WIRE ROPE
B. Greening Wire Co. Hamilton, Ont.
Can. Wire & Iron Goods Co., Hamilton, Ont.
Samuel Osborne, Ltd., Montreal, P.Q.

WIRE NAIL MACHINERY
National Machy. Co., Tiffin, Ohio.
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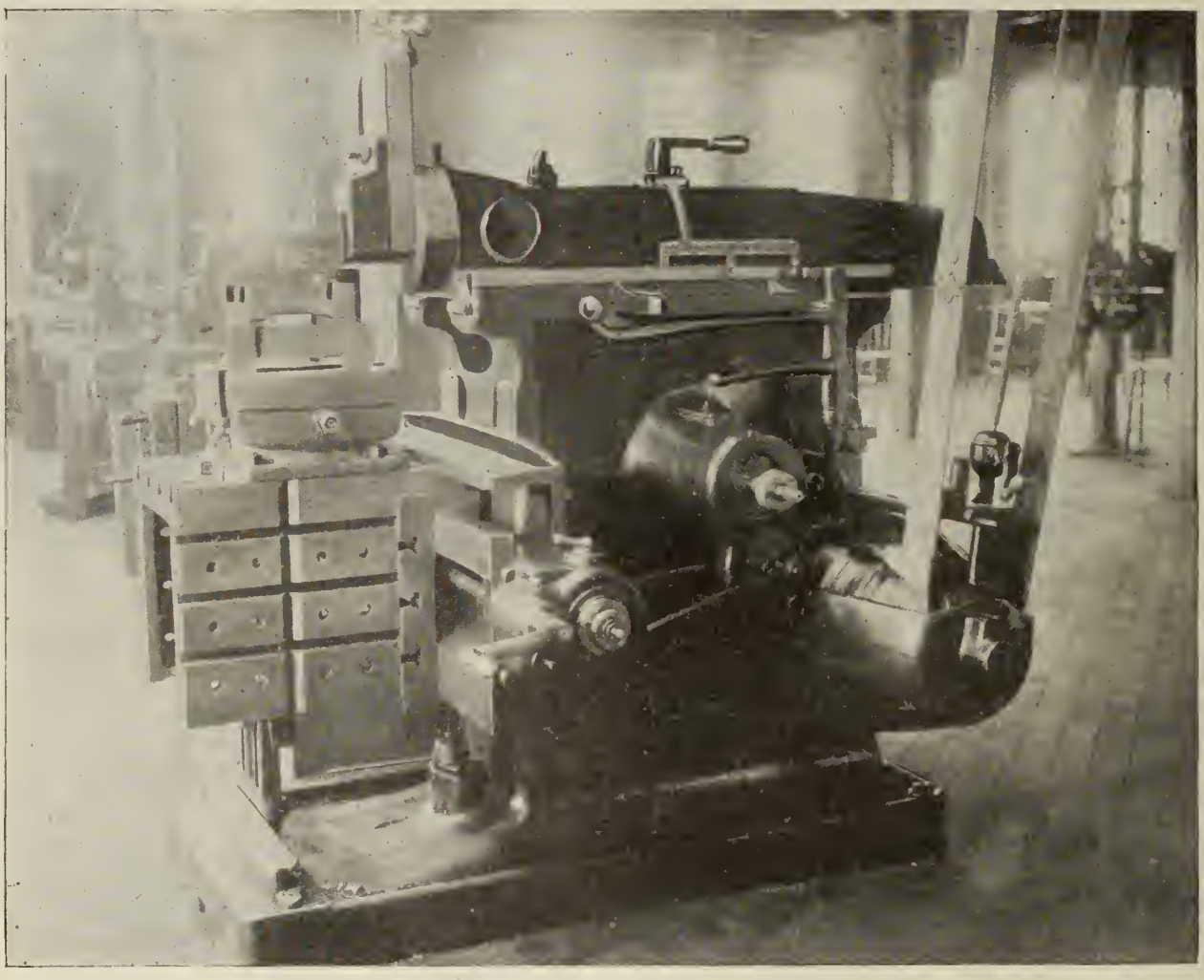

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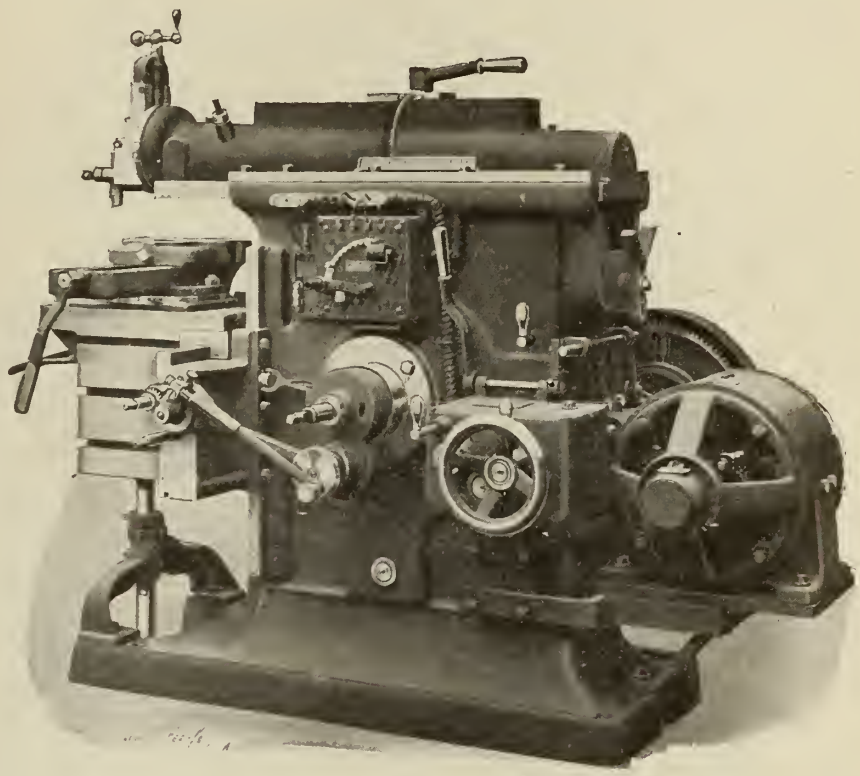

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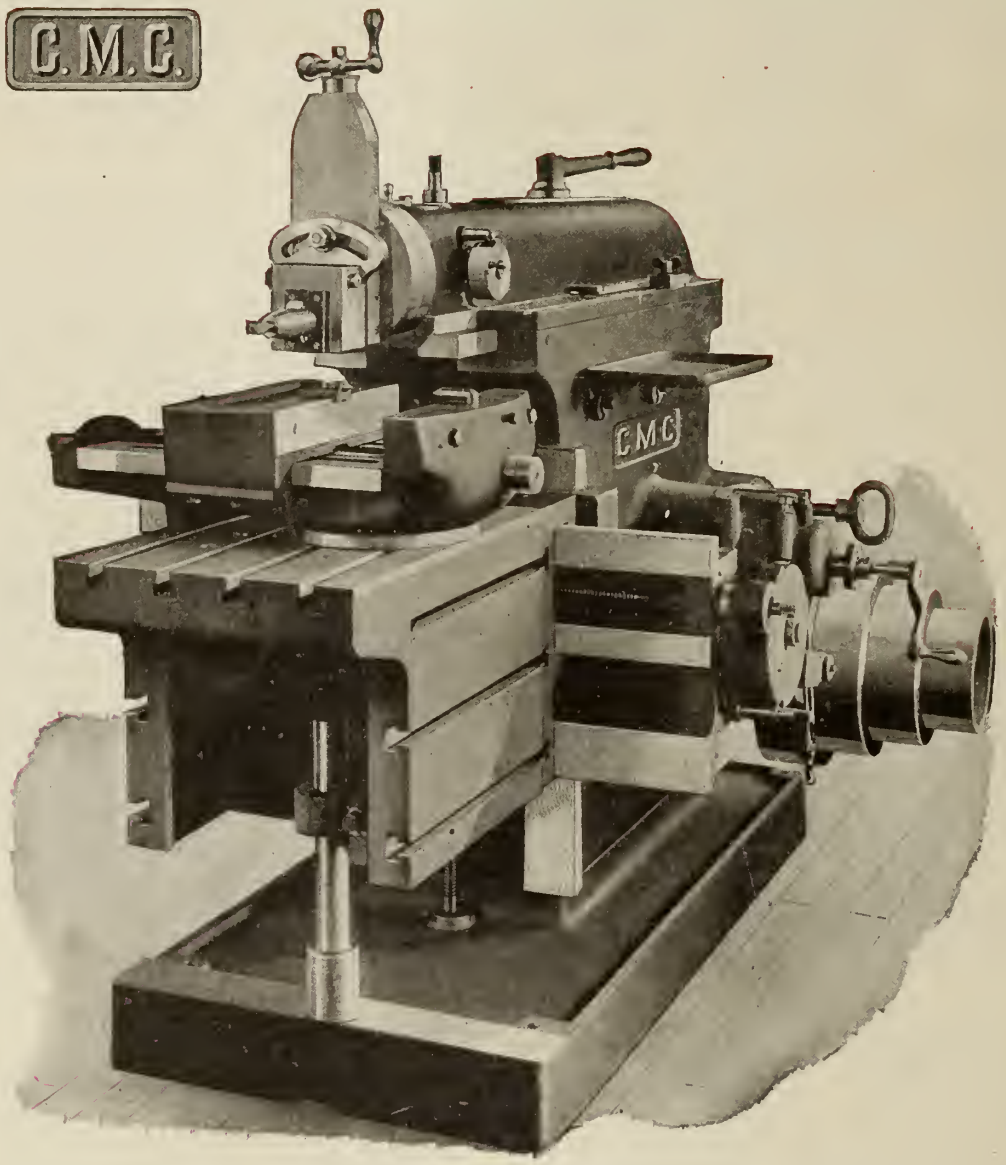

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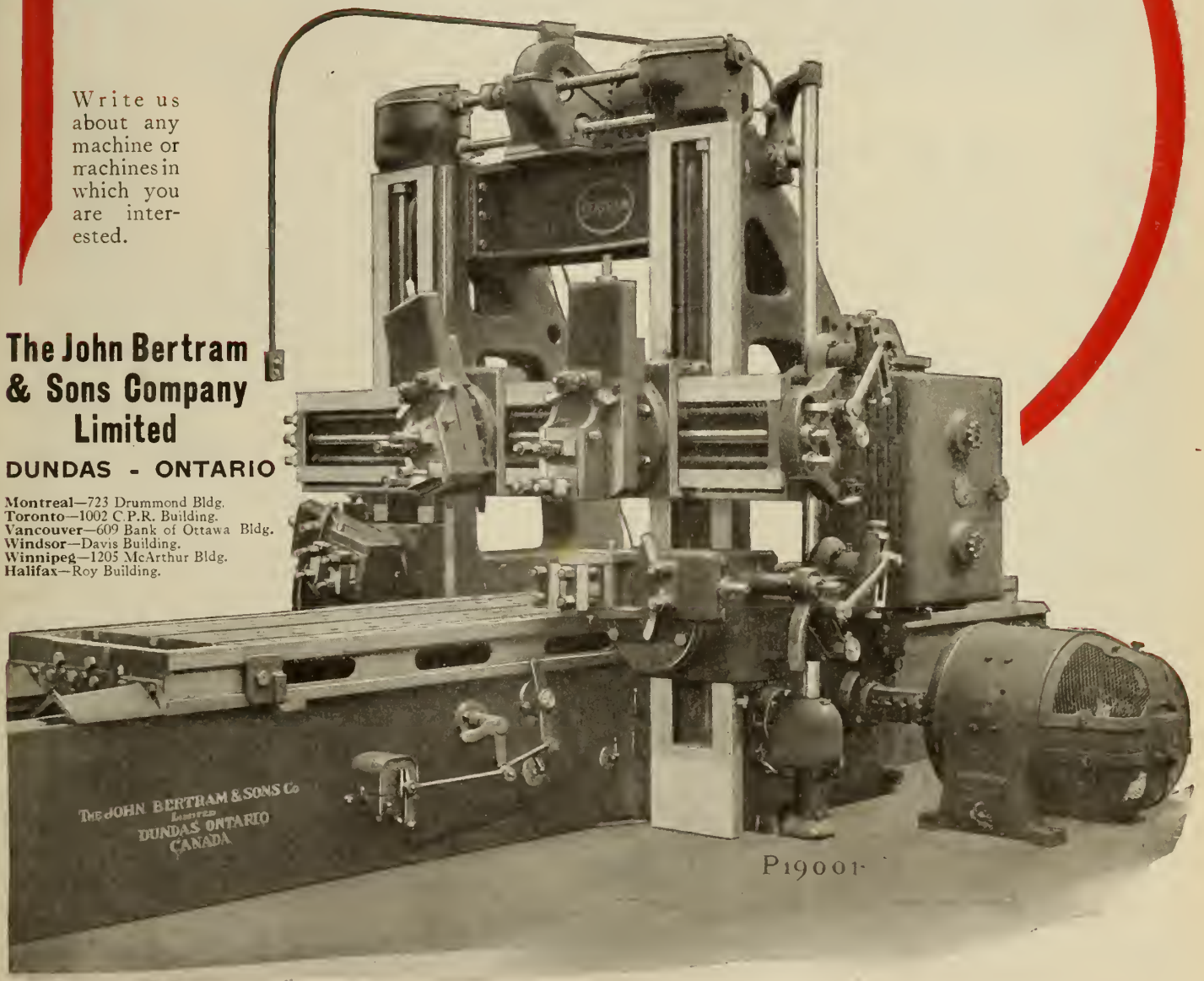

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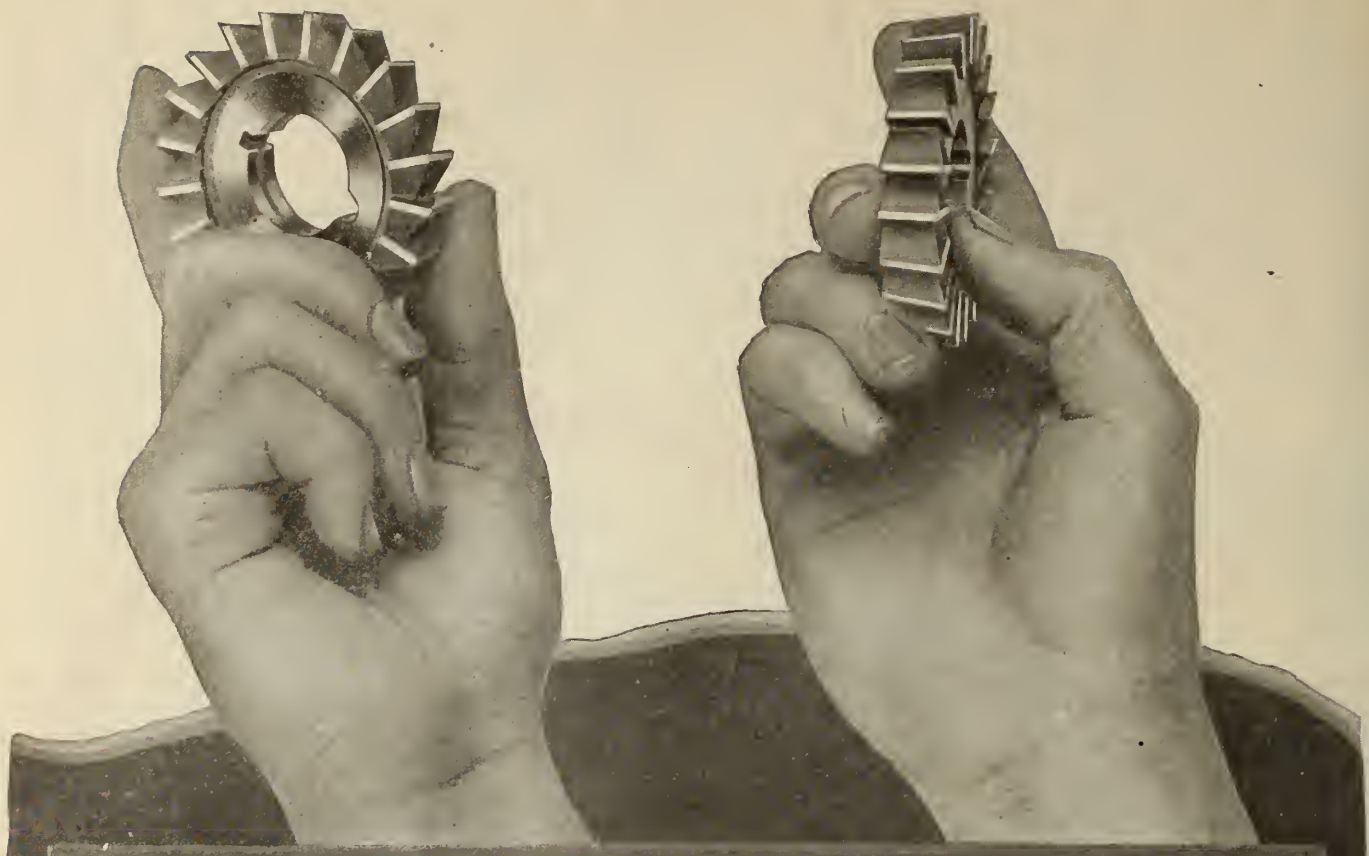

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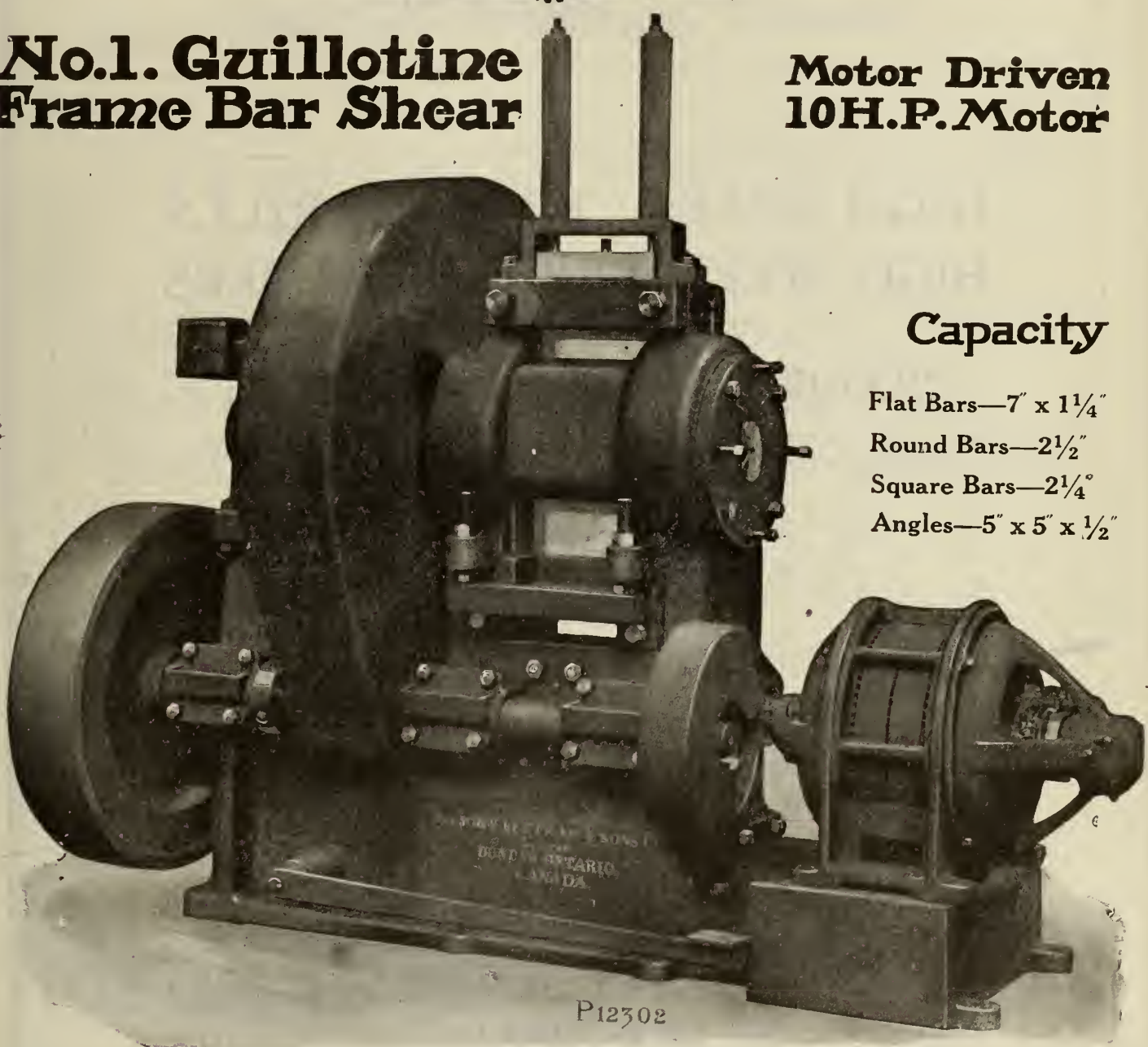

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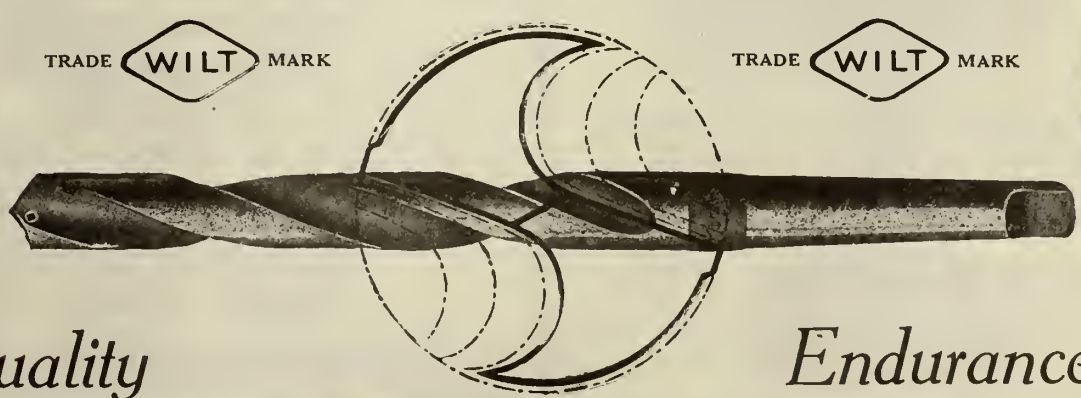

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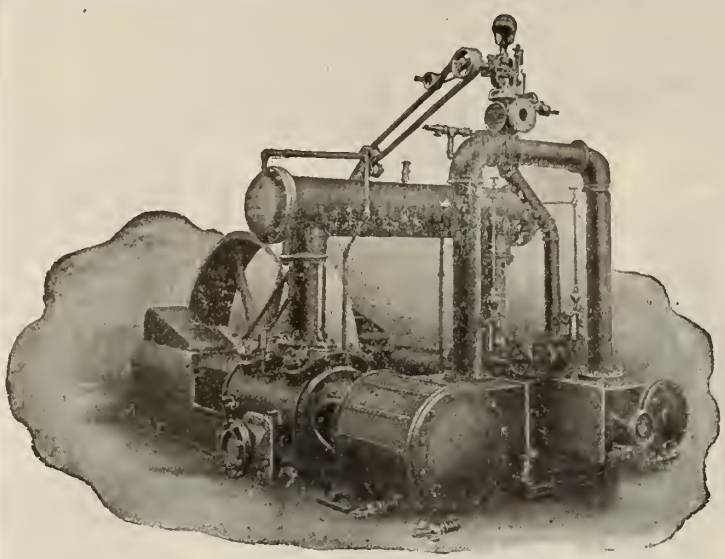

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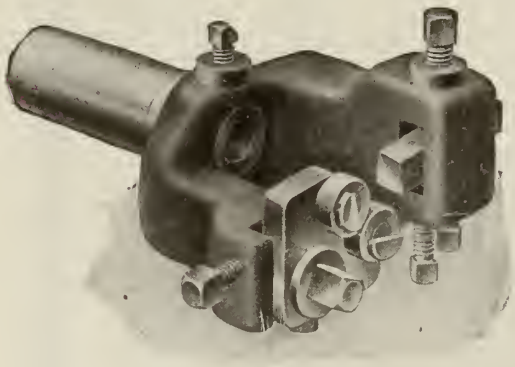

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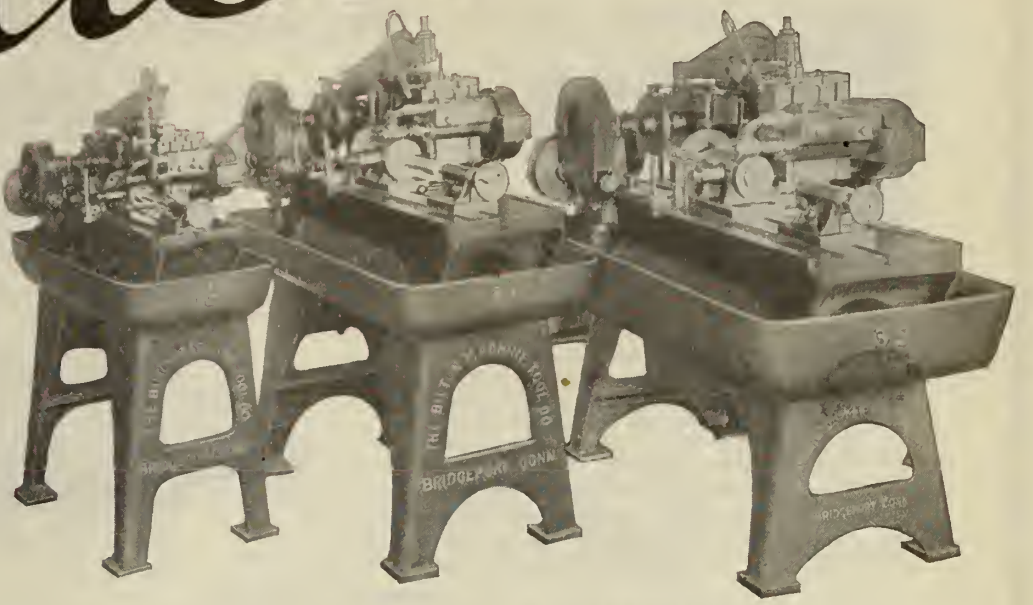

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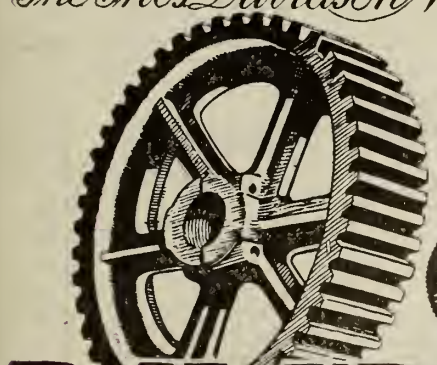


DAVIDSON

—*for a large variety of grinding*

if your variety of grinding is large invest in a Manhattan Universal Grinder. It is capable of handling cylindrical or internal grinding with the utmost in speed and accuracy.

Write for details.

Manhattan Machine & Tool Works

Grand Rapids, Mich., U.S.A.

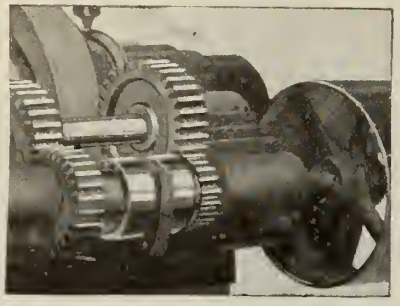
Manhattan All-Around UNIVERSAL TOOL GRINDER

Foreign Representatives The Oliver Machinery Co., Ltd., Manchester, Eng. Farmer & Co., Clerkenwell, London, E.C.

2

If interested tear out this page and place with letters to be answered.

THE JOHNSON FRICTION CLUTCH



Modern Machine Tools Require Good Clutches

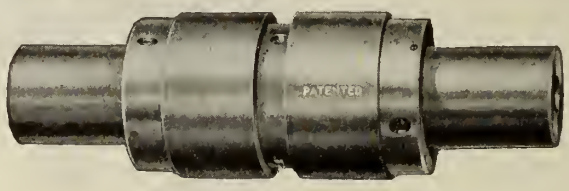
and Johnson Clutches are furnished as regular equipment on a large majority of the best machine tools made.

Exceptional qualities are required in a friction clutch to make it operate with the precision demanded by modern machine tools, and stand up under the service that the ordinary machine tools must perform.

The clutch that has proved its ability on hundreds of such installations is capable of good service anywhere.

Here is a common Johnson Clutch application—a double clutch mounted between spur gears for change of speed with single pulley drive. Where two speeds are needed on continuous production work, the greater convenience and superior endurance of Johnson Clutch control are invaluable.

Write for our Yellow catalog and Booklet, "Clutches As Applied To Machine Building."



DOUBLE CLUTCH EXTERIOR

CANADIAN AGENTS:

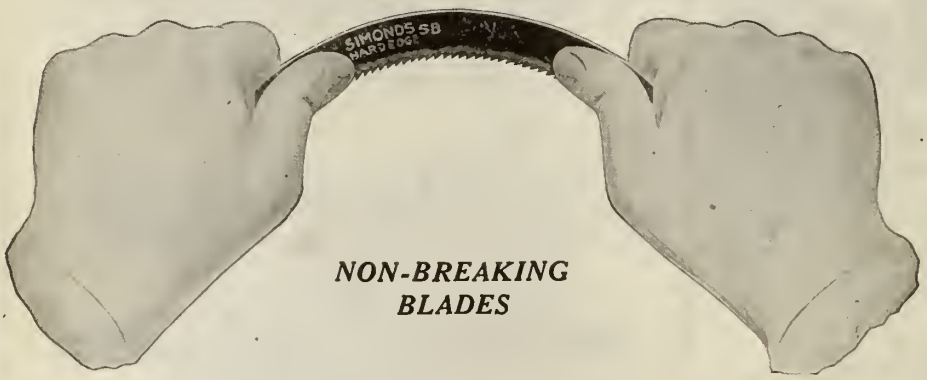
WILLIAMS & WILSON, 84 Inspector St., Montreal

CANADIAN FAIRBANKS-MORSE CO., LIMITED, Montreal, Toronto, Winnipeg

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN.

SIMONDS HACK SAWS

CUT CUTTING COST



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For Machine or Hand Use
Any Size or Length

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MONTREAL

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ELECTRIC AND OXY-ACETYLENE WELDED STEEL TUBING ALSO BUTT STEAM TUBING

Prompt service in supplying Steel Tubing for all purposes. Oxy-Acetylene Tubing is recommended for bending purposes, Electric for straight tubing or slight bends. Also fully equipped for Butt Seam Tubing. Tubing made hot or cold-rolled finish. Our plant is fully equipped for slitting all gauges of stock from sheets or coils. **Enquiries solicited.**

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THE TUBE COMPANY OF CANADA LIMITED

We are prepared to give expert advice on the selection of tubing for various purposes. This service costs you nothing and may save you a lot of expense.

TRACKWORK

FOR STEAM AND ELECTRIC RAILWAYS

Manufacturers of Balkwill Articulated Manganese Steel Crossings

Complete layouts of built-up, rail-bound hard-centre or solid manganese steel construction.

TRACKWORK ACCESSORIES

CANADIAN STEEL FOUNDRIES LIMITED

Transportation Building, Montreal

Do Your Furnaces Waste Oil?

OILGAS Industrial Furnaces

Will save 50% of the fuel used by ordinary furnaces of the same capacity.
Continuous forge furnaces, and furnaces for heating, melting, reheating, heat treating, annealing, hardening, sherardizing, and welding — Any industrial process requiring heat.
The only distinct advance in furnace practice since Siemens' time.
Are you interested in a description of these furnaces? Bulletin 54 is yours for the asking.

General Combustion Company of Canada, Limited

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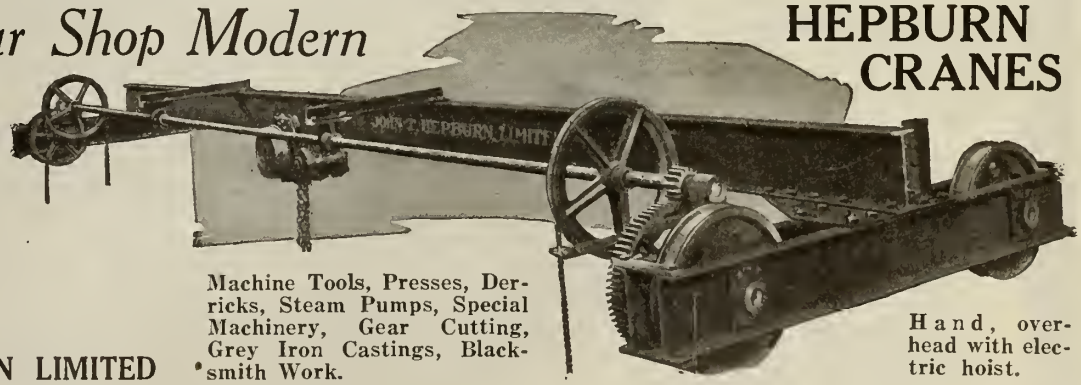
Make Your Shop Modern

HEPBURN CRANES

Well designed and strongly built cranes of this type will improve your shop. They will be a decided saving. Free moving hand cranes can be supplied at low cost.

Send for specifications and prices.



Machine Tools, Presses, Derricks, Steam Pumps, Special Machinery, Gear Cutting, Grey Iron Castings, Blacksmith Work.

Hand, overhead with electric hoist.

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Engineers and Iron Founders
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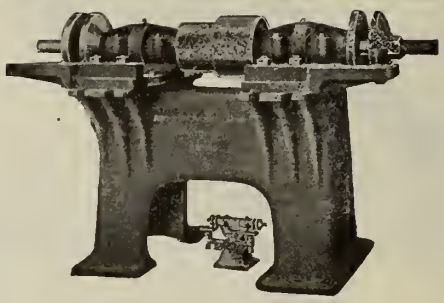
Grinding and Polishing Equipment

Every ordinary requirement of the modern shop is successfully met in the wide range of style and size in the Ford-Smith line. We have a great deal of experience in the construction of special grinding machinery for unusual work.

Many manufacturing operations show possibilities of extraordinary economies by the use of grinding processes. Our wide experience in solving production problems is at your service.

Shall we send you the Ford-Smith catalogue?



Heavy Type Floor Grinders

The Ford-Smith Machine Co., Ltd. HAMILTON, CANADA

Foreign Selling Agents :—

W. E. Storey, London, England — Gollin & Co., Melbourne, Australia

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STEEL *for*

Every Commercial Purpose

We are the only company in Canada producing steel ingots by the "HARMET" Liquid Process, a process that makes these ingots vastly superior to the ordinary kind, improving the physical properties and reducing the waste of ingot.

We can supply forgings of all shapes and sizes made of ordinary or "HARMET" Fluid Compressed Open-Hearth Steel on the Shortest Notice.

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Head Offices:
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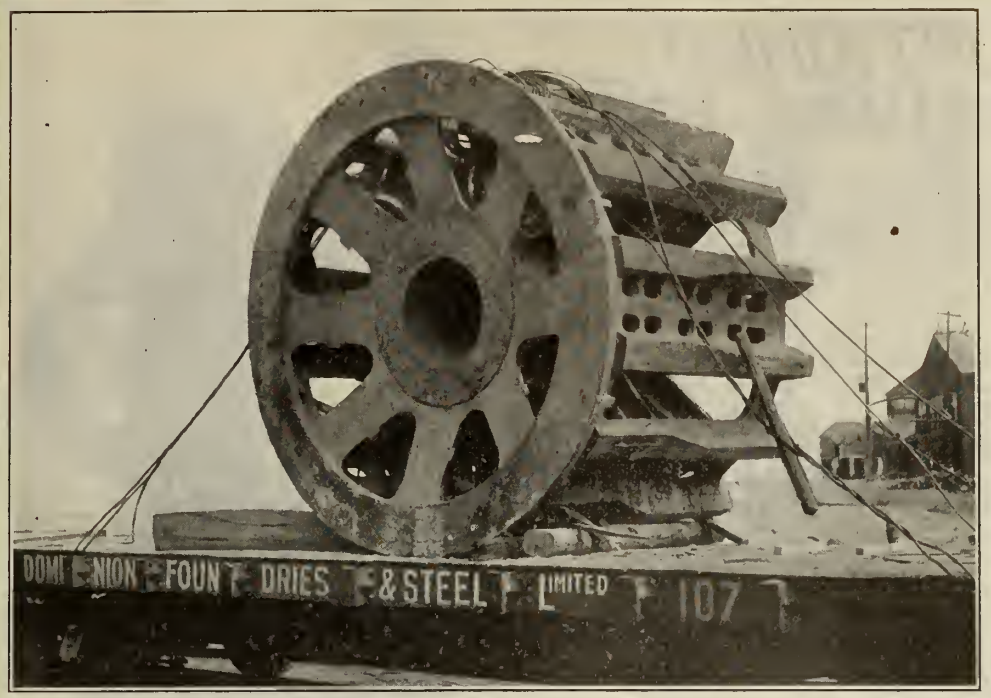
Western Sales Offices:
Room 14, Windsor Hotel
MONTREAL

Steel Ingots *by the* **HARMET** Liquid Process



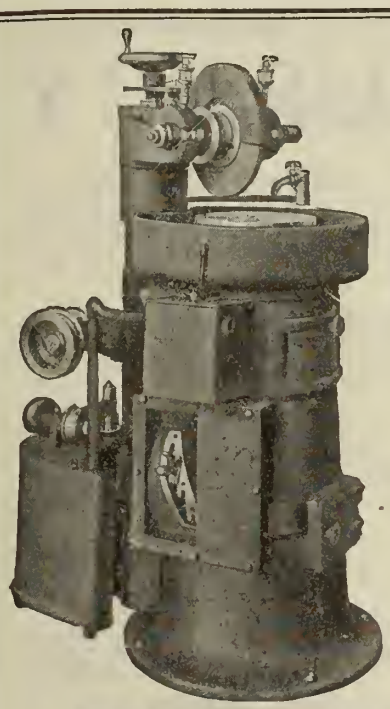
Cast Steel Spider

for Hydro-Electric Development at Queenston

WEIGHT
35 TONS

Dominion Foundries and Steel, Limited

Hamilton, Canada



BRISTOOL

Bristol 12-inch Rotary Precision Surface Grinder

Built for rapid production on grinding work.

It handles work either singly or in multiples within the capacity of the chuck and not thicker than 6-in., and grinds within quarter thousand in. of manufacturing accuracy.

And it is built to last.

It is provided with exceptionally long bearings throughout, especially in the back column. This prevents the wear, which is very slight, from affecting the accuracy of the grinder. The Back Column is made to swivel four degrees, which allows concave or convex grinding.

Bristol Rotary Surface Grinders are made in several types and sizes and are regularly equipped with 8-in., 12-in., and 16-in. magnetic chucks, either belt or motor driven and for dry or wet grinding.

Our Bulletin describes the many good points fully. Send us your name and address and we'll gladly mail you one.

Grinds within .0004 in. of absolute Accuracy

BRISTOL MACHINE TOOL CO.
SUCCESSORS TO C. G. GARRIGUS MACH. CO.
BRISTOL, CONN.

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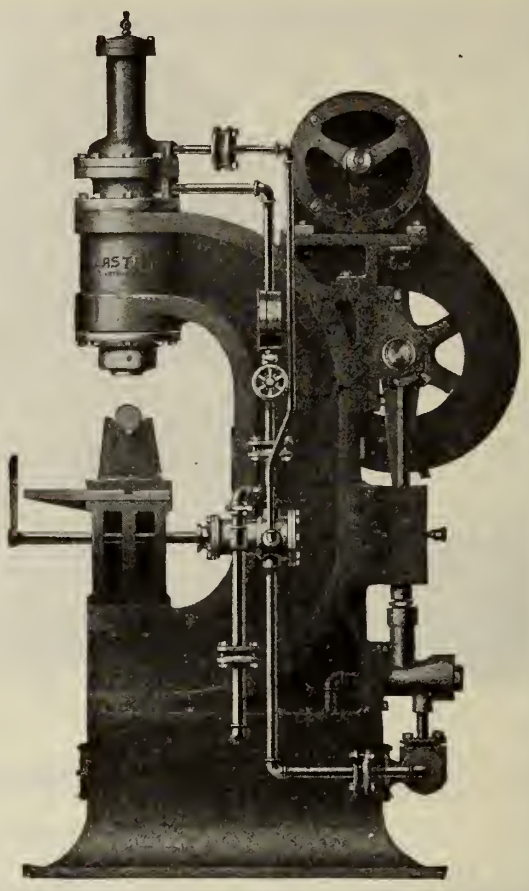
A SELF-CONTAINED HYDRAULIC UNIT



EASTERN UNIVERSAL HYDRAULIC PRESS. Supplied in 20-35 and 50 ton capacities, full hydraulic depending on no springs or weight for return of ram, delivering pressure instantly at a speed of 1½ in. per second return of ram 3 in. per second.

Length of Ram Travel .....6 in.
Depth of Throat .....10 in.
Length of Table .....8 ft.
Width of Table .....10 in.
Table to Ram .....10 to 14 in.

EASTERN UNIVERSAL PRESSES are tested before leaving our plant at 33 1/3% overload. They are furnished with rolling centres and are unexcelled for straightening of motor crankshafts, heavy wheel shafts, broaching splines in drive plate, differential gears, and others. Straightening front axles and spindles.

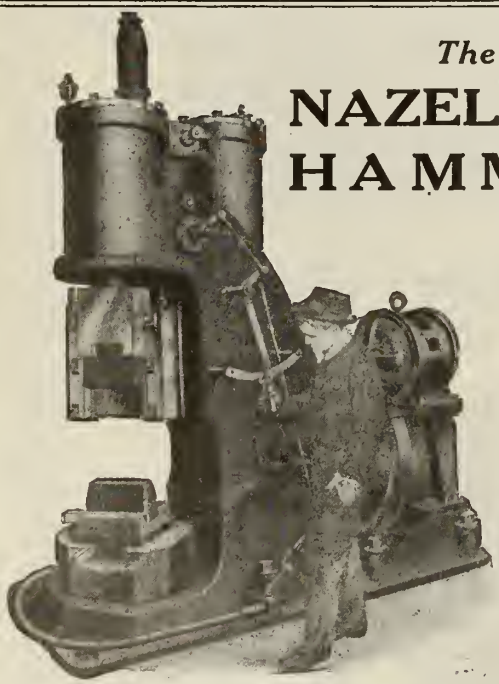
Write for details

EASTERN PRODUCTION COMPANY

137 Leib St., DETROIT, MICH.
120 Wisconsin St., MILWAUKEE, WIS.

Canadian Representatives:
F. F. BARBER MACHINERY CO., Limited,
Foy Building, TORONTO

The
NAZEL AIR HAMMER



NOTED FOR ITS BLOW AND CONTROL

A self-contained unit, HAMMER AND COMPRESSOR COMBINED, built in three types, six sizes arranged for BELT OR DIRECT MOTOR DRIVE, with capacities up to 7 inches square, for all manner of jobbing, manufacturing and certain classes of drop forgings.

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Prompt shipments of all Standard Sizes in
Cap Screws, V or U.S.S.
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S.A.E. Hexagon Nuts, Plain.
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Turned Paper Pins.

Send us your rush orders.

THE GALT MACHINE SCREW CO., LIMITED
GALT, ONTARIO

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If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

"WACO"

THE HIGH SPEED STEEL

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SOLE CANADIAN AGENTS FOR
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ALL SIZES
IN STOCK

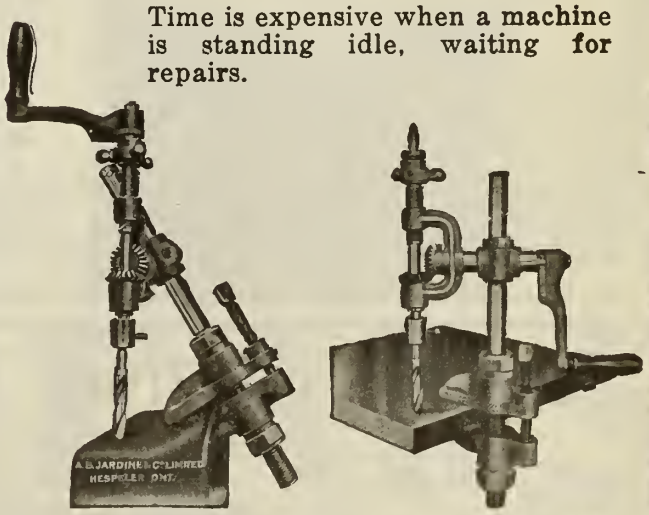
Crucible
AND
Open Hearth Steel
Tool Steel
"ARGO" BRAND *HIGH-SPEED* STEEL

The John Illingworth Steel Co.
1856
Frankford, Phila.
New York Office 217 Broadway

RALPH B. NORTON, AGENT
124 Craig St. W.
Montreal, Canada

Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.



On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

Weight, 40 lbs. Price, $26.50 net.
Sold by all Machinery and Supply Houses

A. B. JARDINE & CO., Limited
HESPELER, ONTARIO

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THIS IS ONE OF THE BEST THINGS WE MAKE. INCREASED SALES INDICATE OUR PATRONS' APPRECIATION.

HOYT METAL COMPANY

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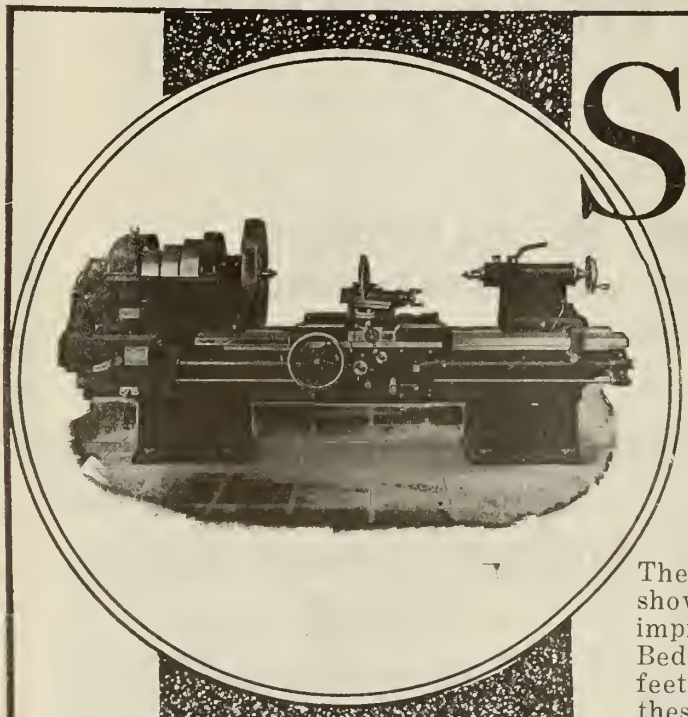
SIDNEY

Heavy Duty Engine Lathes

Noted for Their Power and Rigidity



"Sidney for Service"

One of the outstanding features of the Sidney is the manner in which it takes deep cuts through tough metals. Clean cuts without chatter, without pause. The Sidney is so designed that rigidity is maintained under severe conditions, and, in normal service.

The 25-inch Heavy Duty Quick Change Sidney here shown is the last word in lathe construction. Every improvement will be found in this, the latest model. Bed lengths available are: 10, 12, 14, 16, 18 and 20 feet. 27-inch swing design can also be supplied in these lengths.

The specific details of the Sidney are given in our new Bulletin. Write for your copy to-day.

The Sidney Tool Co., Sidney, Ohio

Canadian Agents:

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THE WORLD'S STANDARD LATHE AND PLANER TOOLS

Machine shops the world over, for more than a quarter of a century, have recognized Armstrong Lathe Tools to be by far the Best in lathe tool equipment.

Refuse to use imitations. Insist upon being supplied with "Armstrong."

By using Armstrong Tool Holders in your shop you will make one pound of High Speed Steel do the work of ten pounds in forged tools, save all forging and 70% of grinding.

Write for our catalog

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"The Tool Holder People"
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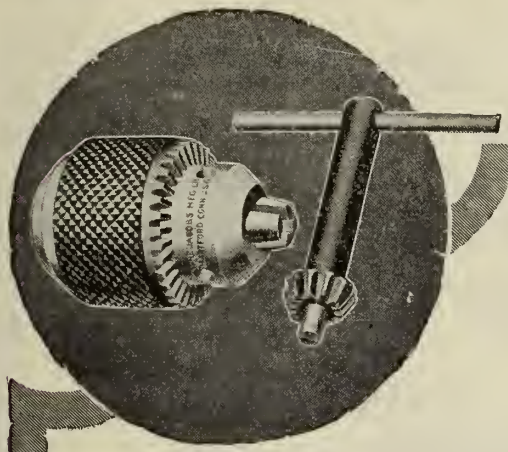

The Safe Chuck

Defective chucks cause broken drills and loss of time and money. The wise manufacturer uses Jacobs Chucks exclusively because he is sure of their reliability.

You can buy Jacobs Chucks from dealers everywhere.

Dept. C.M.

THE JACOBS MFG. CO. HARTFORD, CONNECTICUT, U.S.A.

CUT GEARS

Theoretically Correct

PROMPT SERVICE

ROBERT GARDNER & SON

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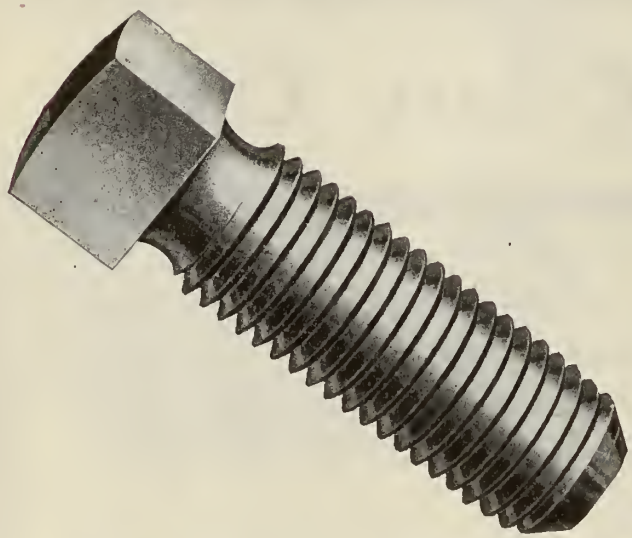
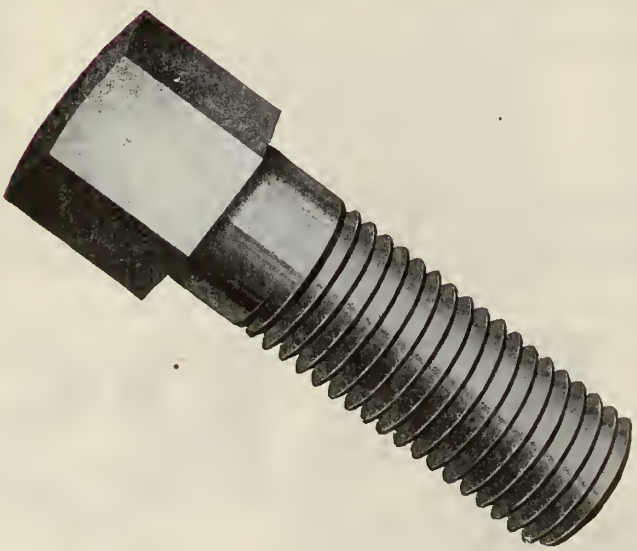




STANDARD

V., U.S.S. and S.A.E. Cap Screws
V. and U.S.S. Set Screws
S.A.E. Plain and Castellated Nuts
V. and U.S.S. Semi-finished Nuts

SPECIAL

Screw machine product up to 2¼" diameter to customers' specifications.

Owing to the market shortage of raw material, it is to the customers' advantage that they anticipate requirements as far ahead of use as possible.

THE NATIONAL ACME COMPANY
MONTREAL, P.Q.

De Courcelles **G.T.R.R.**

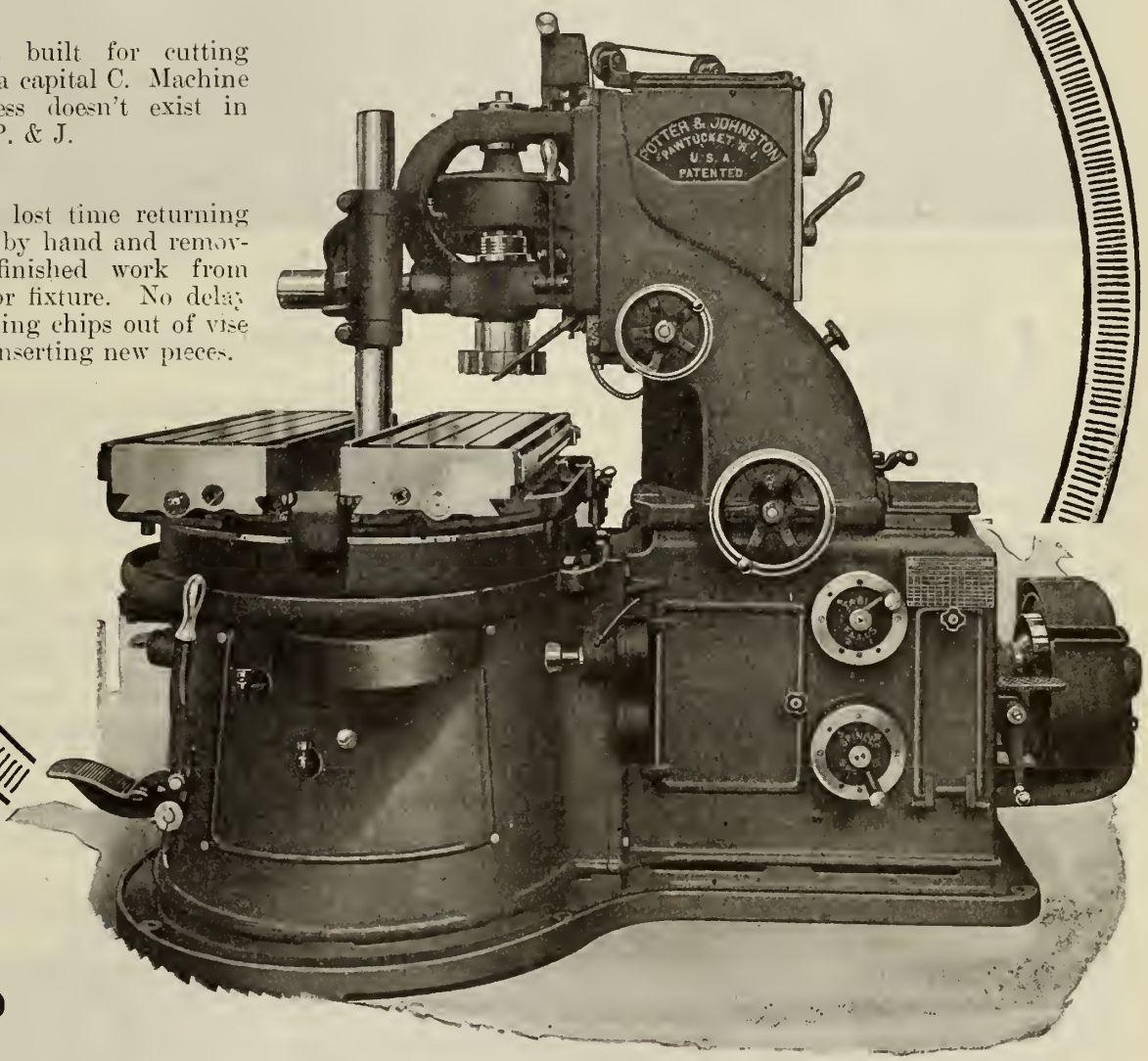
Keep Two Tables Going at a Time on the

AUTOMATIC MILLING MACHINE

Keep two tables going at a time. Load up on one while the cutter is milling work mounted on the other. With the exception of 10 seconds for indexing table turret, bringing work into alignment with cutter, and advancing table—automatically—to cutting point—there's no time used that doesn't go directly into cutting.

It's built for cutting with a capital C. Machine idleness doesn't exist in this P. & J.

No lost time returning table by hand and removing finished work from vise or fixture. No delay brushing chips out of vise and inserting new pieces.

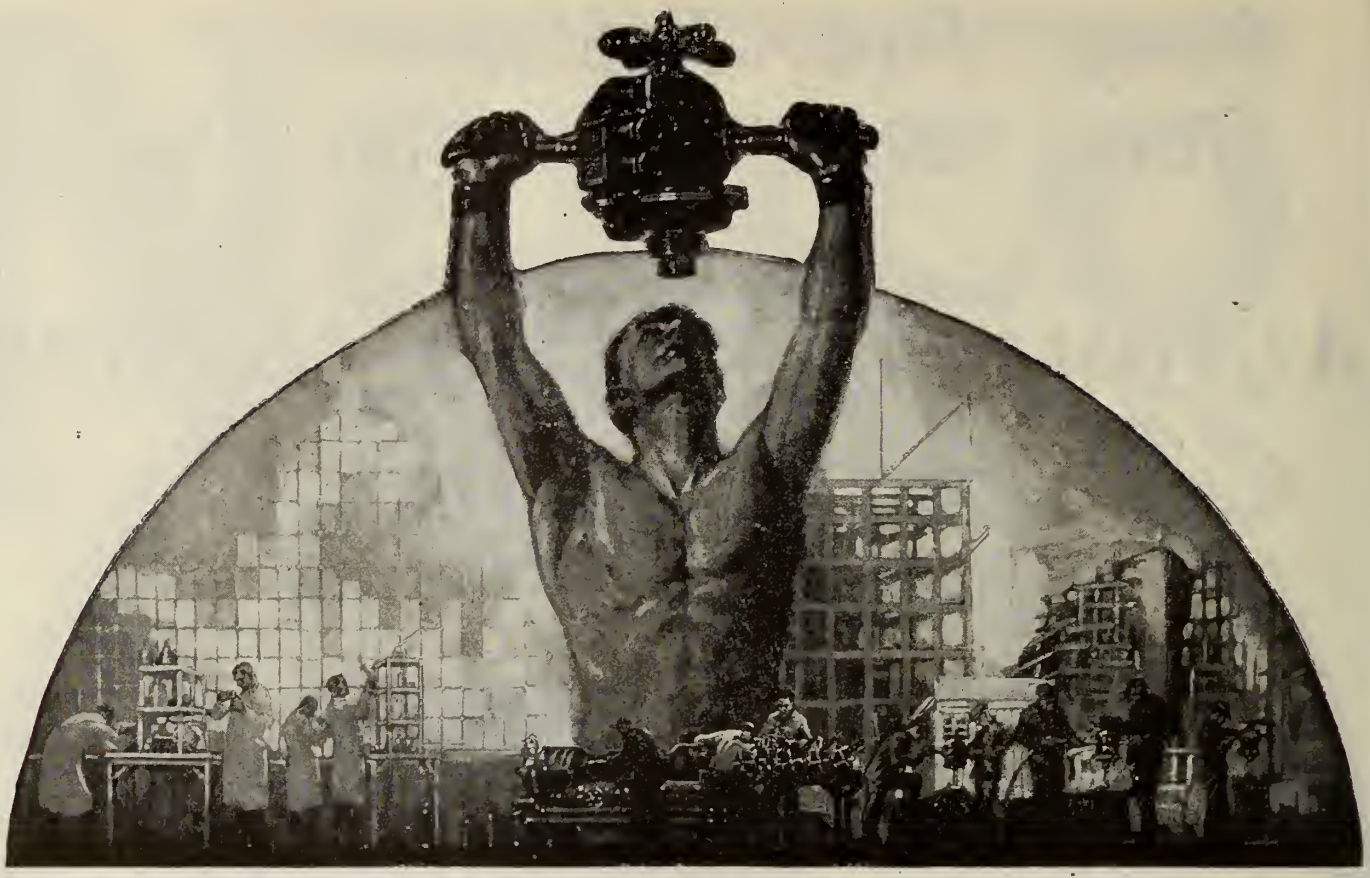


Bulletin 40

Canadian Offices: POTTER & JOHNSTON MACHINE CO.

ROELOFSON MACHINE & TOOL CO., LIMITED

Head Office: 1501 Royal Bank Building, Toronto, Canada



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UPWARDS of 125,000 Little Giants, now the world's standard air drill, are giving faithful, economical service.

The present-day perfection of Little Giant Air Drills is due largely to the ever-active efforts of scientific experts.

Both in manufacture and application, Little Giant quantity is based on *quality.*

Exacting tests by skilled metallurgists maintain proper physical properties of all metals composing each Little Giant part.

Research engineers are constantly contributing to the further perfection and utility of Little Giants, as evidenced by their many exclusive features.

Gauge these qualities by comparative tests in your own shops. A trial Little Giant Air Drill can be promptly supplied from large stocks now carried at the Company Branches listed below.

Sales Representatives

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354-356 St. James Street, Montreal, Canada

Sales and Service Branches: TORONTO, 342 Adelaide Street, West WINNIPEG, 150 Princess Street VANCOUVER, 81 Pender Street

Canadian Factory: Canadian Pneumatic Tool Company, Montreal

P-64-H

BOYER PNEUMATIC HAMMERS··LITTLE GIANT PNEUMATIC AND ELECTRIC TOOLS
CHICAGO PNEUMATIC AIR COMPRESSORS··VACUUM PUMPS··PNEUMATIC HOISTS,
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GIANT ENGINES

CANADIAN PNEUMATIC

Dependable Power at *Less Cost Per Hour*

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Buyers should instruct their representatives in the United Kingdom to communicate with D. B8 Canadian Export Department, Ministry of Munitions, Whitehall Place, London, S.W.

Cable Address:
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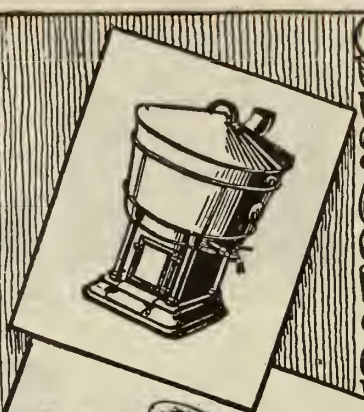
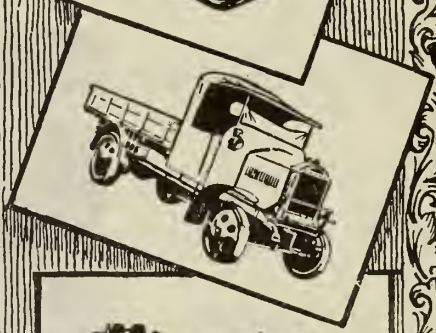
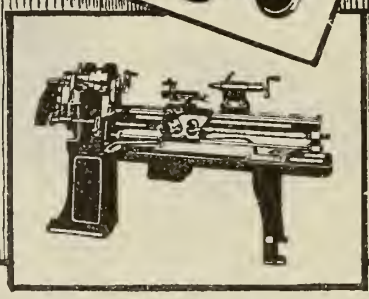
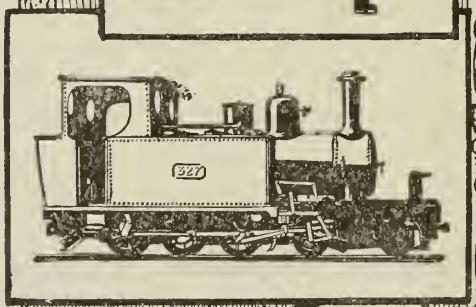

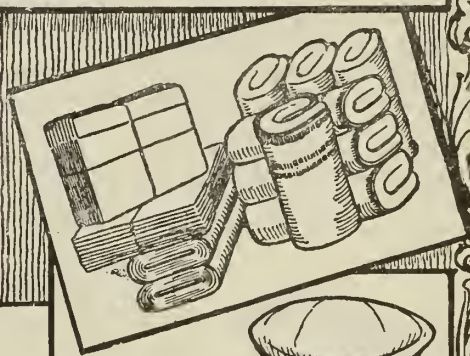

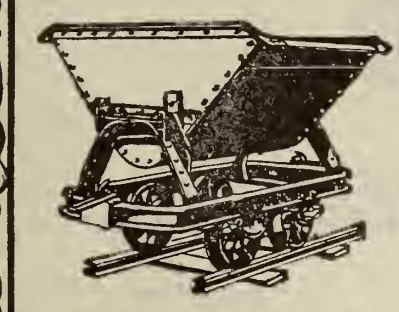
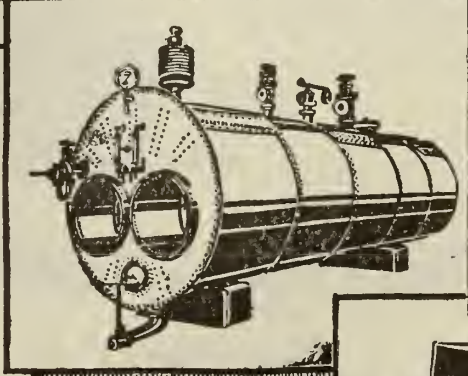
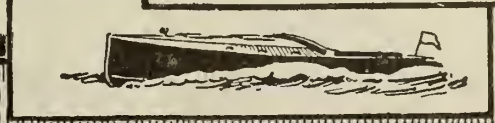

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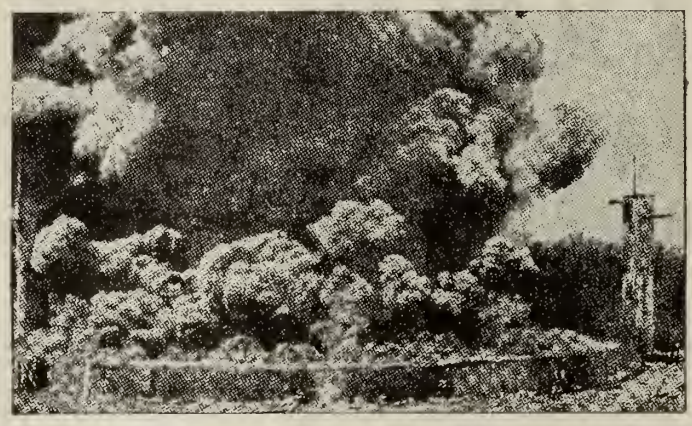
FOAMITE Firefoam SMOTHERS FIRE



Fire Meets Its Master

Recently, fire broke out in the Hamilton, Canada plant of the Canadian Shovel & Tool Company, Limited. It started in a large fuel oil tank.

F. Skelton, Managing Director, writes that the fire burned for four hours, and that water had no effect whatever on it.

A. B. Ten Eyck, Chief of the Hamilton Fire Department wrote: "As water would not extinguish the burning oil, the Firemen devoted their attention to saving the Factory. I called up Mr. J. Lindsey, of the Canadian Foamite Firefoam, Ltd., and requested him to bring down some of his Foamite Firefoam."

Mr. Lindsey then went to his place of business, got a supply of Foamite Firefoam and proceeded to the fire. In less than five minutes after his arrival the Foamite Firefoam had the fire practically extinguished."

W. T. James, First Assistant Chief, Hamilton Fire Department, wrote:

"It is the greatest thing I ever saw. The fire at the Canadian Shovel & Tool Company would be burning yet without the use of Foamite Firefoam."

Foamite Firefoam

is effective against every type of fire of every origin in every industry. It insulates and fireproofs all wooden surfaces. It prevents flames from spreading.

"THIS MUST STOP"
Tells how to protect
Your Factory from fire.
Above Book Mailed Free.
Write Hamilton Office.

Canadian Foamite Firefoam LIMITED

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MOOSE JAW
23 High St. East

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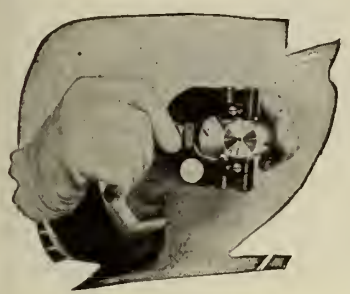
Pointers on Better Gaging

Right and Wrong Ways of Holding Snap Gages

It has been suggested that we devote a chapter of "Pointers on Better Gaging" to the subject of holding Snap Gages while inspecting—particularly in reference to the insulated grip found on all Johansson Adjustable Limit Snap Gages. There is considerably less trouble experienced in using the smaller sizes because their lighter weight makes them easier to handle. It should be borne in mind, however, that the insulated grip is perhaps of greater importance here, as the heat of the hand acts more quickly, there being less metal to be affected. Another important point in connection with the "finger hold" on Snap Gages of this type is that it permits them to be handled more readily. Although no sensitive touch is required with Johansson Gages, the gaging plugs will pass over the work more easily and quickly if the Gage is held correctly. The ease with which the Gage is used decreases the wear on the gaging plugs and prolongs their life and thus postponing the time when it becomes necessary to relap and reset them. If a Snap Gage is always held by the finger grip, its efficiency as an inspection tool is increased. A "Go" and "No Go" Snap Gage is a quick, accurate tool when correctly handled no matter how many different INSPECTORS are using it. Carelessness in holding a gage of this type should at all times be discouraged.



CORRECTLY HOLDING SMALL GAGE BY FINGER GRIP

One of the most efficient methods of gaging on medium sized work is to have a stationary rack or fixture for holding the piece inspected while the Snap Gage is passed over it. If the gage is then held correctly, the temperature change becomes a negligible factor and the INSPECTOR can handle his gage with much greater ease.

AWKWARD AND WRONG METHOD OF GAGING

The greatest difficulty with correct holding has been with the larger and heavier "Snaps." Here the tendency has been to firmly grasp the gage either around the middle or with two hands on the sides as illustrated. It takes a comparatively short time for the temperature which is thus created to affect the accuracy of the gage. When gaging large work which is held stationary in a fixture, suspend the gage vertically above it by the finger grip and let the weight of the gage gradually carry it down over the work. If the gage is to be held at an angle or "run in" from the side as is frequently the case when gaging while the work is in the machine, balance the weight with two fingers of one hand at the lower end and swing the gage with the other, holding it by the insulated grip as shown in the bottom illustration.

TEMPERATURE IS SURE TO AFFECT GAGE WHEN HELD THIS WAY

INCORRECTLY TRYING TO USE A LARGE SNAP GAGE WITH ONE HAND

The part that Adjustable Limit Snap Gages play in the operation of the Limit System is described in the Johansson catalog which will be gladly sent on request.

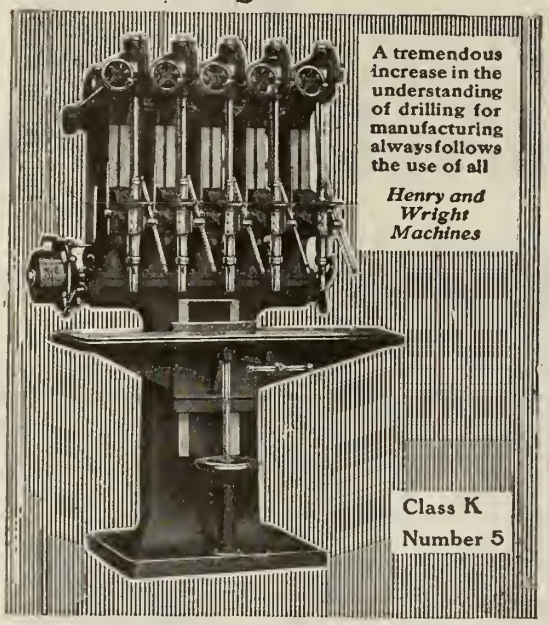
THE RIGHT WAY TO HOLD A BIG SNAP GAGE

C-E-Johansson-Inc Johansson ACCURACY Poughkeepsie-N-Y

If interested tear out this page and place with letters to be answered.

HENRY & WRIGHT

Drilling Machines


A tremendous increase in the understanding of drilling for manufacturing always follows the use of all
Henry and Wright Machines
Class K
Number 5

The Henry & Wright Mfg. Co.

Hartford, Conn.

Canadian Fairbanks-Morse Co., Montreal, Toronto, Winnipeg; A. R. Williams Machinery Co., Toronto, St. John, N.B.; H. W. Petrie, Ltd., Toronto; Williams & Wilson, Montreal; Rudel-Belnap Machinery Co., Montreal; Canada Machinery Corp., Galt, Ont.; Geo. F. Foss Machinery & Supply Co., Montreal; General Supply Co., Montreal.

LANCASHIRE MOTORS

HAVE WORLD WIDE REPUTATION FOR

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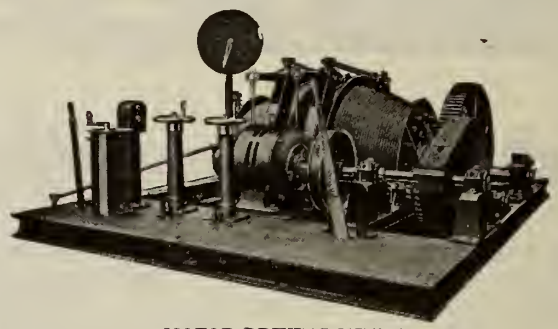

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Specialists in Motor Manufacture and Application

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The Lancashire Dynamo & Motor Co., of Canada, Limited

Head Office and Works
45 NIAGARA ST.
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Branch Office
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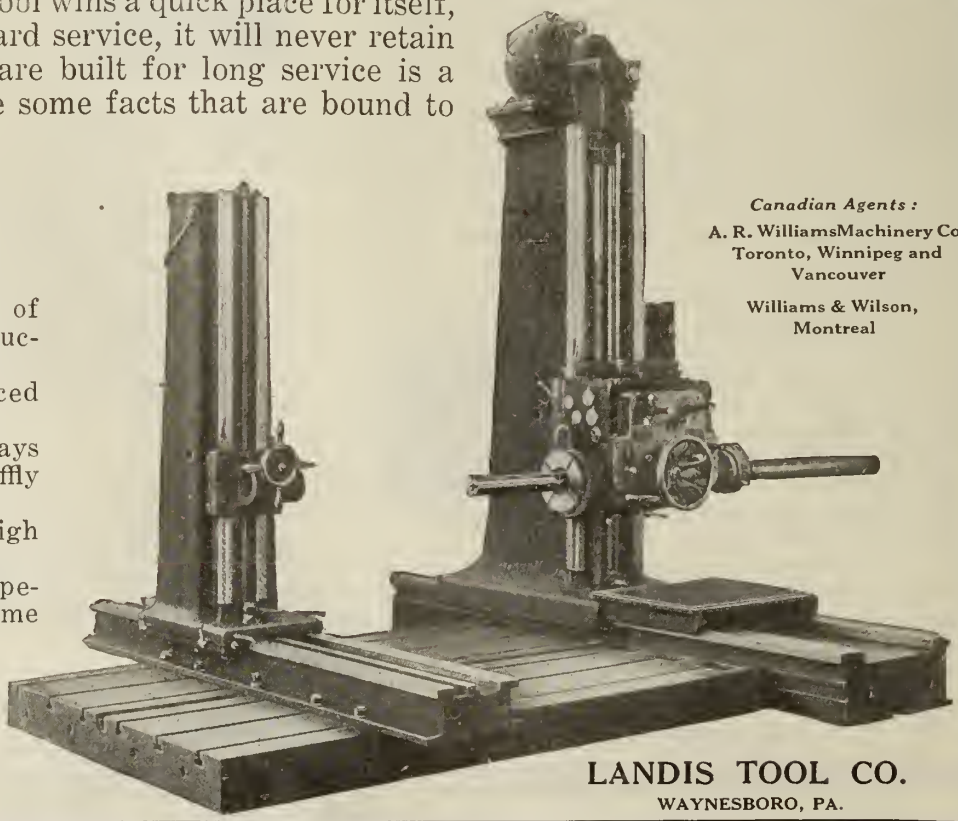
Enduring Service, Landis Service, Satisfaction

The rapid and efficient tool wins a quick place for itself, but unless it survives hard service, it will never retain it. How Landis tools are built for long service is a long story, but here are some facts that are bound to impress:

LANDIS

All the main details are of unusually heavy construction.
The columns are side-braced in two directions.
The floor plate and runways are massive and very stiffly ribbed.
All bearings are of high grade bronze.
Gears and shafts are of specially heat-treated chrome nickel steel.

The whole story is in our catalog. You should read it.



Canadian Agents:
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LANDIS TOOL CO.
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CANADA
FOUNDRIES & FORGINGS
LIMITED

If a Bad "Nut" Gets Loose
—Use a Wrench

Endurance Brand

Never Wear Out
Ask You Jobber

Canadian Billings & Spencer Plant
WELLAND, ONTARIO

Harris Heavy Pressure

The Babbitt Metal that's at the Front in Efficiency and Economy

Order a Box from our nearest Factory

Our Guarantee is Back of Every Pound of Babbitt Metal We Make

Manufactured by
The Canada Metal Company, Limited

TORONTO - CANADA
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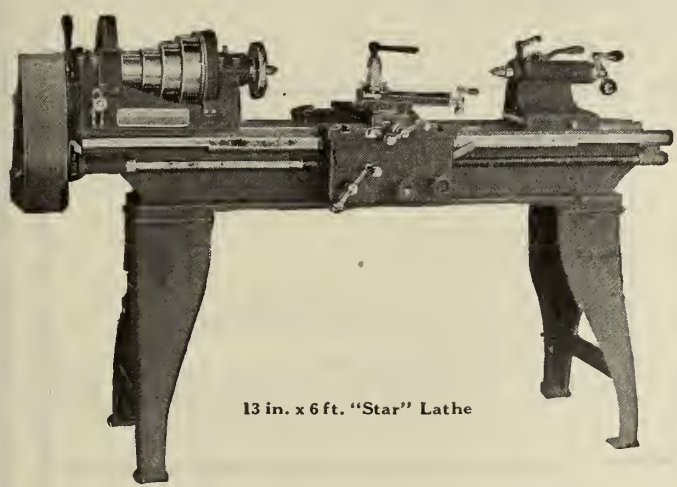

13 in. x 6 ft. "Star" Lathe

9 in. x 4 ft. "Star" Lathe

"Star" Lathes—Small Accurate Work

On all small work "Star" Lathes are much more economical than large heavy lathes. Keep the big machines on the big jobs. "Star" Lathes are designed particularly to take care of the small jobs. The extra power, time and floor-space required by heavy lathes is pure waste. Those large machines are also expensive. Do not let them suffer wear and tear from jobs which a "Star" could readily handle. "Star" Lathes are strong, accurate and speedy. Thus precision remains unimpaired by long periods of severe strain.

Send for a copy of the "Star" catalog. It explains fully the various features of "Star" Lathes.

The Seneca Falls Mfg. Co., Inc., 366 W. Falls St., Seneca Falls, N. Y.

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BELTING

One of These Lines is for You

SCANDINAVIA BELTING

Scandinavia Belting

The original Solid Woven Belt. Especially adapted for hot, oily, dusty drives; also used to advantage on your other work.

TRADE MARK LANCO BALATA BELTING

Lanco Balata Belting

A throughly waterproof belt not merely waterproofed. As nearly stretchless as is possible in a good belt. Splendid for motor drives.

Saturn Hair Belting

A solid woven belt made of camel and goat hair. Has the advantage of a solid woven belt, quite heavily made and waterproof as well.

Scandinavia Conveyor Belt

Gives long life for conveying coal, coke, stone, ore, etc. No plies to come apart.

Flour Mill

Elevator Webbing
Undressed Belting for Screen Cleaners
Canton Flannel
Dufour Bolting Cloth
Bolting Cloth Tape.

Shoe Machinery

Belting
Round Leather Belting
Fab Stay Tape.

Grinder Belts, Special Belts, Tapes and Narrow Fabrics

FEDERAL ENGINEERING CO., LIMITED
172 John St., Toronto

Greater Production A World Necessity

THERE can be no slackening of production of manufactured goods. World demands are greater now than ever. Working hours are shorter. Men and machines must produce every minute. A big factor in continuous production is the quick lacing of power belts. The leading industrial plants of the world have installed "Clipper" lacing because

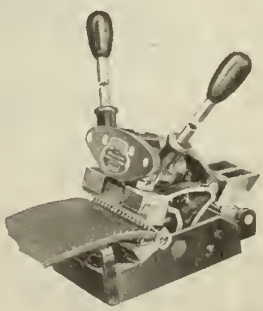
The Clipper Belt Lacer
Laces a Belt in Three Minutes

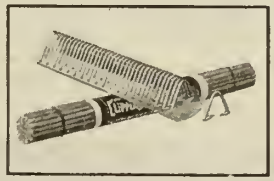
It is the quickest, simplest and most satisfactory method of belt lacing ever devised. Old methods took from fifteen minutes to half an hour to make a crude joint. The "Clipper" joint is smooth, flexible, safe and lasting. Any factory workman can use the "Clipper." Its cost is negligible, its saving beyond estimate. On request the "Clipper" will be sent to manufacturers for free trial at our expense.

Most mill supply houses sell the "Clipper."
Dealers not stocking it write for particulars.

"The Connecting Link Between Power and Production"

Clipper Belt Lacer Company
GRAND RAPIDS. MICHIGAN. U.S.A.





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"MEAD-MORRISON"

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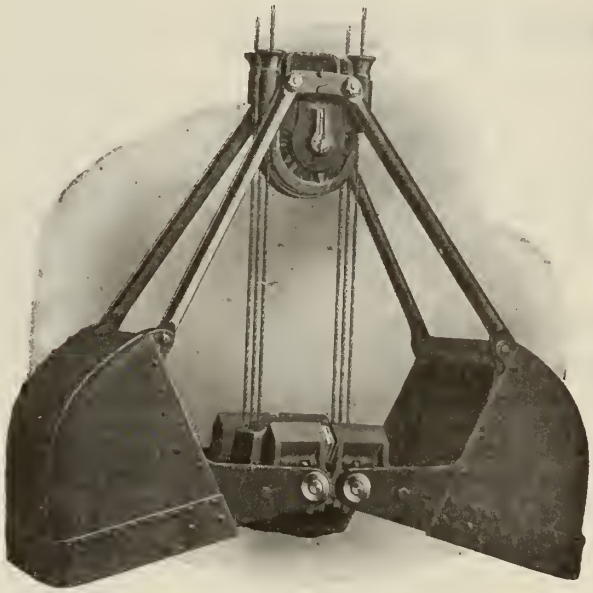
GRAB BUCKETS

and

Hoisting Machinery

Manufactured in Canada



TYPE U BUCKET

¾ to 2 Yd. Capacities

This particular bucket is made for coal handling and for operation of transporters or travelling cranes.

Hoisting Engines, Derricks

Put your Problem up to us!

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WORKS: WELLAND ONT.

Electrite

Electric furnaces, automatically regulated, the most modern methods, and the introduction of Uranium — make this a steel of truly remarkable cutting properties.
We know "Electrite" cannot be bettered — and stand ready to prove it to you.

LATROBE
ELECTRIC STEEL CO.
LATROBE, PA.

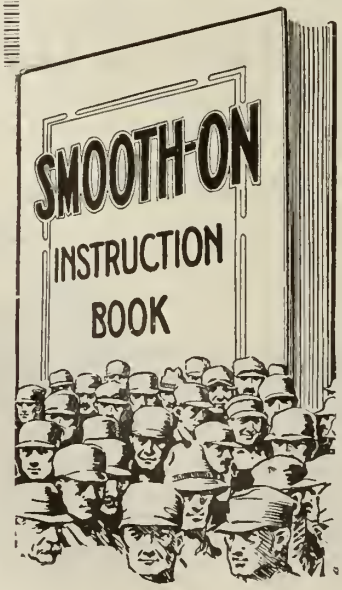
High Speed Steel

Uranium

SMOOTH-ON IRON CEMENTS

What Other Engineers KNOW About Repair Work, This Free Book Tells YOU

It is full from cover to cover of practical ideas developed to meet actual emergencies. There is no theory in the



Smooth-On Instruction Book

Its 144 pages of *real facts* — facts that — if you knew them — might save you hours — or days — and dollars in your next repair job.

Write for it to-day — It's FREE

Smooth-On Mfg. Co.
Jersey City, N.J., U.S.A.

MATTHEWS STEEL STAMPS STAND CLOSE INSPECTION

MAKERS OF MARKING DEVICES SINCE 1850

Under a glass the heavy uniform Bevel—the neat, accurately formed characters—show clearly why Matthews Pittsburgh Bevel Steel Stamps give better, clearer impressions and longer service.

If you are interested in "Better Marking" and "Marking Economy," our new Steel Die Catalogue offers useful suggestions.

Your copy awaits request by card or letter.

JAS. H. MATTHEWS & CO.
1716 FORBES FIELD, PITTSBURGH, PA, U.S.A.

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Springs *for* Every Use

We have been making springs of all kinds for 70 years. Let us advise you when in difficulty.

Tell us the purpose for which the spring is intended, and experts will gladly co-operate to see that you get the design best suited to the purpose.

Dunbar Springs are thoroughly tested for **accuracy** and **quality**. Send us specifications, for estimates.

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General Office and Works: Pittsburgh, Pa., U.S.A.

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Pittsburgh, Pa. U. S. A.

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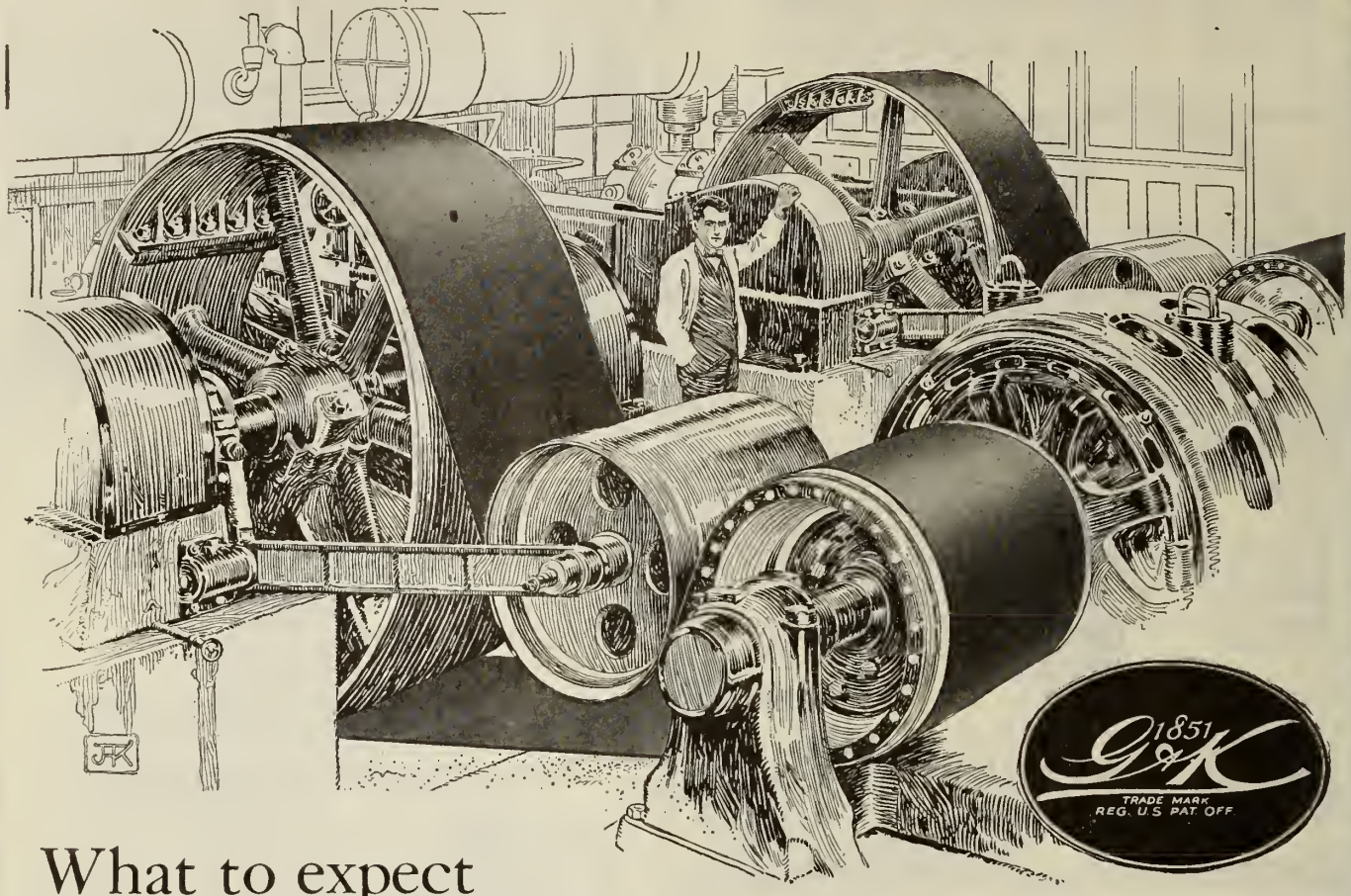
This is an advertisement in the Graton & Knight campaign on Standardized Leather Belting. It appears in the Saturday Evening Post, June 19, 1920.



What to expect from a leading industry

Two GraKnight 30" Heavy Doubles on Bury Air Compressor at the Northern Pacific Shipbuilding Company, Seattle, Wash., delivering 300 horse-power each at a speed of 4000 feet per minute.

The day is past when the only duty of manufacturing leadership is simply to supply goods of a high quality.

Leadership now carries the responsibility of a service which assures to the customer the best obtainable results from his purchase.

Because it is as important for the belt user to buy belts built specifically for his various power transmission needs as to buy quality, Graton & Knight have long held that the quality of their service must equal the quality of their products.

So the Graton & Knight Standardized Series of Leather Belting is a standardization of application of belting as well as of manufacturing of belting. For while many sizes and brands of belting may give satisfaction on a particular drive, *one* size of *one* brand will give the perfect results which mean minimum cost in power transmission per year.

G & K brands are sold on the basis of the work to be done. The right belt for every class of drive is listed in the Graton & Knight Standardized Series of Leather Belting.

Graton & Knight experts have long been advisers for some of the best-belted plants in America. They will be glad to serve you without obligation on your part.

Write for our book, "Standardized Leather Belting"

THE CANADIAN GRATON & KNIGHT, LIMITED

84 St. Antoine St., Montreal, Canada

Oak Leather Tanners, Makers of Leather Belting and Leather Products

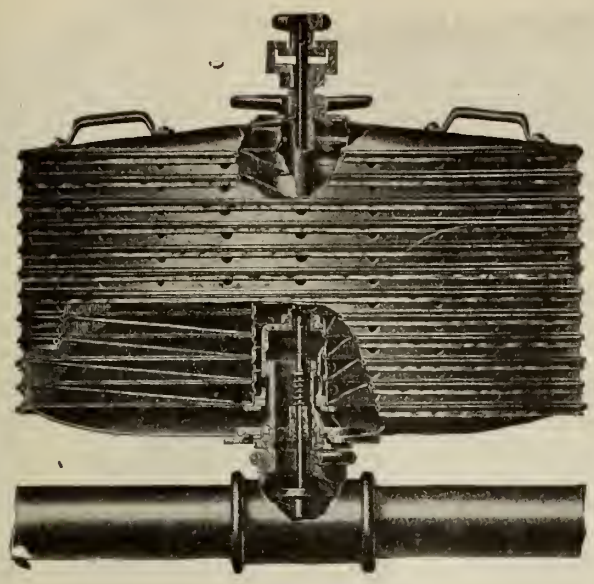
Branches and Distributors in all Principal Cities

Graton & Knight

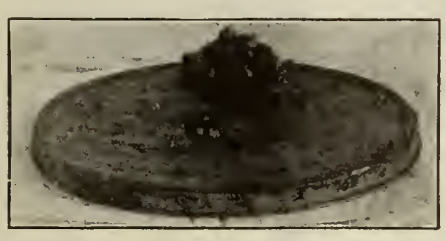
Standardized Series

Leather Belting

Tanned by us for belting use



No. 1—Sectional View of Bowser Filter Section Assembled.



No. 2—Filter Disc with dirt filtered from oil.

It Gets The Dirt It's A BOWSER Oil Filter

The pictures shown illustrate the Bowser Filter Section as used in the Bowser Oil Filter.

No. 1 shows the Filter Section assembled, ready for use. No. 2 shows one of the Filter discs with dirt that the Filter has collected from used oil. This pile of dirt is about 6 in. in diameter and from 2 in. to 3 in. high.

There are twelve of these filter discs and cloths in a Bowser filter section, each as effective as the one you see pictured. As many complete Filter Sections as needed are furnished in the Bowser System.

Bowser Systems are applicable to any size and type of power producing and transmitting machinery.

We will be glad to send literature and explain to you how the Bowser principle of Oil Filtration can be applied to your power plant.

S. F. BOWSER COMPANY, Limited

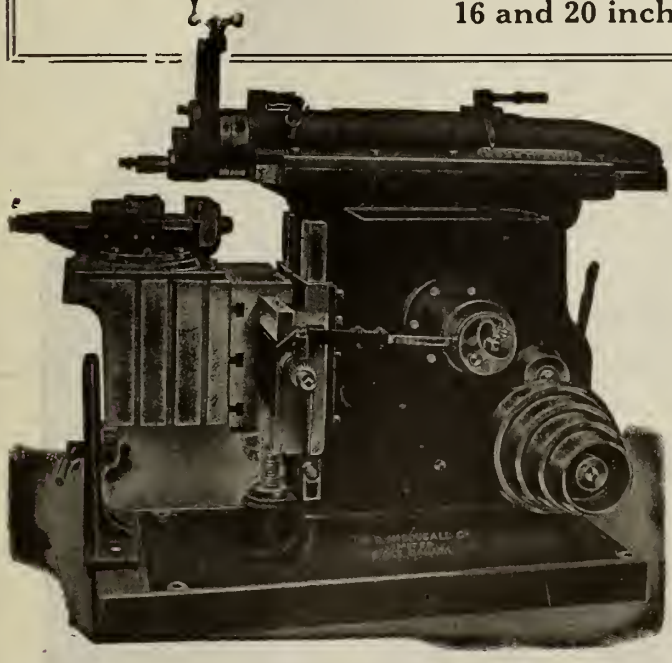
66-68 FRASER AVE., TORONTO, CANADA

Offices in Principal Cities of the World

McDougall Crank Shapers

16 and 20 inch

ARE-MAC-DEE IS A GUARANTEE



A Bigger Day's Work—

is made possible with McDougall Crank Shapers than with any ordinary Shaper because the McDougall is built on lines especially for this purpose. It embodies the most approved features of the most practical shapers on the market and care has been taken to exclude all non-essential parts.

The column is massive in construction, well braced and reinforced internally. Exceptional strength is also seen in the ram, which is semi-circular in form and of box type. It can be set forward by crank conveniently arranged.

Slides are square, accurately fitted and with broad bearing surfaces.

Have us explain the other salient points of this finely constructed machine. Full details on request.

THE R. McDOUGALL COMPANY, LIMITED, Galt, Ont., Can.

The Canadian Fairbanks-Morse Company, Limited
Sales Agents

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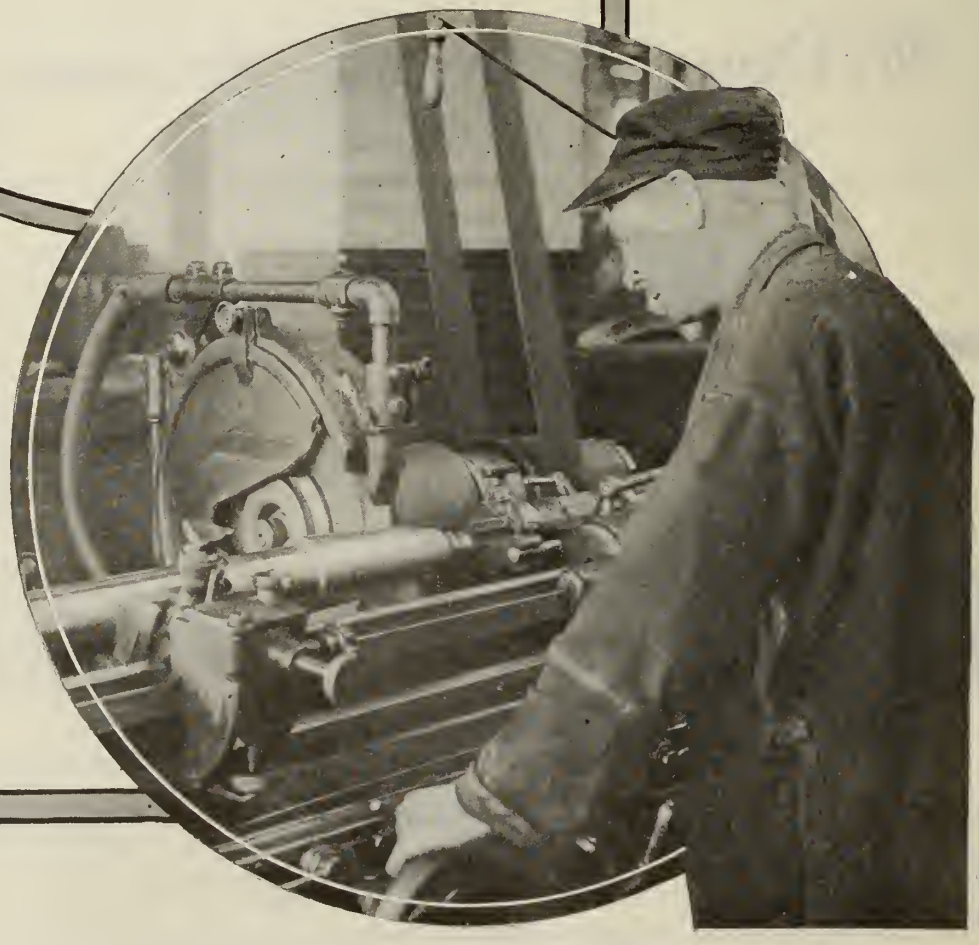
Wheel Service—

The service one gets from a grinding wheel is primarily a matter of character and quality in the abrasive and bond and skill and care in manufacturing. Next in importance is intelligent wheel selection. It has been said that a good operator can get results from almost any wheel within reasonable range. While to a certain extent this is true, it none the less pays to use the grain and grade which demonstration or experience has proved most efficient for a given condition. Finally, the treatment of a wheel by the user is of utmost importance. Careful handling, proper mounting and timely dressing and truing of the wheel are essential. Attention to the combination of work speed and table traverse is likewise necessary to good results.

Users of Alundum and Crystolon wheels may secure maximum service in all respects. The correct wheel is always available, extensive records of practical results are at a customer's service through our Sales Engineering Department, and expert instruction in the care and use of wheels can be had from our technically trained salesmen and demonstrators.



Norton Company of Canada, Ltd.

Hamilton, Ontario, Canada

Electric Furnace Plants

Niagara Falls, N.Y. Chippawa, Ont., Can.

Canadian Agents

The Canadian Fairbanks-Morse Co., Ltd., Montreal, Toronto, Ottawa, St. John, N.B., Winnipeg, Calgary, Saskatoon, Vancouver, Victoria.

F. H. Andrews & Son. Quebec, Que.

Simonds Canada Saw Co., Vancouver, B.C.

GISHOLT

Two of a Kind—

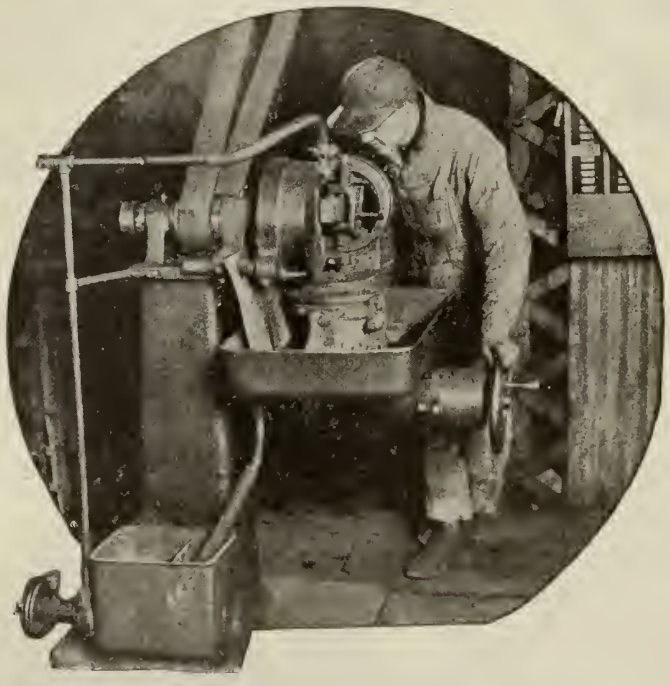
The old cracker barrel and the emery stand.

Are you using "cracker barrel methods" of sharpening tools in your shop? Lots of talk and little action. Idleness, instead of production.

Gisholt Universal Tool Grinders keep your men and machines busy all the time. When you get your Gisholt Grinder you can install a central tool grinding station and pay for it out of the extra profits earned by helping your men keep on the job.

Don't run a "cracker barrel shop." Look into the Gisholt way and get on a more profitable basis.

Why not write for the full story?



GISHOLT MACHINE CO., 1207 East Washington Ave., MADISON, WIS., U.S.A.

Builders of Standard and Automatic Turret Lathes, Vertical and Horizontal Boring Mills, Tool Grinders, Small Tools, Special Machinery, etc.

Eastern Sales Office: 30 Church St., New York. *Works:* Madison, Wis., Warren, Pa.

Canadian Agents: The Canadian Fairbanks-Morse Co., Ltd., St. John, Quebec, Montreal Ottawa, Toronto, Hamilton, Windsor, Winnipeg, Saskatoon, Calgary, Vancouver, Victoria

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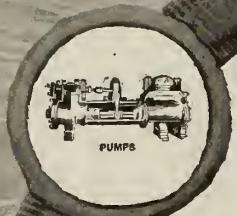
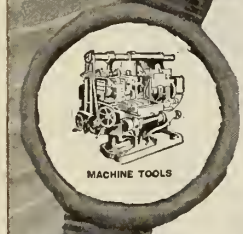
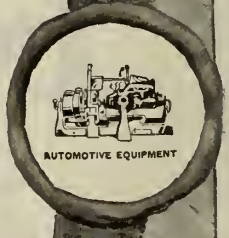
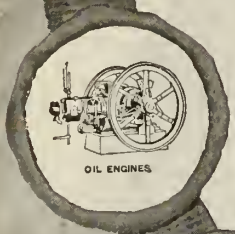
FAIRBANKS-MORSE









Speeding-up the Nation's Production

TO meet the nation's insistent call for greater production—production to bridge the gap caused by the long period of hostilities during which our every effort was concentrated on winning the war, the entire Canadian Fairbanks-Morse organization is again bending every effort, exerting its full strength to serve Canada and Canadians.

Here is a Canadian institution backed by a Dominion-wide distributing organization, its branch houses extending across the country, giving a new conception of service to manufacturer, farmer, fisherman—to every branch of industrial activity. Here is an institution which is a dominating factor in Canada, whose name has become the synonym of quality and whose service is recognized in every branch of business where mechanical goods are used.

Our 100% quality mark is the outward symbol of all that this organization stands for. This seal not only marks the standard of quality of Fairbanks-Morse goods, but it represents the ideals of the organization and of the men whose service and advice are yours.

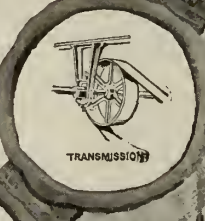
Everything mechanical for factory, mill, farm or motorist
and everything backed by 100% mark of quality.

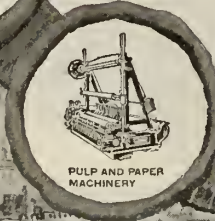
Ask our nearest branch house for information about anything mechanical.

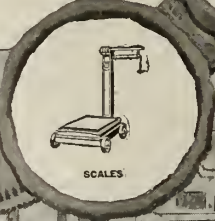
The Canadian Fairbanks-Morse Co. Limited

Canada's Departmental House for Mechanical Goods

Halifax St. John Quebec Montreal Ottawa Toronto
Hamilton St. Catharines Windsor Winnipeg Regina
Saskatoon Calgary Vancouver Victoria







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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

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Boring as It Was Accomplished 80 Years Ago

Machine Shop Methods Have Improved Wonderfully in the Last Eighty Years. They Certainly Needed to, Judging From the Photographs and Description as Given Herewith

By W. F. Sutherland

THE boring of a cylinder 10 ft. in diameter is not much of a trick, comparatively speaking, but it is sometimes a matter for speculation as to how some of the large cylinders, used in some of the earlier steamboats, were finished. Machine shop methods have improved wonderfully in even the last twenty years, and when the inadequate equipment available is considered, the achievements of the builders of the first steam engines are little short of marvellous.

No doubt the necessity for better methods of working and handling the raw materials used in the making of engines and other mechanical devices caused a development in the machine shop which went hand in hand with the engineering discoveries of Watt, Stephenson and others.

The engine lathe, in its essentials, the steam hammer and other mechanisms were all developed as necessity arose for better mechanical processes and the machines described herewith were designed for the boring of the large cylinders necessary in the earlier days when low steam pressures were much in evidence.

Messrs. Nasmyth, Gaskell & Co. were probably among the first to realize the advantages of vertical boring in the making of cylinders for steam engines, the freedom from distortion, due to the weight of the cylinder or boring bar being marked and one of the first machines designed by this firm is shown in Fig. 1. As is seen, the factory building in which the machine was placed formed an essential part of its structure and good use was made of the building walls, the whole outfit being tucked away in a corner.

The driving mechanism was entirely below ground level, a pit being provided for inspection and repair, stairs t providing means of access. Tight and loose pulleys, k, k, took power from the main shaft and transmitted it by means of the bevel gears, j j, to the shaft i, and the worm p to the worm wheel o and the boring bar. It will be noticed that the shaft i is not at right angles to the boring bar, but makes an angle with it of such magnitude that straight teeth could be used in the worm gear.

The vertical boring bar was made in two parts, the upper one, a, carrying the boring head or wheel r and the lower one connected to the driving apparatus. The upper part rested in a socket in the lower part as is shown in Fig. 3, and was fastened by a key or pin l. The boring bar was supported by a step bearing consisting of two hardened steel disks, submerged in lubricant in the cup shown. This cup in turn carried on its upper flange brass segments coned to fit the taper on the boring bar and provided with means for adjustment whereby the bar could always be centred and any play sideways taken up.

The upper end of the boring bar was carried by the cross-beam g, which was fitted to the sockets f built into the walls of the building. An additional stay was carried to the corner formed by the two walls.

Considerable ingenuity was displayed in the arrangement for feeding the boring cutter to the work and in provision for its lifting when a cut was finished. The boring wheel r was centred and driven by means of a sleeve m on the boring bar and by means of a nut l, which served both as a feed nut and key; the feed was regulated by the lead

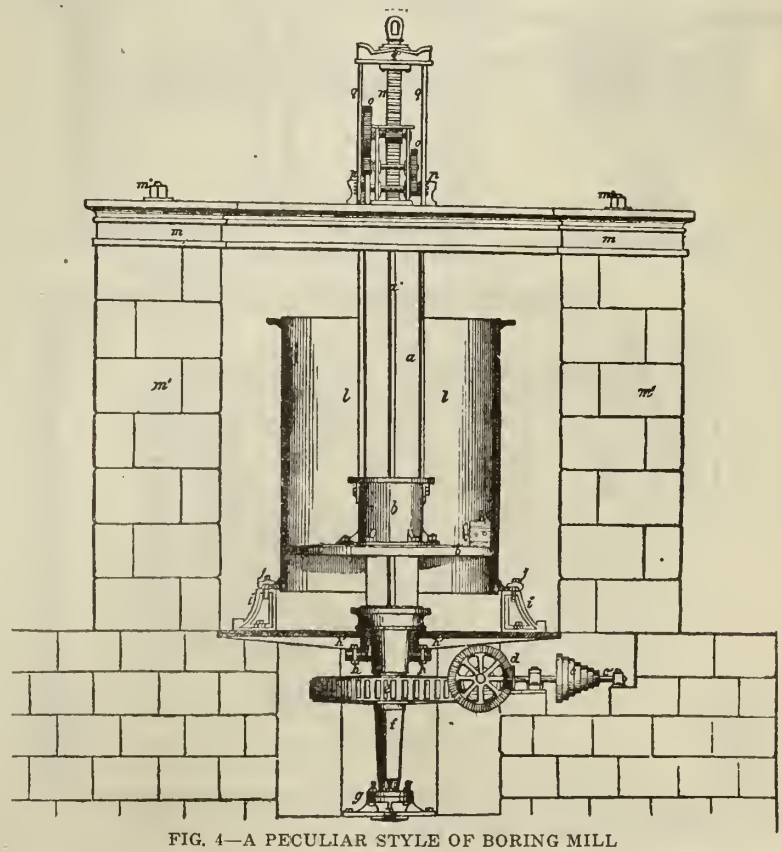


FIG. 4—A PECULIAR STYLE OF BORING MILL

screw shown. The lead screw was driven through the medium of a planetary gear transmission. When the cut was finished the boring wheel was raised by means of a winch shown in Fig. 2, the nut remaining on the lead screw and being afterwards raised.

Another machine of somewhat similar type and made by the same firm of engineers is shown in Fig. 4. The same arrangement of worm gear drive will be noticed, but the main lower boring bar bearing is placed above the worm gear. Coned plates are also fitted in this bearing, working on a tapered portion of the shaft as before. The upper bearing and feed mechanism are carried on massive masonry piers.

A keyway a' was cut in the boring bar and the two side slings, q q, carried the cutter head b and controlled its movement on the boring bar.

Feed Mechanism

These side slings were attached to a cross-head q at the top, which also carries the rack n. The whole of this upper machinery revolved with the boring bar with the exception of a ring at the bottom cut with an internal thread. A wheel working in the thread operated the gears and rack and thus lowered the cutter head as the work progressed.

Cylinders 10 ft. in diameter for the steamer Mammoth were bored on this machine.

Combined Machine

The next machine illustrated has several features of interest, three machines being combined in one for boring, drilling and face grinding. The Ionic order of architecture is also very much in evidence.

The centre machine was a boring machine used for boring large cylinders, the cylinder being not only held in place by the usual clamps at the bottom, but also by a sliding ring f. Fig. 5 carried on the centre columns and provided with adjustable clamps.

Motion was imparted to the boring bar by means of a vertical shaft and gear wheels, the proper feed being given to the cutter head by the rack and wheel k.

The second machine B, to the left, was a vertical boring mill of much smaller dimensions and was used for various boring and drilling operations.

The third machine, C, was used for the grinding up of the faces of piston rings, valves, etc.

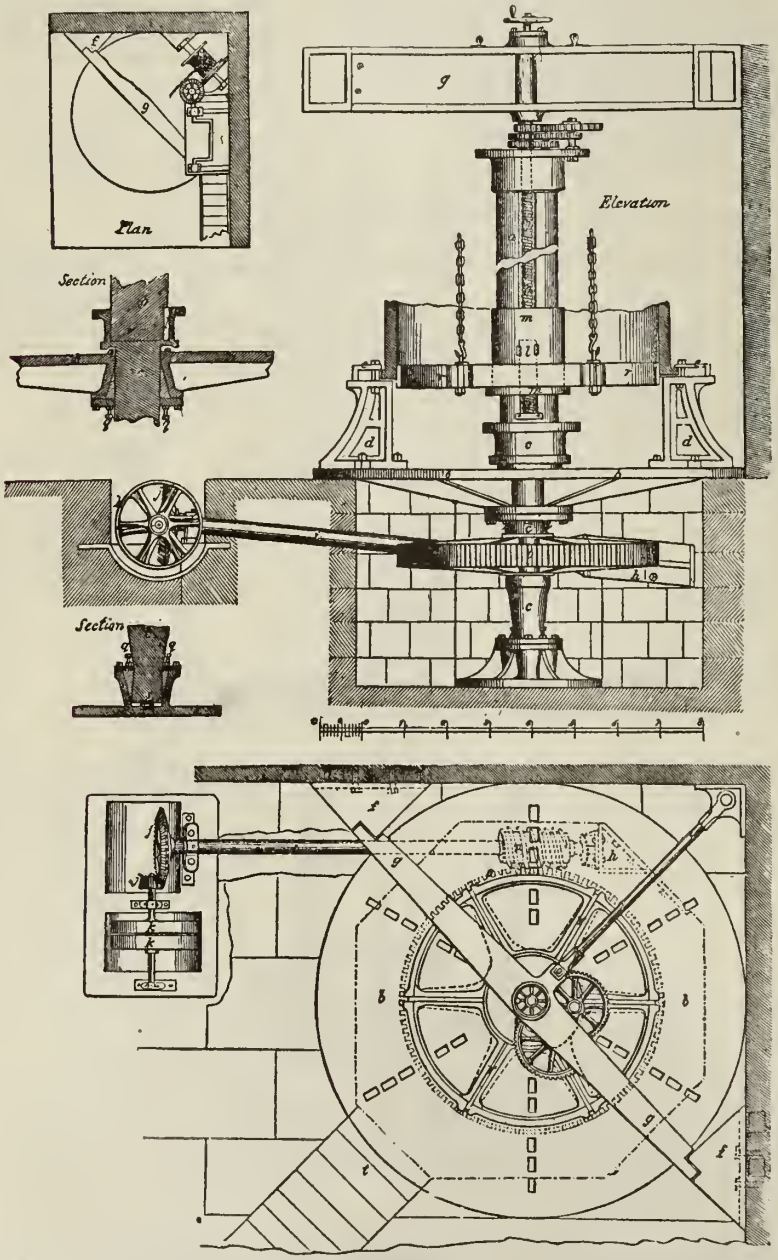


FIG. 1—AT BOTTOM. YOU MADE THE BUILDING TO SUIT THE MACHINE.
FIG. 2—UPPER LEFT. OTHER DETAILS.
FIG. 3—MIDDLE SECTION. ELEVATION OF MILL.

THE GUARDING OF MACHINERY

A recent article in Mechanical World, an English periodical, deals with the subject of proper safeguarding of machinery. As this is a subject of like importance on this side of the water, we reproduce this material for our readers' benefit. The author starts on the following manner:

It is the purpose of the writer in the few lines which follow to give free vent to opinion of theories and of facts regarding the problem of the effective guarding of machinery. The effective guarding of machinery will be clearly understood by those "close up" to the problem. For the sake of others equally interested and yet not so familiar such title may be more fully extended and its meaning rendered clearer and more convincing, as it meets the eye of the reader, thus: "The Effective Guarding of Mechanics and Operators From Injury by the Machines They Respectively Work and Operate."

The writer holds no brief for, nor cherishes an atom of sympathy with, proprietors and managers who, in a cold-blooded way, neglect all reasonable safeguards in respect of their workers, and neither does he hold a brief for those who would ignorantly and insensately enclose every piece of running gear in boxes of wood or iron, such enclosures rendering the machines they circumscribe commercially unproductive and comparatively valueless.

With the former class may be found the ignorant and the callous, but often less ignorant than callous; such men who buy a boiler and set it to work on their estate, not bothering a little anent its history and its present condition, and so long as it will, for a time, burn fuel, make steam, and drive their machinery. Then, if "the old trap" chooses to "go up" and kill a few people who have trusted the employer for their individual safety, "It is no affair of his," "Ordinary risk," "Unforeseen accident," "Regrettable circumstance," etc., etc., a Board of Trade inquiry, a few pounds fine, and he buys another boiler. There are a few wives widows, a greater number of children fatherless, and the world still revolves. No, the writer holds no brief for those but would punish each and every offender with the utmost rigor of the law, and if the law did not provide rigor sufficient, a law should be provided which did. Pro bono publico.

In the opposite class—those who would

cover every bit of moving machinery with a case—may be found various inspectors, doctors for insurance, and such like. There may be some of these officials who are experts and who are practical men, and who offer suggestions which are found to be practicable to follow, though the writer has been in charge of shops for nearly forty years without discovering one such. Those he has met and has come into close contact and conversation with have approached the shop foreman in a most objectionable manner. He (the inspector) has at times suggested that the shop foreman is a callous-minded being, "who would be much more careful in the guarding of machines under his charge if he had boys of his own." He, (the inspector), does not know, nor does he care to inquire respecting the fact that some of these "callous" foremen have boys of their own working machines, and that some of these foremen have preached the gospel of "effective guarding of machinery" years before they (some of the inspectors) were born.

It is suggested, therefore, that with all due and proper respect and courtesy to inspectors of machinery, they should be advised to go warily, and, while doing their ostensible duty, not to inflict obvious plantitudes and time-worn arguments on attentive and considerate shop superintendents, who may have spent the greater part of their lives propounding schemes of safety for these under his or their charge.

All honor to the fearless inspector, who, when he comes across the callous man, "goes for him," and so would the writer. But if there is one position in this world where tact and discrimination is necessary for the successful discharge of such position, in the writer's opinion it is that of the factory inspector. He has the writer's sympathy, and hence these few lines on the subject of his work. Now, there is quite a boom just now in the home offices of the manufacturing countries in reference to the guarding of machinery. There is also a most pretentious "Safety First" association of Great Britain just now in the making. How many "bed-rock" shop men are on that committee, it would be fair to ask. All this is good, for it is admittedly high time that greater endeavor should be exerted for the purpose of lessening the number of casualties that result from the use of guarded and unguarded machinery.

The action of the Home Office inspectors, and, of course, the authorities above them, is highly commendable and salutary, and fully welcomed by foremen in charge of shops, but at the risk of being thought "speaking ill of dignitaries" the writer cannot help but offer a mild and friendly criticism of the plan of campaign and of the methods sometimes adopted by those esteemed officials.

There is another phase of the "guarding" problem. It is this. To legislate for it requires considerable discrimination. For example, take a large factory with hundreds of operators attending to or feeding machines. There are also hundreds of mechanics working machine tools. To get about such a factory and among the operators he would discover abundance of cases demanding his attention; in fact it would in many factories constitute a veritable "hunting ground" flagrant neglect of safeguarding. But, visiting a machine shop, it is suggested he goes stealthier, for the ground is more delicate. Men who work these tools are mostly mechanics, skilled men, fully aware of dangerous "couples," and from early and subsequent habit and training they keep involuntarily and unconsciously and intuitively clear of such known and obvious danger, and they also know that the only way to remove that danger and similar dangers from many machine tools would be to box them up and keep the worker outside the box. Take, for instance, the cone belt of a 18-in. centre lathe of heavy build. Here we have a 5-in. wide two or three-ply canvas or leather belt, a belt of sufficient strength to smash up an elephant, and such a belt running at hundreds of feet per minute, the belt and the cone. This belt may be shifted on to the various steps of its cone twenty or thirty or more times a day, yet it is manipulated from one cone to another frequently with the bare hands of the turner, or, at best, with a hammer shaft or a piece of stick, and not once in thousands of changes does anything approaching an accident occur. But let such an operation of shifting such a belt be done by unskilled labor or by boys; they would certainly come to grief. So considerable discrimination is essential, nay more, is absolutely necessary when framing rules respecting the guarding of machinery, and this discrimination is demanded of Government inspectors. These inspectors, in the writer's opinion, do not seem equal to their job; they may be too high—even that is possible—but certainly not equal to it.

Real practical men—shop habitues for many years, trained to care for the safety of their comrades—should fill the position of shop inspectors primarily, and, after having done duty for a number of years in the shops it is suggested that from these the Government factory inspectors should be recruited. Better results, it is thought, would then accrue than the gathering up of inspectors among a number of applicants for the past, whose fluency in writing answers to stereotyped questions, may easily be in direct, yet adverse proportion to their familiarity with the problem of safeguarding mechanics and operators from damage by machinery.

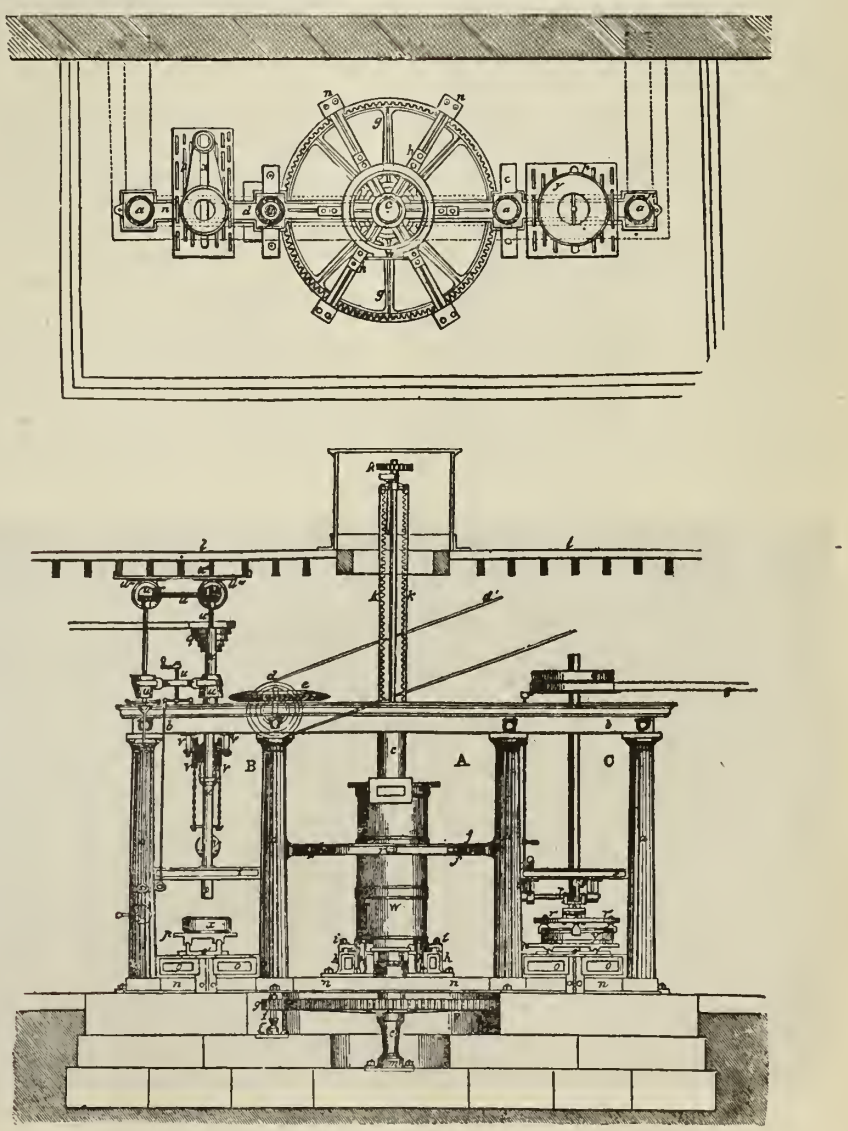


FIG. 5—A COMBINATION BORING MILL, DRILLING, AND FACE GRINDING MACHINE.

Have You an Efficient System of Packing?

If Not, Read This Article, and You May Find Some Hints Well Worth Following Out. The Company Whose System We Describe Have Studied the Packing Question Thoroughly

By J. H. Moore

SYSTEM, if properly applied, is one of the greatest assets we have in the industrial world. It is true that system can be carried to extremes, but immediately this condition arises, the name system is improperly applied and should be termed misapplied effort.

The International Harvester Co., Ltd., Hamilton, Canada, have been very careful to draw the distinction line between well-directed system, and wasted effort, with the result that their various operations are planned both systematically and intelligently. The human element has been carefully considered and the different tasks have been arranged in such a manner as to aid the workman in every way.

This viewpoint holds good in all departments throughout the plant, but in order to place before our readers some specific examples, let us consider two methods employed in the packing of some of their products.

At Fig. 1 we show a workman preparing for shipment what is known as a Deering Mower Bundle. It is the policy of this concern to ship their products in standard boxes, packages, or bundles. Each department knows what is contained in these various bundles, and when the box, package, or bundle as the case may be is in assembled condition, it receives a special symbol number by which it is always ordered. Any agent, dealer, etc., can order from this number, knowing exactly what parts it will contain.

In order to eliminate error in packing, special trucks, benches, etc., are used to hold only such articles as go to make up the box or bundle. For example, let us consider the packing of the bundle shown at Fig. 1. A truck is used which is divided into certain compartments. In these various compartments are placed the parts used in making up the bundle. As a rule the workman makes up so many bundles from one loading of the truck. In the case illustrated the truck is loaded with sufficient material for thirty bundles.

The remaining task is simple. The workman merely takes a part from each compartment, consecutively. At the conclusion of thirty bundles he should have used up all his material, and in the event of his having some stock left over, or minus some necessary part, he knows he has made a mistake somewhere in the thirty bundles, and at once can check them over.

Apart from this checking feature, the systematic idea of having all parts within easy reach makes for added production with no lost motion. There is many a plant that could adopt this truck idea to good advantage.

FIG. 2—IN THIS CASE THE CORRECT NUMBER OF PIECES ONLY ARE PLACED IN THE DIFERENT COMPARTMENTS.

Another Packing Scheme

Another system of a more elaborate nature is shown at Fig. 2. The work being accomplished in this instance is that of packing certain parts of a Deering New Ideal harvester. It might be well to first call attention to the style of packing crate used for this purpose. It will be noted that the sides, top and bottom, are of crated construction, spaces being left between the boards, only the ends being solid. The idea of this may not be apparent at first glance, but when we explain that they use the canvas (shown hanging out of crate at the first truck) for protection of the contents, one can readily grasp the idea. Considerable lumber is saved every year in this way, and the crate just as efficient in every respect.

This crate, when finally completed, contains quite a number of parts, so that a truck would hardly be practical for use in conjunction with its packing. A bench is therefore employed and is so arranged that starting at the one end the packer can pick up each part consecutively until the crate is finally completed. Only such parts are placed in this bench, or rack, as go to make up the crate. Immediately the packer has taken a

(Continued on page 589)

FIG. 1—PACKING A MOWER BUNDLE, USING A SPECIAL TRUCK AS AN AID TO SPEED.

Crank Shaft Machine on Which Tools Revolve

The machine as illustrated is a very interesting machine, built by Hulse & Co., Limited, Salford, Manchester, for turning large crankshafts, and is of that type in which the shaft is held stationary while the cutting tools are caused to revolve around it. The machine comprises a slide bed 21 ft. 9 in. long, 8 ft. wide, and 18 in. deep, accurately planed and faced and having two longitudinal and numerous transverse box girders. On the bed is mounted a sliding carriage provided with a variable self-acting feed motion along the bed by means of rotating nuts and twin-feed screws, the nuts being fitted with ball thrust bearings.

The sliding carriage also has a quick power traverse motion and means for hand adjustment in either direction. The sliding headstock is built in two halves, and forms a housing for a revolving cast iron ring, which is caused to rotate in bearings inside the headstock by means of double helical gearing, the final drive being through a steel ring encircling the cast iron ring. A 30 horse-power electric variable-speed motor with double reduction helical gears provides the motive power, the motor being mounted on an entablature on the headstock, with which it can move. The motor has a speed variation of 3 to 1. On the front of the headstock are securely bolted two transverse slides, upon each of which is mounted a cast steel tool slide with variable self-acting feed motion to and from the centre.

The feed motion comprises two long cam surfaces bolted to and projecting from the front face of the headstock. Runners passing over these cam surfaces actuate the feed motion mechanism through a set of spur gears. The internal revolving body has an adjustable ring on the back to take up any lateral wear, and lubrication of the bearing surfaces is provided by means of an oil-box on the top of the headstock. The two short cutting tools are carried in slots in the steel slides, endwise adjustment being provided by means of adjustable screws, while the tools are securely held in place by means of two set-screws.

Both the feed and power traverse motions are controlled from one position, and the arrangement is such that it is impossible to engage the two motions simultaneously. This is brought about by the provision of interlocking levers. For securing the crankshaft firmly two supporting stays, adjustable along the bed by means of a rack and pinion, are employed, each fitted with clamps and bolts and swivelling brackets on the stays are provided to secure the crank webs in the necessary positions.

The machine is designed to deal with cranks up to 28 in. throw, and crankshaft and pins from 8 in. to 24 in. diameter. The height of the centres is 5 ft. 9 in.; the traverse of the headstock along the bed with both stays in position, 9 ft. 6 in.; the traverse adjustment, 2 ft. 6 in.; the range of speeds, 2.5 to 7.5 revolutions per minute; the range of feeds to the headstock along the bed, 1-4 in., 1-8 in., 1-16 in., and 1-32 in. per revolution of the tools; and the range of feeds to the tool slides, ⅛ in., 3-32 in., 1-16 in., and 1-32 in. per revolution of the tools. All the bearings for the quick running shafts are brass bushed, and the approximate total weight of the machine is 35 tons.

The United States Civil Service Commission announces examination by mail for assistant mechanical engineer at $1,680 a year, plus a temporary increase of $20 a month. The applicant must have graduated with a B.S. degree from an engineering course in a college or university of recognized standing and have had three months' experience in engineering requiring considerable computation work similar to that required by the duties of this position. Applicants should apply for form 1312, stating the title of the examination desired, to the Civil Service Commission at Washington, or the secretary of the U. S. Civil Service board at the nearest custom house.

The United States Civil Service Commission announces an examination by mail for metallurgist, at $3,600 to $4,000 a year. The applicant must have graduated in mining engineering or metallurgy from a college or university of recognized standing, and have had at least five years of responsible experience in such work. Applicants should apply for form 2118, stating the title of the examination desired, to the Civil Service Commission, Washington, or the secretary of the United States Civil Service Board at the nearest Customs House.

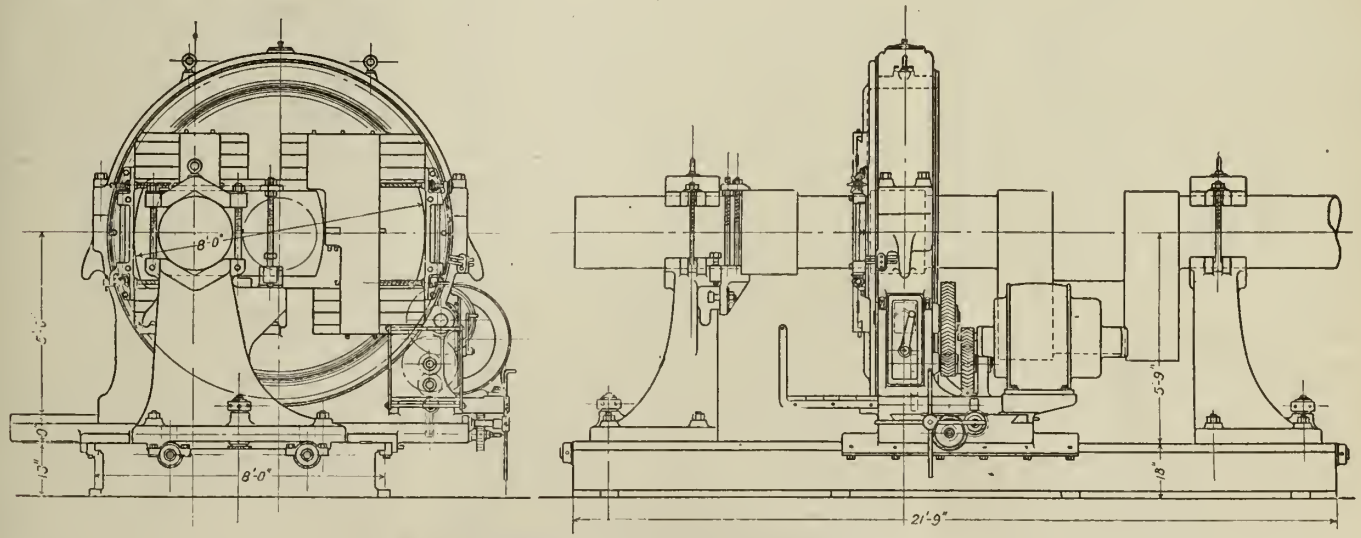
EFFICIENT SYSTEM OF PACKING

(Continued from page 588)

piece out of the rack, a workman on the other side places another similar part for the next workman. In this way there is no confusion, no delay, and the process of packing keeps on without interruption. The workman, whose duty is to replenish the packers rack, receives his parts from storage shelves at his side of the packing bench.

In our photograph we show only the finishing up the end of rack, but as the first portion is exactly similar in appearance we considered it much better to get a close up view of the arrangement. We call attention to the fact that at the end of a crate is shown the symbol number H7132F. This is, of course, the symbol number of the shipping package which we referred to earlier in our article.

We leave the subject at this point, believing that the two examples shown prove that systematic handling of any product is profitable and wise proposition.



GENERAL END AND SIDE VIEW OF THE MACHINE.

Recent Developments in Oxygen Cutting*

IN presenting the most recent developments in the art of cutting with oxygen we have concluded that the most interesting development which has occurred recently in connection with cutting is, without doubt, the successful cutting of cast iron.

More than a year or two ago, there were rumors heard now and then in the industry, of some genius who stated that he had cut, or could cut cast iron. These rumors were not given much credence because it was thought that in most instances the man who believed he had cut cast iron had, in reality, cut something else which he thought was cast iron.

About this same time our Engineering Department began to think more deeply upon the subject, with a view to learning more of the basic principles underlying cutting, particularly with respect to cast iron. We began to experiment and detailed Mr. F. J. Napolitan to the work. He has continued his efforts in this direction, until we believe he has developed some very interesting theories, and has evolved some principles which are of extreme importance to the art. In compiling this paper we have worked together to lay before the Society an outline of these theories and principles, which we believe will be of interest, and which may explain some of the conditions well known by men practised in cutting, but which had never been clearly understood by the majority of cutters.

When we succeeded in cutting cast iron, it must have disturbed our dignity in that we were obliged to reverse our former opinions and beliefs, and to take back the statement often made, that cast iron could not be cut with the oxy-acetylene torch. Unfortunately, our experiments are by no means concluded, so that we are not free to disclose all that we would desire. Frankly, our investigation of cast iron cutting was inspired by nothing more noble than to seek a better explanation of why cast iron could not be cut. Most of us, and I am no exception, have expressed at some time or other in our experience, the solemn opinion that cast iron could not be cut, because the oxide of iron melted at a temperature higher than cast iron itself. Not only does cast iron burn to form an oxide, but the higher melting point of the oxide probably assists the reaction.

While we are rather skeptical of the commercial value of the cast iron cutting torch, and are convinced that, financially, we will never be repaid for the expense of our experiments, yet there are undoubtedly occasions when the cutting of cast iron would be of great value. In the ordinary scrap-yard, or in instances where the cutting process would be used as with steel, it is so easy to break cast iron, that it would hardly be economic to use the cutting torch. Were we not to further develop cast iron cutting, however, we should feel remiss in the work of our Engineering and Research Department.

You are all aware, of course, of that application of oxygen cutting used largely in blast furnace practice, the opening of a "frozen" tap hole. You could not quite reconcile this more or less common application of the process with the pet theory that cast iron could not be cut.

One of the usual methods for releasing a frozen tap hole in a blast furnace, is substantially as follows: A piece of one-quarter inch iron pipe with a brass handle, at least ten feet long, is attached to a manifold of several oxygen cylinders. Oxygen is delivered through this pipe at a pressure of approximately 100 pounds per square inch. A hole is started with a star drill or diamond point, until it is just about thre inches deep. The metal adjacent the hole is heated with a fuel oil burner or by other means. The end of the iron pipe is ignited and the composite stream of molten iron slag and oxygen caused to impinge against the frozen cast iron.

A spectator to this performance of infernal fury, is readily convinced that the heat is not all due to the combustion of the wrought iron pipe, but that the cast iron is burning with a violence equal to that of steel. This reaction inspired some inventors to incorporate a device in an oxy-acetylene torch for cutting cast iron, which would feed a steel wire between the cutting jet and the cast iron piece being cut. Ignition of the wire carried a stream of molten slag on to the cast iron and it was hoped thus to propagate the cut. In a second process, a plate of steel of definite and predetermined thickness was placed on top of the cast iron. It was hoped that the slag incidental to the oxidation of the steel, would exercise some influence over the cast iron and enable it to be cut.

Unfortunately for those responsible for the exploitation of these devices, the inventors were more concerned with converting cast iron into iron oxide by means of the oxy-acetylene torch, than they were in constructing a practical process and a practical tool. It was next proposed to simplify the reaction by supplying an apparatus with a mixture of pulverized slag and iron powder, and in fact a number of patents were issued covering various applications of such a device. Crude and elementary as such devices were, they actually produced combustion of the cast iron and went a long way in stimulating us in our endeavors to find a successful method.

Experimental work was continued with a torch having a good many different tubes leading to the head, so that almost any combination of gases at varied pressures might be obtained. Mr. Napolitan has evolved from these experiments, interesting theories pertaining to the reactions which take place in cutting, together with their relation to our success in cutting cast iron. He has noted these theories in the article which follows. We are presenting these theories for what they are worth. We can actually cut cast iron and we do it by preheating the oxygen. We have endeavored to tell our conclusions pertaining to the reactions which take place. We will now take up the subject of metallography of iron and steel with reference to oxygen cutting.

Points Discovered

From the ease with which wrought iron is cut, we may conclude that an aggregate of ferrite combines with oxygen with greatest avidity, and permits the propagation of a cut with least interruption. As the carbon content is increased, there is a material change in the nature of the metal. In place of the preponderance of ferrite grains, we recognize the formation of cementite, and its union with some of the ferrite to form pearlite—the original mass of pro-eutectoid ferrite rapidly diminishing in prominence. As we should anticipate from the nature of pearlite, no material change is noticed in the performance of these alloys under the cutting torch. Of course, an ultra-precise consumption test would probably indicate a lowering of the efficiency coefficient, but from all appearances, no unusual difficulty is experienced in cutting carbon steels up to about 80 to 90 point carbon. But here, a definite transition is indicated by a distinct laboring of the cutting torch. While the torch will begin a cut with practically the same effort, and proceeds to completion without interruption or unusual delay, yet the kerf is wide and ragged and undeniably distinguished from that of a mild steel cut. It is recognized practice, now, to preheat the piece to be cut to a black or dull red heat, when the impediment, whatever it was, seems to have been entirely eliminated.

But let metallography explain the sudden change of properties of the steel. As the carbon content of the hyper-eutectic steel was increased, and the proximate mass of pearlite increased, and the pro-eutectoid ferrite correspondingly diminished in volume, until eventually, a point was reached where all of the cementite and ferrite existed in the stratified or laminated relationship of pearlite. This state is

*Paper read before the American Welding Society by Stuart Plumby and F. J. Napolitan.

recognized as existing where the carbon content is between 80 and 90 point—the approximate analysis of pearlite is yet undefined. As the carbon content is further increased, there appears a constituent that we know as pro-eutectoid cementite—in fancy, the cementite which has been ejected from the pearlite growth. It is circumstantial that the presence of this pro-eutectoid cementite is directly responsible for the increasing difficulty of our cutting. But why did preheating of the steel before cutting make such a remarkable difference in the results? To be sure, the rise in temperature might affect the stability of any martensite, troostite, or even sorbite, that might have existed, but the temperature was too far removed from the $Ac_{2,1}$ point to affect the characteristics of the pearlite. And surely the pro-eutectoid cementite was unchanged—and it was this same constituent that we blamed for the difficulty.

Again, as the carbon content is substantially increased, an equivalent interference with cutting is apparent, until, when the carbon content approaches 2.5 per cent., cutting becomes so labored as practically to cease, and no amount of preheating short of incipient fusion will permit it to propagate. As you are aware the metal is now termed "cast iron," and a micro-analysis indicates that in addition to the presence of a certain amount of pearlite and pro-eutectoid cementite, as well as certain foreign and to our discussion, unobtrusive substances, we recognize the presence of the final and most stable state of carbon—graphite. The pearlite constituent exercises a favorable influence upon the operation of cutting—and the pro-eutectoid cementite, while it impedes cutting, is readily compensated by a slight preheating—but the graphite presents an entirely new problem.

We might digress from the subject enough to present some remarks that would prove the fallacy of at least one of the stereotyped explanations of why cast iron cannot be cut—that the melting point of the slag is appreciably higher than the melting point of cast iron. A micro-analysis of the structure of an average cast iron—and by average we refer to a gray cast iron of about three to four per cent. carbon—would indicate a structure identical with that of a hypothetical steel of the same carbon content, except that some of the carbon sems to have been precipitated as graphite. But should that identical pour of cast iron have been cast against a cold iron mold, or otherwise chilled, the carbon would not have been precipitated as graphite and we should have had what we shall call a "chilled cast iron," or a "white cast iron,"—and it would actually have been a hyper-eutectic steel. Such alloys are not uncommon in commerce, and the fact that operators have been able to cut them with no extraordinary effort, has been responsible for innumerable false claims that cast iron has been cut. Unfortunately, the nomenclature of steels and irons is not clearly defined, and undoubtedly, a chilled cast iron is but an extension of the hyper-eutectic series. The melting point of an iron-carbon alloy is a constant of its composition, whether, in the solid state, the metal exists as a typical cast iron or as a steel. Long before the point of fusion, the carbon and the iron exist in one relationship, that of austenite. The conditions affecting the pouring of a melt of cast iron would determine the final state of its constituents—and we might as readily produce a gray cast iron or a chilled white cast iron—the carbon as graphite or the carbon as in cementite. In either event, the melting points of the resulting products would be identical. We agree that chilled cast iron can be cut with comparative ease, notwithstanding that its melting point is lower than the melting point of the slag produced. It is evident, then, that the melting point of slag is not responsible for the difficulty encountered in cutting cast iron.

We had concluded that while the existence of pro-eutectoid cementite appreciably retarded cutting, the presence of but a comparatively small amount of graphite completely prevented cutting. The phenomenon, if it were true, is unique, for it would pre-suppose the incombustibility of carbon. Science contradicts us immediately. In fact, our own welding practice belies us. We might point to the reaction accompanying the removal of carbon from automotive cylinders by the oxygen method—or, leaving our immediate field, we might mention the explosive combustion of carbon in ordinary gun-powder. We are forced to conclude then, that far from retarding the combustion of the steel matrix, the graphite of cast iron should actually assist it.

We investigated further to determine how much graphite influenced cutting. We obtained specimens of so-called malleable castings of the characteristic "black heart" structure. Such a structure is made in this country by the annealing of white cast iron in which all of the carbon exists in cementite or pearlite, the latter in some cases entirely removed. The treatment decomposes the cementite to precipitate the carbon in minute particles, differing from the graphite of gray cast iron in their extreme subdivision and uniform distribution throughout a ferrite matrix. In making a black heart casting, an oxidizing package is used in this country, so that while the core is that of a black heart casting, the mass near to the surface is ferrite. We removed this shell of ferrite so that our materials indicated, under the microscope, a uniform aggregate of ferrite and temper carbon. By preheating this piece to a dull red heat, it was cut with the characteristics of a high carbon steel. Then we were satisfied that carbon as such did not prevent cutting, but that the physical state of that carbon was responsible. As plates of graphite, cutting was prevented—but as finely divided particles, cutting was scarcely impeded.

Reconsidering our previous observations in the light of this development, we began to substantiate our first logical hypothesis. We found, to summarize, that ferrite permitted most readily to be cut. Pearlite with pro-eutectoid ferrite did not materially affect the conditions. A completely eutectic composition first suggested a transitory stage. The existence of pro-eutectoid cementite retarded cutting but preheating of the piece to a red heat readjusted the conditions so that cutting was again as efficient as in the case of ferrite. As the comparatively low temperature produced by preheating was insufficient to affect any change in the physical state of the constituents of the alloy, we were forced to conclude that the addition of heat units affected a definite constant, which we assumed was the heat of combustion of the iron, as the two forces were of like characteristics. Then a constant result from a variable, made axiomatic the existence of a second variable. Our second variable, then, we concluded, was the cooling effect of the stream of cutting oxygen, and a further thought suggested a third variable in the time of chemical reaction between the iron and oxygen. The preheating flames ignited the steel—the cutting oxygen produced combustion—and the propagation of the cut was a natural consequence. But as the carbon content was increased, the speed of the reaction was materially lowered; however, the velocity of cutting oxygen to insure a continuity of oxygen and slag to the bottom of the cut, was a constant. Then, eventually, a point was reached where the rate of combustion between the iron and oxygen was so slow that the heat units liberated from the reaction were dissipated to such an extent as no longer to ignite adjacent masses of metal—and cutting ceased. By preheating the piece before cutting, we add to the forces on the weakening side of the equilibrium, and cutting once more obtained. The heat units so obtained, compensated for the relatively less heat units liberated from the chemical combination of the iron and oxygen in a definite unit of time.

While the pearlite and pro-eutectoid cementite are readily compensated, the graphite carbon effectively prevents cutting by the ordinary means. No addition of heat units short of incipient fusion, by preheating the object, restores the equilibrium. We cannot strengthen further one side of our equilibrium, but we have not attempted to affect the other side. We have made no attempt to reduce the cooling effect of the cutting oxygen. We therefore experimented in this direction, and found that we could so effectively preheat the cutting oxygen that we could restore the equilibrium without preheating the object.

Operating a Machine is Not as Easy as It Looks

At Least, So John Conley Says. He Has Now Been Promoted to Drill Hand and Learns Some Valuable Hints From Both the Foreman and His Own Father

By J. Davies

"WHEN I walked through the shop this morning, John, I noticed you were working at a small drilling machine. Have you been promoted?" "Why, yes, Dad, I have been trying to run that machine for six weeks now." "How are you getting along with it?" "Sometimes I think I am getting along fine, then at other times I wish such a thing as a drilling machine had never been invented. I used to think any fool could run a drill." "I see you found out one fool that couldn't. Well, let me hear some of your experiences, perhaps I may be able to help you."

"Well, father, the first job I had, was to drill some small holes in a number of pieces of flat iron, and everything went along fine for a while. It was a pleasure to see the cuttings come curling out of the hole. The machine was running at a pretty fast clip too. I left it for a while to go and get a drink of water; when I came back I couldn't get the drill to cut at all. Of course the men working nearest to me made some kindly suggestions. One said I was feeding too fast, another said to put some soapy water on the job, another said to put some clagem on the belt. I tried all these suggestions but they were of no use, the drill would not cut, so I had to go and get the foreman. As soon as he neared my machine he gave me one look and said, 'Don't you see the drill is running backwards?" I explained shamefacedly that someone must have changed the direction of the drill while I was getting a drink of water."

"'I suppose you left the machine running,' he said. 'That is why you didn't notice the change when you came back. Whenever you find it necessary to leave your machine for any purpose, always stop it.'

"I got started off again and everything went smoothly until the drill had to be sharpened, then I certainly had a time of it. It was no good getting someone else to sharpen it, for I had to learn to do it myself. I guess I sharpened that drill half a dozen times before I could make it cut, but at last I got it cutting fairly well. I had lost a great deal of time, so I thought I would make up for it by holding some of the pieces in my hand instead of bolting them down to the table as I had been doing. I managed the first one and second alright, then the drill snatched the third one out of my hand and whirled it around on the table, knocking the oil can, my rule, and a few bolts and nuts off the table. It also hit me a whack in the stomach and broke the drill.

"The foreman walked up just at that moment. He has a habit of turning up just when you don't want him, but when everything is going fine I never see him around. I expected he was going to sympathize with me, but instead, he coolly picked up one of the pieces I had just drilled, examined it critically, and said, 'John, you are making those holes too big.'

"At this I got hot under the collar and asked him how in the world I could make the holes too big when I was using the same drill he gave me at first; then he gave me a clipping that he had cut out of Canadian Machinery and asked me to study when I had time. Here it is and this is what it said:

"'There are at least seven wrong ways of grinding a drill to say nothing of a few original methods of every apprentice: (1) too flat; (2) too sharp; (3) unequal cutting edges; (4) unequal angles; (5) no lip clearance; (6) too much lip clearance (7) unequal lip clearance.'

1. The result of grinding too flat forms a hook-like cutting edge and it is very hard to get a round hole. The drill ground in this manner is very apt to get away from the centre punch mark, and must be watched very closely.

2. Too sharp a point puts unnecessary strain upon the machine and if you happen to be drilling thin plates, the drill points come through the plate before the full size of the drill is entered into the metal, this allows the drill to wobble all over the job and causes a very irregular shaped hole.

3. Unequal lengths of the cutting edge form a serious defect as this results in the hole being too large, although sometimes the fact of a drill possessing equal angles and one cutting edge longer than the other, can be turned to advantage, as in a case where you want a hole just a shade larger than the drill, or between the sizes of standard drills, otherwise, as it often happens, especially in a small shop, you will have to use a drill with the margin considerably worn. Wear on the margin or land leaves the drill without sufficient clearance, so that it is apt to bind in the hole, and also drill a little small. In a case of this kind it is a distinct advantage to grind one cutting edge longer than the other.

4. If the point of the drill is in the centre but the angles of the cutting edge different, all the work will be done by one cutting edge, and the drill will be crowded over to one side, which has a tendency to bind the drill, also make the hole too large.

When both the angle and the length of cutting edges are wrong it is impossible for the drill to give anything like satisfaction, it will be working under very bad conditions. The support which a properly ground drill receives from the metal being drilled is entirely lacking.

5. If the drill has no clearance it simply will not cut and any attempt to make it cut by force will only end in disaster, usually splitting the drill up the web. On the other hand if the drill has too much clearance it is liable to dig into the work and becomes loose in the drill socket. If you are using a straight shank drill, it would most likely slip around in the drill chuck and the edges also will keep breaking away because there is not sufficient metal behind them to support the edge.

As the drill becomes shorter, the centre becomes thicker, because the web of the drill is made thicker towards the shank to give it strength. To overcome this, thin the edges, taking care to keep the point central. The three main features to aim at in grinding drills are: (1) equal lengths; (2) equal angles; (3) proper clearance. The angle recommended by most makers is 59 degrees on each side.

After I had studied that clipping I found out the reason I had been making the holes too big. I had been grinding the drill with unequal lengths of the cutting edge.'

"After this I had an interesting experience drilling some very deep holes in some cast iron blocks. I would drill for a little while, then the drill would choke up and I tried to blow the cuttings out of the hole. I blew them out alright, but they went right into my eyes and mouth and made me look like a nigger, so I quit that method and tried poking them out with a stick, then I got a good idea from Jim Walker. He told me to get an old round file small enough to go in the hole and take it over to the boss electrician and get it magnetized. This worked fine,—when the drill choked again I just poked it into the hole and it came out loaded. I could clean out the deepest hole in no time, but I had some trouble in drilling holes deep enough. The standard drill was too short, it scarcely left any hold in the chuck, so I consulted one of the old drill hands and asked him the best thing to do.

"He said, most people use an extension drill, that is a special long drill, but a much cheaper and a very useful tool to make was to make a holder of my own, which I could use with the ordinary standard drill. This is how he said to make it. Take a piece of cold rolled steel long enough to give a good grip in the chuck, drill a hole in the end the size of the drill we wish to extend, then file or shape a slot at the end of the drilled hole to fit a flat surface that has

been filed on the end of the drill. Here is a little sketch he made for me. He helped me to make one, and it worked fine."

"That's right, John," remarked the father, "never be afraid to ask questions and never pretend you understand anything if you don't. If anyone wants to tell you how to do a job, listen respectfully, then use your own judgment. When that piece of iron hit you a rap in the ribs it would appeal to you with some force that whatever piece of work you are operating on it needs to be made secure.

"Apprentices as a rule, are careless in this respect; they often try to hold the job with their hands, thinking it too much trouble to hunt for bolts, etc., to make the job secure. This is the cause of broken drills, and often of more serious accidents. You will have to learn to use your own judgment in this respect, as every job must be handled on its own merits, but it is better to err on the safe side.

"Some jobs, such as rough holes in a flat bar, need not be bolted down. Put the job on a piece of wood of even thickness, hardwood preferred. Then fix a bolt with piece of pipe on it in one of the slots of the table, which will form a good stop for all jobs of that description. For jobs that need to be bolted down, the common U-clamp is the most convenient. This consists simply of a piece of square iron bent to leave a slot in which the bolt fits easily. Sometimes in places where the nut would be in the way, it is convenient to have a set in it.

"In bolting work of any description to the drill table, see that there is room under your job for the drill to go clear through without making a hole in the table. It may be necessary to put parallel pieces or other packing under the job. Have your bolt or bolts as near the job as possible, and your packing piece as far away as is convenient, and your packing pieces the same height.

"In such a simple operation as bolting a piece of work to the table of a machine (this applies to other machines as well as the drill), there is a principle involved, which if you keep in mind it will help you in many ways.

First, never place your packing too low, for if you do you will not grip your work properly. Another thing to watch is that you do not use a clamp that is too thin. Thin clamps always bend and spring, therefore not holding as they should. The third thing to watch is that you get the bolt at the right end. You may say, "What do you mean, right end?" but here is what I refer to. Suppose you get your bolt away out from the work, and practically up against the packing, what happens? Simply this, that you are actually clamping your packing and not your work. The correct position for your holding down bolt is as near the work as practical, and as far away from the packing piece as possible. This is the true secret of proper and secure holding, but enough for this time, we'll continue our talk at some later date.

The Carbon Contained in Different Types of Steels

By W. S. STANDIFORD

ONE of the most important subjects in the manufacture of metal goods, is the amount of carbon content that tool steel contains. This element has a great influence on the hardness that the cutting edge will hold, which is a most important point in the rapid production of articles.

High-speed steel containing little carbon is not used as extensively as it should be for machining work. The average machine shop foreman has a very hazy idea regarding the part that carbon content plays in the machining. In many cases he uses a steel for working hard castings that is too low in carbon content; the result being that the workman has to waste a great deal of time regrinding the tool. In order to do any cutting at all, the tool has to be harder than the metal cut; and the harder it is, the longer it keeps a keen cutting edge, thus enabling a large amount of work to be done before it needs regrinding. It is characteristic of steel that the harder it is, the more brittle it becomes, so that for manufacturing purposes, it has to be tempered, which process renders it slightly softer but tougher, thus enabling the metal to withstand shocks and strains much better.

To enable any foreman to select steel having the right amount of carbon for different classes of work, the writer appends a list which will be found, by experience, to give good satisfaction for use in making various tools as indicated. Manufacturers who use a great variety of tools will find it advantageous to keep on hand a stock of steel containing different percentages of carbon. This allows greater flexibility in the tempering process, allowing for tools to be made to suit various requirements of work. Thus a high carbon steel crowbar of 1.50 per cent. carbon, no matter how carefully it is tempered, would be brittle compared to a crow-bar made of .80 per cent. carbon, the latter being able to withstand far better the rough usage which this class of instrument generally receives. All tools requiring a fine cutting edge for finishing work, such as lathe tools, milling cutters, taps, razors, needles, etc., for fine dies where sharp outlines and great endurance are required, and for fine springs, saws and kindred uses, are generally made out of crucible, or a steel made in the electric furnace, the latter giving a very superior product.

Carbon Contents of Steel for Tool Making

.50 per cent. carbon is best for battering tools.

.70 per cent. carbon is used for hot work and dull edge tools.

.80 per cent carbon should be used for wood cutting chisels and some forms of reamers and taps.

.90 per cent. carbon steel is used for making cold chisels, drills, taps, dies, etc.

1.00 to 1.10 per cent. carbon steel is used for lathe tools, axes, hatchets, knives and also large lathe tools.

1.50 per cent. carbon is used for roll turning lathe tools, graving tools, scribers, scrapers and small drills.

The best all-around steel is that between .90 and 1.10 per cent. carbon. For many purposes, especially in rolling mill work where large shapes or sections have to be turned; it is customary, in order to save expense, to have the cutting edges made out of a piece of steel which is welded to the top edge of an iron bar. This gives good service in turning rolls if the welding is properly done by the blacksmiths. In the welding of a high-carbon steel bar to an iron one, it has been found out by experience that steels containing a large amount of carbon are difficult to weld, the classification being about as follows: 1.50 per cent. carbon welds with difficulty. 1.10 to .90 per cent. of carbon welds fairly. .80 per cent. carbon and lower percentages weld easily. Steel containing .15 per cent. carbon is generally used as a substitute for iron and it will not temper. It will readily be seen from the foregoing, that in order to make steel that will take a keen cutting edge—it is necessary for it to contain a sufficient amount of carbon; as the latter is the hardening agent. Tools for the turning of rolls used in steel works, which are made out of cast iron, chilled iron, semi-steel, steel and alloy-steel rolls containing manganese, are usually too hard to be turned with a tempered tool such as is used on an engine lathe by machinists; but have to be left as hard as fire and water can make them in order to do any cutting at all.

All steel tools that require tempering have to be hardened first. This is done in many ways, the tool being turned over from time to time, until it is evenly heated to a cherry-red color. It is then plunged into either a solution of plain water, salt water, or a solution of cyanide of potash in water, according to the preference of the temperer. The cyanide and salt water solutions make a tool very hard. When used to turn rolls, no drawing of the temper needs to be done, the metal being ready for use if it has been previously ground. In tempering machinists' lathe tools, etc., the method adopted by good blacksmiths is to first harden the metal in the manner previously described, with the exception of not plunging all parts of the tool in the hardening solution; but leaving some heat in its shank, while the cutting

Continued on page 60

WHAT OUR READERS THINK AND DO

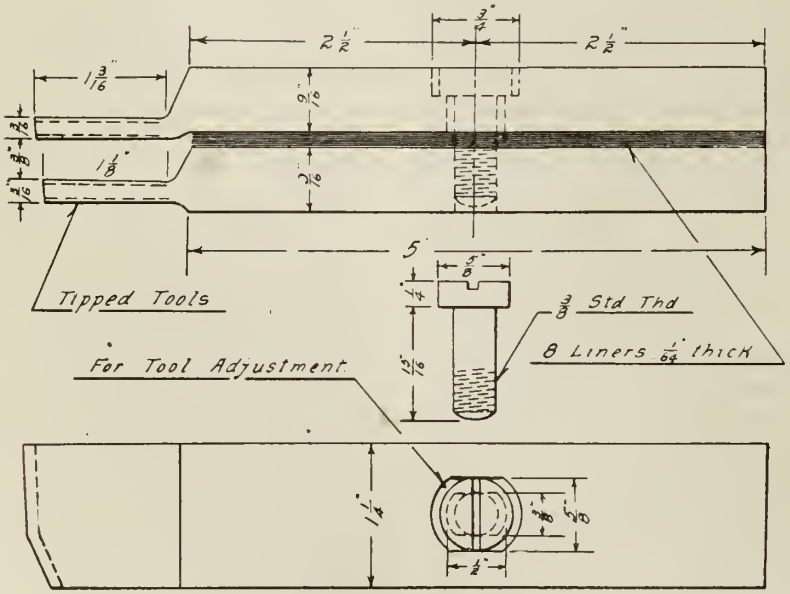
DOUBLE PARTING TOOL

By Clyde D. Thorburn

The tool as shown is one that we have used with considerable success in parting off piston rings from sleeve castings. This tool is adjustable, which makes it doubly useful and we also have a gang tool of four cutters which works admirably when soft grey iron castings are given us by foundry. Frequently the castings are extremely hard and on these we are unable to use the gang tool economically, as both feed and speed have to be reduced, and under these conditions the life of the gang tool was very short.

The tool, as illustrated, is merely two parting tools, mild steel body, with high speed tips, one drilled and counterbored and one drilled and tapped to take the cheese head screws for holding the two tools together. Between the tools are eight liners, each 1/64 in., to allow for adjustment when tools are worn and ground. Using this tool we were able to maintain the same R.P.M. and feed speed as when only using one tool, therefore practically doubling the number of rings cut off.

The upkeep is very small in comparison to the four cutter gang tool, as all



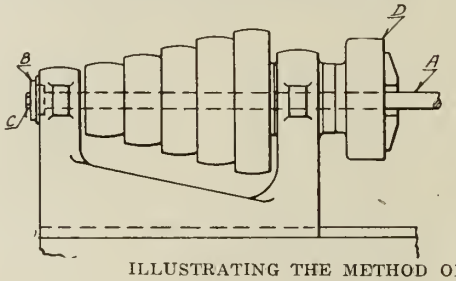
GENERAL VIEW OF THE HOLDER.

that is necessary is renewal of tips when worn. It is important that the top tool has the required amount of lead, and the cutting faces of both tools so ground that the top edge of each tool will cut through before the bottom edge.

HOLDING A LONG SHAFT TRUE IN A LATHE

By F. Scriber

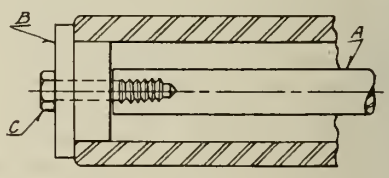
Having a number of shafts with a tapped hole in the end to machine and these being longer than would go between centres of the lathe, they were to be machined on, recourse was had to the method shown by Fig. 1 for holding them true. The hole was first drilled and tapped, using a back rest on the lathe bed and holding the drill and tap in the tailstock by passing the work through the hole in the headstock spindle and driving with a chuck in the usual manner, following which the shafts were reversed end for end and again passed through the headstock spindle as shown at "A," Fig. 1.



ILLUSTRATING THE METHOD OF HOLDING SHAFT TRUE.

In this position a bushing "B," which fits the inside diameter of the spindle is fastened to the end of the shaft by screw "C." The chuck "D" is then tightened, thus the shaft is held true at the tapped end by the bushing; it is trued up at the chuck and the back rest holds the outer end while that end is machined. The bushing "B" also locates each shaft in the same position endwise.

An enlarged view of the bushing and spindle end showing the screw holding the shaft is illustrated by Fig. 2. The particular advantage in holding by this method consists of having the tapped holes true with the turned end.



MARKING NAMES ON TOOLS

By W. S. Standiford

Many mechanics like to have their names or initials put upon their tools. This is generally done by means of a steel stamp containing the desired letters, but as marking the name by use of a stamp requires considerable force in order to do the work properly upon the unhardened part, it frequently happens that they are thrown out of adjustment by being sprung or bent, which interferes with their accuracy and often renders them useless.

The steel stamp cannot be used upon hardened parts at all, thus some articles such as hardened steel rules must remain unmarked. The acid process of etching names has the advantage that it does not throw any parts out of alignment, and also allows hardened or soft sections to be eaten away by the acids, so that a workman can place his name upon the metal wherever he likes. By using the first chemical method which makes copper colored letters, or if a set of rubber type is used with asphaltum varnish, it will be found by experience that the corrodent employed makes

a much neater appearing piece of work as contrasted with the sulphuric acid mixture given in the last recipe. Both are good though, and do the work well, but the writer regards the copper formula as producing the most artistic work. Formula for a copper corrodent is as follows:

Distilled water	4 ounces
Copper sulphate	1 ounce
Salt	1 ounce
Zinc sulphate	½ ounce
Alum sulphate	¼ ounce

Mix all the chemicals in the water and shake vigorously until they are dissolved. The mixture is then ready for use. Now take the articles to be marked; clean off any rust on the article with fine sand or emery paper on the spot where the name is to be placed. Smear it with good soap or paraffine wax, then write name down with a scriber, or other sharp instrument, and cover the marking with the fluid—or better still, fill up the tracing with it. Leave the object alone until the name turns copper colored. Moisten the soap with water, or if the wax is used, scrape it off. The soap can be removed easily by rubbing. The solution need only be left on for five minutes.

To those who would like to have their names put on tools in a neater manner than is possible by using a scriber, the employment of rubber type, which can be bought at any ten cent store, is recommended. In using the type, proceed as follows: Set type in the holder in a reverse direction to what it will appear when printed; or in other words, reading from right to left. Get a small can of asphaltum varnish from a hardware store, tack a piece of cotton cloth to a piece of level wood, spread a small amount of the varnish by means of a flat stick on the cloth; press the type on the cloth, then press type lightly on the metal and let it dry, which will take only a few minutes. Make a small rectangular piece of wood about ⅜ of an inch thick, the length and width depending upon the size of tool and length of name; the object being to have as wide margin as possible around the name.

Bevel the sides of the rectangular piece of wood with a knife or file—a steep angle making it withdraw easily from the soap. Put a tack in the middle of wooden piece to serve as a handle, lay the rectangular section of wood over the name, making sure that the margins are equally spaced. Then put soap or wax around the sides of wood so that none of the solution will escape. Withdraw the block, and fill the place with corrodent. Pour the latter off after it has been on five minutes, and clear away soap or wax as previously described and you will have your name in black letters on a copper colored background. The type should be cleaned with turpentine after using. In inking the type with asphaltum, care must be taken not to get too much on as it will clog the letters; if they should contain too much ink, it can be gotten rid of by pressing it on a piece of paper. It would be better for the beginner to try the process on a piece of iron or steel before putting his name on the tool; thus he will get familiar in handling the type and do a good job. These directions for doing the work may seem tedious, but it will be found in practice, that it is a very easy matter to place names upon tools.

Another method of etching names on steel, is by the use of sulphuric acid solution. This cuts directly into the metal and leaves the letters countersunk, both background and letters having the same color. If the rubber stamp letters are used with asphaltum varnish, the background will be eaten away, leaving the letters in relief. The acid mixture is made as follows:

Sulphuric acid	1 ounce
Water	4 ounces

Pour the acid slowly into the water, stirring with a stick—don't add the water to acid as it will fly up into the face. After making, use soap or paraffine wax to cover the parts of tool as previously described, using a scriber to scratch through soap or wax to enable acid penetration. After the work is done, wash off acid thoroughly and grease article to avoid rust. It should be remembered that both etching mixtures are poisons, and the hands should be cleaned after the work is done.

DRILL JIG FOR TWO PARTS

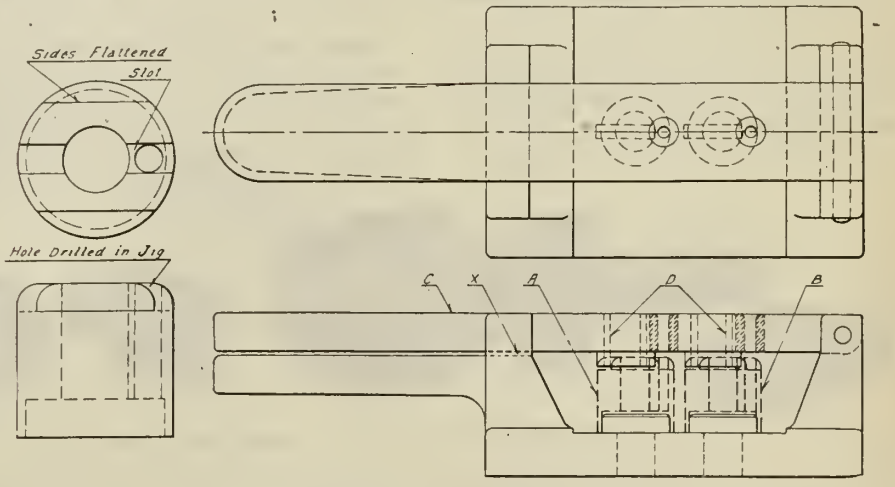
By F. Scriber

It quite frequently happens when small parts are to be drilled that a jig is made, which although it locates the work properly, it is in turn very hard to hold, owing to it being so small that it is carried round by the drill as it is fed into the work.

With this in view, the jig illustrated by Fig 1 was designed for holding two parts such as are shown in Fig 2. These parts are first drilled, counterbored and turned on a screw machine, after which they are flattened on the sides and slotted across on a milling machine. The jig shown is for drilling the small hole at the side.

Referring to the jig drawing, Fig. 1, two parts, A and B, are slipped over pins, the cover C with a handle formed on the end of it carries two pins D, which are flatted to go into the slots of the work, thereby locating the same radially. The cover swings down against the seat X, and in this position there is about .010 clearance between the work and the cover, consequently the work is not gripped in any manner, but is held in a fixed location from which it cannot get away, the cover being held down and the jig held by one hand while the drill spindle is operated with the other hand.

This makes a very quick and efficient jig, is easily held by the operator, and he is not apt to be cut by revolving sharp edges.



DETAILED VIEW OF THE JIG.

INTERESTING BOOKLET

A very interesting booklet has been prepared by the Warner & Swasey Co., Cleveland, Ohio, to record the celebration of their fortieth anniversary. This book presents in brief form the history and development and character of their business, and has been prepared, not only for distribution to the members and employees of the firm, but to any others who may be interested.

NEW CATALOGUE

The Butterfield & Company division, manufacturers of taps, dies, screw plates, blacksmith stocks and dies, tap wrenches and reamers, etc., have issued a new catalogue known as No. 18. In addition to the various lines illustrated, a section is devoted to tables and general information, all of which are useful at any time.

Producing Lignite.—By the first of August the lignite briqueting plants established by the Research Council to fit for use the coals obtained at Souris and at Estevan, Sask., will be producing. It is expected that 30,000 tons will be produced this year at a cost much less than anthracite.

DEVELOPMENTS IN SHOP EQUIPMENT

FRICTION CHUCK

The Roberts Manufacturing Co., New Haven, Conn., have placed on the market what is known as their Improved Friction Chuck. This chuch is especially adaptable for drilling, tapping, and stud setting, and its positive friction prevents the breaking of taps.

The first illustration shows the different parts disassembled, while the second photo shows the different attachments in assembly condition.

The design of this chuck has been carefully prepared, and the number of working parts reduced to a minimum. All set screws and feathers have been eliminated, which enables the operator to handle the chuck with perfect ease.

The friction is metal to metal, no fibre washers being used. This ensures positive friction, with no accompanying trouble or annoyance. The nose piece, which is used as a driver for the sockets, is so designed as to remove all strains, thus insuring the accurate running of sockets, and adding to the life of the chuck.

Once it is set for required size tap, it is absolutely fixed. A clamping nut accomplishes this instantaneously. When the tap strikes the bottom of the hole the friction slips. Owing to the metal to metal friction the action is positive, eliminating the possibility of broken taps.

In order that readers can grasp clearly the uses of the various parts we refer them to Fig. 2, the parts of which are as follows:

A. The spindle, made to fit any machise. B. The driving plate; this attachment removes all strain from tang of the spindle. C. The clamping nut. This nut screws into body of chuck and has left hand thread, so that in case it should cut for lack of oil, instead of tightening, it would back off. D. The main body of chuck. The male part of "V" friction is screwed onto end of the spindle and is made of cast iron: This contains two slots in the "V" which insures perfect lubrication. E. Sliding collar. By raising upward it enables operator to remove and replace sockets without stopping the machine. Socket is locked in place by lowering sliding collar. F. The clutch nose piece. The driving is done entirely by this nose piece, which relieves all strain from the recess and guarantees accurate running of sockets at all times. G. The socket for holding taps. H. The socket for stud setting. I. The bushings for holding taps. J. The bushings for holding stud setters. K. Drill socket.

ILLUSTRATING THE CONSTRUCTION AND DETAILS OF THE CHUCK.

These chucks are made for the following size drills and taps:

No. 0 arranged to take from 1-16″ to ½″
No. 1 arrangel to take from ⅜″ to 1¼′
No. 2 arranged to take from ⅝″ to 2″
No. 3 arranged to take from 1½″ to 3″

THE CHUCK COMPLETE, AND OTHER ATTACHMENTS.

HOIST FOR FURNACE DOORS

Every interesting hydraulic system for raising and lowering heavy doors such as are used on open hearth and heating furnace work has been perfected by the Link-Belt Co. of Chicago, Ill. As this news is of particular interest to those using furnaces with heavy doors, we give, in the following article, a description of the arrangement.

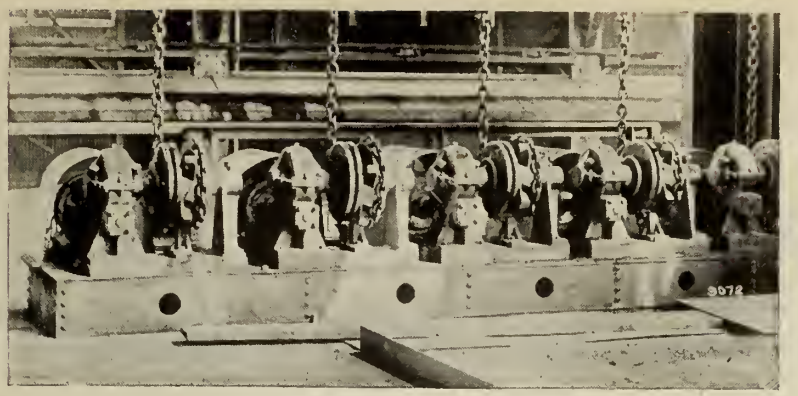
The method has been made foolproof, and, as has been demonstrated, doors thus operated always go up to the proper position and always go down to the proper position, no matter what the weight.

The first installation of this system, made at the plant of the Alan Wood, Iron, and Steel Company, Conshohocken, Pa., has been in continuous operation for fourteen months without repairs, attention, or maintenance expense whatever. Five hoists, with an automatic release, are used in this plant.

On each hoist is mounted a pair of chain sheaves attached to a worm wheel shaft between two flanges which are pinned to the shaft and supplied with fibre friction surfaces on the sides toward the sheaves. The worm wheel is driven by worm mounted on the shaft of a reversible motor, the worm and wheel being inclosed in suitable housing.

To raise the furnace door the motor is started in the direction which will pull down on the left-hand chain. As long as the counterweight continues it pull the sheaves squeeze out against the flanges, and are thereby driven in the direction which will wind up the left-hand chain and thus lift the door.

The right-hand sheave has a fixed stop on its periphery, so located that it will come in contact with a stop on the bottom casting when the furnace door has reached its proper height. With the motion of the right-hand sheave arrested by this stop the shaft cannot rotate the left-hand sheave further gecause the squeeze between the sheaves and friction flanges is relieved. Ther is no opportunity, therefore, for overwinding, and if through carelessness the urrent is not shut off promptly, the shaft with its flanges will simply continue to revolve in sliding frictional contact with the sheaves, but without the power to grip and rotate them further.



GENERAL VIEW OF CHAIN SLEEVES.

For lowering the doors the direction of the motor is reversed, and practically the same process repeated, except that in this case the power of the motor is used to lift the counterweight, while the pull from the weight of the door serves to keep the sheaves squeezed apart against the friction flanges until a stop on the left-hand sheave engages with a stop in the bottom casting and prevents over-winding of the counterweight chain in the same manner as described for the other sheave.

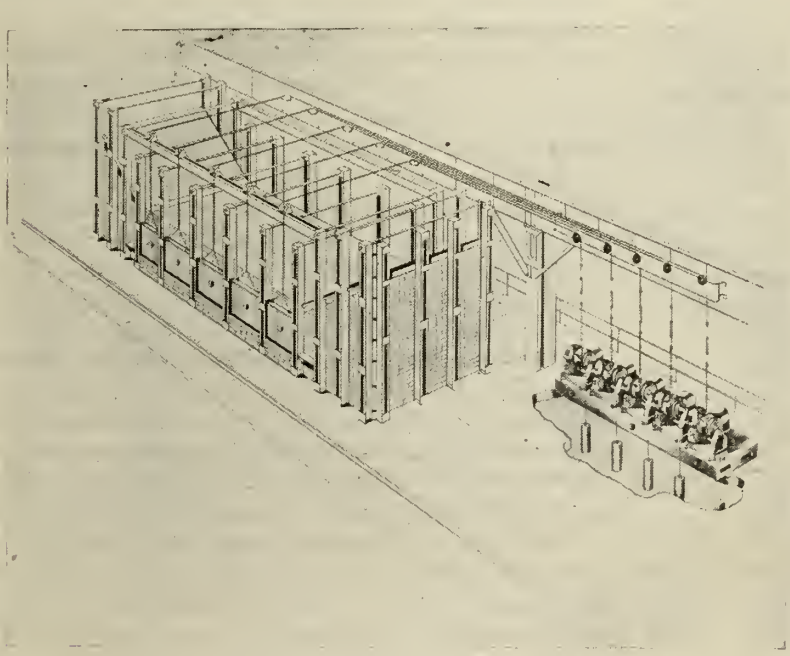
The stop features do away with the automatic electric switch devices which have proved so troublesome for this type of hoist, and they secure an exact stop for all hoists without involving failure from human carelessness or complicated electrical equipment. The motor is started, stopped or reversed, and the door raised or lowered, by simple push button mechanism.

The photograph and diagram shown with this article will further interest any possible user.

NEW THINGS IN MACHINE TOOLS

ROD POINTING MACHINE

The Kent Machine Company, of Kent, Ohio, has just placed a two-spindle pointing machine on the market that is intended for the pointing of bolt or rods up to ¾ inch in diameter. One operator only is required to run the machine, all he has to do is to insert the work in the gripping chucks, the other operations being performed automatically. Cams actuate the spindles so that one is moved forward while the other is drawn back. Guide bushings are provided for different sizes of work. It is claimed that fifty rods per minute can be pointed by this machine.



DIAGRAMMATIC VIEW OF THE FURNACE ARRANGEMENT.

16 FT. STRAIGHT SIDE PRESS

Williams, White and Company, of Moline, Ill., are now manufacturing a straight side press which has a working length of 16 feet between the housings, and capable of exerting a pressure of 300 tons, distributed load. The width of the ram is 16 inches, and it is provided with a pneumatic counter balance operating at a pressure of from 80 to 100 lbs. per sq. in. A 50 h.p. direct current motor is direct connected to the machine, the initial speed of 775 r.p.m. being reduced to a normal ram speed of 25 strokes per min., the length of the stroke being 5 inches. Friction slip is provided in the fly-wheel to protect the machine against jamming of the dies. The machine is fitted with front and rear adjustable clamping strippers. Side housings are of cast steel and other frame members are made of semi-steel.

NUT FACING MACHINE

A new type of nut facing machine has been developed by the Victor Tool Company, of Waynesboro, Pa., that has many interesting features. The nuts are contained in a magazine and are automatically fed onto a hardened threaded mandrel and against an equalizing collar. When the nut is faced, the backing off of the head operates the friction clutch that reverses the spindle, and fingers on a yoke hold the nut while being unscrewed from the mandrel. The machine has an approximate capacity of twenty ¾-inch nuts per min.

GANG SLITTING AND LEVELLING SHEARS

The Yoder Company, of Cleveland, Ohio, has recently placed on the market a specially designed slitting shear that removes any irregularities in the strip after it has been cut, the long guides and the levelling rolls assuring a perfectly flat piece of metal, free from burrs left by the slitting shear. After being cut the metal strips pass through a set of seven rolls that entirely eliminate any tendency to warp or twist. On metal up to ⅛ inch in thickness, strips as narrow as 2¾ inches may be cut. The machines are made in various sizes to accommodate different widths and thickness of material.

OIL FILTERING CABINET

The Wayne Oil Tank and Pump Company, of Fort Wayne, Ind., has recently placed on the market a new oil filtering cabinet, which is intended to be placed under the machine from which the oil is flowing. The oil, after entering the cabinet, passes through a fine wire screen and is heated to a temperature of about 180 degrees Fahr., and is then delivered to a precipitating chamber where all the grit and sediment is deposited. After passing through cloth filters, the oil is delivered to the storage tanks.

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British Steel Tonnage

THE way in which Great Britain is coming back into the iron and steel markets of the world is a matter of surprise. There have been all sorts of obstacles thrown in the way. There have been strikes of all sorts, lock-outs and transportation troubles, but against all this there has been steady and determined progress, until now her production is greater than the record-breaking months of 1918.

For the first five months of this year the British steel output has been at a greater yearly rate than the total for any calendar year, or at a rate of 9,672,000 tons as against 9,591,000 in 1918 when the pressure of war necessity was driving production figures to new levels.

Before the war Britain's production of iron was greater than that of steel, but now the figures have been reversed.

A fairly large tonnage of British high speed steel is again going into the American market, from which the British makers had to withdraw during the war.

Britain's recovery is well shown in the steel tonnage records she is hanging up through all her troublesome days.

He Urges Use of Caution

CHARLES PIEZ, Presient of the Link-Bedt Co., on behalf of the Illinois Manufacturers' Association, asks the U. S. Railroad Labor Board to go carefully in adjusting new wage awards. He bases his argument on four points:

First: The practice of basing wages on the cost of living, without taking into account the work performed for the wages, is, in our opinion, at the very bottom of the present disturbed and unsatisfactory labor condition. It is usual now in presenting claims for wage advances, to attach an estimated family budget, upon which the percentage of wage increase is predicated. Unfortunately this family budget is presented only to further the claims of a particular body, but we believe it to be the duty of your Board to consider where a universal application of the budget presented in the railroad case would lead.

Second: The divorce of wages from production has been one of the calamities of the war, for it has created in the mind of the wage earner the delusion that irrespective of output, performance, or character of service rendered, he is entitled to live on a certain scale. Statisticians spend their time in developing elaborated lists of family requirements, instead of determining how wage increases based on these requirements can be paid.

Third: The industries have for the past eighteen months been adjusting their wage scales to meet the changed conditions. We think your honorable body should be guided in the final determination of wages to be paid, by the rates obtaining in similar crafts in the industries.

Fourth: The advances in cost of living have affected most adversely the lowest paid wage earners, and the increases in the wages paid unskilled labor have, therefore, been largest.

The Merger Goes On

IT would appear now that the opposition to the formation of the British Empire Steel Merger had been overcome at least for some time. This opposition was being directed chiefly by the late president of the Dominion Steel Corporation, and he was supported by several of the directors of the corporation. The objections held by these gentlemen were not against the merger itself, but against the inclusion of some of the smaller companies which it is proposed to include. At the annual meeting recently these directors all spoke, and demanded more information, claiming they were safeguarding the interests of the shareholders. However, the result of the meeting was the election of a new board of directors, which did not include any of those protesting. It was stated by Col. Grant W. Morden that ample opportunity would be given shareholders to approve or disapprove the amalgamation at a later date.

The formation of this great combination of interests holds such possibilities for our future trade, that given sound financing, its success is assured. Where steelmakers are combined and shipowners have to buy from them, it makes for high prices of steel and ships. If, however, steelmakers and shipbuilders are both actuated by the same interests, it makes for cheaper ships. That is only one aspect of the case. The most promising thing is that with the capital that would be made available the natural resources of the coal and iron districts of Nova Scotia would be developed in a manner that has not yet been approached. We are not among those who see nothing but evil in mergers or trusts, but on the contrary, believe that the solution of the high prices of commodities will be found in the reduction of production costs, made possible by combinations of capital and management. In the engineering field, the most efficient use of the various types of works is made possible by this means, and it is a significant fact that most of the leading engineering firms in Great Britain are now amalgamated, as the result of the conditions prevailing since the armistice.

SEVERAL CHANGES IN THE FAIRBANKS-MORSE CO.

Mr. G. J. Brittain Becomes Vice-President and Sales Manager of The Company—Other Announcements

Mr. G. J. Brittain, formerly managing-director of the Winnipeg, Calgary and Saskatoon Branches of the Canadian Fairbanks-Morse Co., Limited, has been appointed vice-president and general sales manager of that organization, with headquarters in Montreal. Mr. Brittain succeeds Mr. C. Graham Drinkwater, who has been vice-president in charge of sales for many years, and who has resigned to join the banking firm of Aldred & Company, Limited.

G. J. BRITTAIN

Mr. Brittain brings to his new post a wide experience of many years and a splendid record of achievement. He was one of the first salesmen engaged by the Canadian Fairbanks-Morse Co., Limited, in the early days of the Company and he has made good in every position to which he has been appointed. He has the entire confidence and hearty support of all those who know him, both in the organization and as customers.

Mr. Kenneth Forbes, who has been manager of the St. John, N.B., Branch, goes to Winnipeg to assume charge of that Branch, together with that of the Regina Branch, which is under construction at the present.

Mr. Forbes is succeeded at St. John, N.B., by Mr. W. J. Hill. Other changes in the management of the Sales Department—all of which represent well-earned promotion and increased opportunity to assume greater responsibilities—are the appointments of Mr. Malcolm Cordell to be Montreal manager, and Mr. George L. Nies and Mr. Archibald Turnbull, who will become manager of the Calgary and Saskatoon Branches, respectively, taking up a portion of the duties which formerly came under the direction of Mr. Brittain.

A FIRE broke out under the decks of a vessel at New York harbor, and at the time it looked as though a number of men would be roasted like rats in a trap. They were at the front of the vessel in a place where they could not be reached by the firemen.

Fortunately they were engaged with a welding and cutting outfit and of this they made such good use that they were able to cut a hole big enough in the ship plate to allow the imprisoned ones to get out.

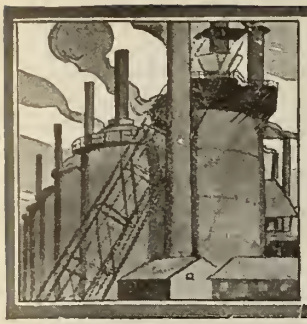
Science and industry are constantly adding something worth while to the world's sum total of things that count. Welding and cutting devices have never been recommended or advertised as part and parcel of life saving equipment, but here is a case and here is the evidence.

Artificial Feeding

IT would seem that the new United States merchant marine, having been brought into life very hurriedly, now requires some more than ordinary stimulus to keep it living. The Jones Act, which has recently passed, provides for the abrogation of all treaties which prevent discriminatory duties being imposed on foreign ships, and also prevents United States goods being carried from a U. S. port to another U. S. port via a foreign port in any but a vessel flying the U. S. flag. This would appear to be aimed particularly at the trade which has developed between U. S. ports and Alaska over Canadian railways and by Canadian steamers. The whole measure seems to be a tacit confession that, left to itself, the U. S. merchant marine cannot survive, and that to ensure its prosperity open competition must be eliminated. Whether the course pursued is a wise one is open to doubt. It is not to be supposed that other nations will sit quietly by and see their ships practically barred from United States ports, and still allow vessels of that nation to come and go freely where they list. If a policy of retaliation should be adopted by the maritime nations who are the chief competitors of the United States, it is conceivable that the Jones Act could become a very efficient boomerang. The new merchant marine of our neighbors can become a successful trading fleet only if it can join in world trade, and it would be a comparatively easy matter to effectually bar it from a large portion of the world's ports, to say nothing of coaling and oil fueling stations. It is to be hoped that the formal representations that will doubtless be made by the interested nations to the U. S. Government will result in a modification of the new act, and that a commercial war with all its dangers may be avoided.

A mid-West banker writing to the Financial Post, June 14, says: "Just at the present time agricultural conditions throughout the West are most favorable. We have had some splendid rains, and the weather of late has been such as to bring the grain along at a very fast pace. I think, generally speaking, it is not more than a week behind normal progress, and bids fair to make this up quickly. If this Western country should harvest the present prospective crop there would be plenty of money available this fall to purchase goods made in Eastern Canada."

It might be a good idea at that.



MARKET DEVELOPMENTS

Shipments Still Coming in Very Slowly

Warehouses Handling Premium Shipments Kept Busy Getting From Under Their Obligations—Talk of Another Strike in the Steel Mills of United States, to Start on First of July.

SOME shipments of material have arrived from the steel mills during the past few days, but a good deal of it is coming from the premium operators, and it is taking more money to handle this trade than some of the dealers care to risk. They have to pay a high price in the first place, and so are anxious that the material shall move out quickly when it arrives here. There have been cases where orders at premium prices have been cancelled in transit, the warehouses on this side fearing that the trade would not stay with them in paying prices high enough to let the mout of the obligation they had undertaken. A fair tonnage of black sheets has arrived in Toronto under these conditions, but so far they have been sold out as quickly as the cars are placed. There is the element of risk in the business, but very often premium material is the only kind available.

During the war many makers of tools cut down to two or three much-wanted lines, and by so doing were able to turn out great quantities of these. Now that the demand is more general, there is a tendency on the part of some of them to broaden the field of operation again.

The British steelmakers are coming into the market again. Reports have it that a good tonnage of high speed has been placed in Boston and disposed of. The figures for the first five months of the year show that British mills have turned out more steel than at any previous time, even breaking the records of 1918, when the war was driving production figures to high levels.

Considerable confusion still exists, especially in steel warehouses as to the interpretations of various taxes on imports and sales.

Boiler tubes are much wanted and correspondingly scarce. In some of the large yards it has been two months since a shipment was received, and in ordinary times they would be coming in every week or oftener. Repair work as well as contracts are being held up right in the season when it is usually busiest.

Some material is coming from Canadian bar mills. The trouble is that such a tonnage is booked against the output that it is impossible to satisfy the trade. When flats are being rolled the dealers are busy drawing the attention of the mills to the fact that rounds are urgently needed.

PRODUCTION INCREASES BUT ROADS CAN NOT HANDLE IT QUICKLY YET

Special to CANADIAN MACHINERY.

PITTSBURGH, June 24.—Production of both pig iron and steel has increased a trifle and the rate is now nearly, if not quite up to the rate in March, the best rate attained since October, 1918.

Steel shipments have increased but little, and are still hardly equal to production, though the additions to the large amount of steel accumulated are now small. In occasional instances mills are probably shipping somewhat more steel than they make. Early last week car supplies at some of the plants suddenly dropped off, the explanation offered being that this was due to the establishment of the railroad pools in lake coal and lake ore, under instructions by the Interstate Commerce Commission. A desperate situation had arisen as to lake coal, the Northwest being faced with a fuel famine next winter. The extra car shortage proved to be only temporary. Shipments of tin plate have been excellent, far in excess of the production.

The pig iron and steel markets are very quiet all along the line. There is business being placed, but it is only of routine character, the market being absolutely devoid of snap. Customers of the Steel Corporation are buying freely in so far as the corporation is willing to accept their contracts, and evidently have entire faith in the stability of the Corporation's prices, which are all in accordance with the Industrial Board schedule effective March 21, 1919. The Corporation has given another evidence of its disposition to hold prices down in having allotted some pig iron tonnages to regular customers in the Chicago district at $36 when the independent market is $43, this being in line with its policy on Birmingham iron, which the Corporation has not sold at above $38, the independent market being $42.

Regular customers of independents are limiting their purchases to absolutely known requirements in the case of independents that have particularly high prices, while in the case of independents that are only $10 to $20 above the Corporation prices it is the producer that limits the amount of business placed.

Contracting for Connellsville furnace coke for the second half of the year presents very difficult problems for both producers and consumers. The producers see a present coal market in the Pittsburgh district ranging between $8 and $10 per net ton at mines, and at $9 the market value merely of the ton and a half of coal required to make a ton of coke would be $13.50, while the cost of making coke would be say $1.50, making $15 for coke, to get back the coal value. Coal may be worth much less during the second half of the year, but no one can prove that it will be. To ask $15 for coke would mean that no sales would be precedents the conditions that would be paid might mean a big loss, compared with what might be obtained for the coal.

The furnaceman, on the other hand, does not know whether pig iron is going to advance or decline, but seriously fears that it is going to decline. Some operators have offered "ratio" contracts at 4 to 1 on basic pig iron, which would mean $10.87½ for coke when basic pig iron is $43.50, valley, as at present. If pig iron went to $32 the coke would cost $8 on such a ratio contract, but according to precedents the conditions that would make $32 pig iron would also make coke

in the open market worth much less than $8, and thus the furnaceman is puzzled, just as is the case with the coke operator.

Contracts involving about 25,000 tons of coke a month have been closed on the 4 to 1 ratio basis, also contracts for a considerable tonnage at flat prices between $10 and $12. Some operators and furnacemen are indisposed to contract at all, and may get together on the basis of a monthly or weekly adjustment of price during the half year.

PREMIUM LINES TO MOVE OUT QUICKLY

Dealers Prefer to Get High-Priced Materials Off of Their Hands as Soon as Possible

TORONTO.—Warehouses are the busiest places in the steel or machinery market just now. They are busy because they want to keep themselves sold out and they are not finding it very hard yet. Much of the material they are taking in is coming at a pretty fair premium, and in order to keep well inside the safety margin they must hustle and get this stuff out.

In other lines there is an apparent dullness, and this is quite true of the machine tool business for the past week or so. The volume of business is smaller.

During the war there were tendencies developed that have been adhered to so far by machine tool builders, but there is now a willingness on the part of some of them to depart from these ideas. One of the dealers pointed this out to Canadian Machinery to-day. "When the war was on there was a call," he stated, "for certain lines of machinery for the making of shells. This work was taken on by some shops, and they found that by devoting all their time to one or two lines they could get much better production returns, as they were able to work on a quantity basis instead of building each machine or set of machines. They decided that if this were good practice for their shops during the period of the war it was good practice for their shops when the war was over, and they were again operating on peace-time lines. This has been going along very nicely until they find that there is a limit to the market for these special machines. They see other businesses going by now because they are not in shape to go out and take it over. I find there is quite a change coming over some of the firms with whom we do business. A little while ago they would not consider making a proposition on certain lines and sizes, but now there is quite a change in attitude on their part, and I believe that this movement will continue."

Several Canadian dealers have been in Atlantic City during the past few days attending the big railway convention there, where there was a good exhibit of machine tools especially designed for that class of work. As far as can be gathered the feeling seems to be that the railroads of United States are counted upon to do quite a bit of buying in the Canadian roads are also out with a small list now, calling for some equipment for the Western shops, including both metal-working and wood-working machinery.

POINTS IN WEEK'S MARKETING NOTES

There is talk of another steel strike in the U. S. steel mills starting on July 1.

Britain's output of steel for the first five months of the year shows an increase over any existing record.

Black sheets, 14 and 16 gauge, have been selling as high as 12½ cents per pound.

Boiler tubes are not arriving and they are much needed in many plants.

National Railways are out with a small list of tools—wood and metal working, for the Western shops.

Machine tool trade in this district remains quiet, and large orders are not being placed.

Indications point to a stiffening in the price of Old Country high-speed tools.

Pig iron is being sold in Toronto at $53.80 per ton.

Those Tax Proposals

Many dealers are appealing to customs brokers and to the collectors here for rulings on certain cases as they come up from day to day. Some of the rulings that have been given are not definite enough to enable the collectors to give answers that are definite enough.

One of these sections that affects the sale of machine tools is as follows: 8. (a) "That in addition to the present duty of excise and customs, a tax of one per cent. shall be imposed, levied and collected on sales and deliveries by manufacturers, wholesalers or jobbers, and on the duty-paid value of importations; than in respect of sales by manufacturers to retailers or consumers, or on importations by retailers or consumers, the tax payable shall be two per cent."

One firm handling among other things small tools, claims that the Government was not intending to protect the jobber, but was simply after the revenue that might go slipping through here by the jobber losing the business that would come to him without the tax being on. The consumer might try and evade the jobbers' tax by buying direct from the maker. The Government, in order to make sure of this, has put on the two per cent. here. There is one point that does not seem certain. Some dealers are charging the buyer with the one per cent. sales tax, while others, especially on small tools, are absorbing it and decreasing their profits to that extent.

Several large shipments of English small tools have arrived during the week and these are being placed on the market. The price seems to be a little lower than that quoted by most of the Canadian firms, but according to some of the Old Country makers they are looking for a stiffening in price of the Old Country high-speed lines. One of the firms representing Old Country lines stated that the British firms were in shape to recover the high-speed steel market in the United States which they lost during the war. As proof of this they called attention to the large order that was placed and shipped to Boston recently of British high-speed steel.

Canadian makers of small tools, it is understood, have notified some of those who have been receiving preferred prices that this practice will be continued. This refers to manufacturers or large buyers who have heretofore been able to buy from the dealer at just as good a figure and under just as good or better chances of quick delivery as from the jobber.

Several of the Canadian makers considered these matters last week, but there was nothing drastic in their programme at Montreal.

Reporting Better Deliveries

Black sheets, especially 14 and 16, have been much wanted and are hard to secure. A good shipment of these came in during the week, and were sold quickly at a price fairly well above what might be considered an ordinary market quotation. The warehouse bringing them in had a top price to take care of.

"This business of handling a fairly large tonnage of premium material when deliveries are slow is not a pleasant task," was the way one warehouseman sized it up. "We know that when we take on the tonnage we are taking with it a risk, but we also know that there are firms all over Canada that will be glad to pay if they can get the material they want. We are always glad when these decidedly peak premiums are cleared out of stock, for we could not be caught with many of such shipments and keep on the right side of the books." There is a tendency on the part of some of the importers to drop premium bookings, and cancellations are more frequent now on short notice than they have been for some months.

Neither have the warehouses become altogether accustomed to the manner of placing and allotting the new taxes. For instance, one firm wanted tubes for a certain boiler, which would come bent. It was not known whether this would be considered a manufactured article and come under a different rating to ordinary boiler tubes. The local collector advised asking Ottawa for a ruling, and Ottawa replied to the wire telling the buyer here to get in touch with the local collector.

Movement of ordinary, standard size boiler tubes is very slow. Some of the dealers state that they have not had a tube in two months, whereas in ordinary times they would be getting in from one to two cars a week.

Bar iron is coming along in fair quantities, one of the Canadian mills at least being able to give fairly good shipment. It seems impossible to please both users of flats and users of rounds. There is, as far as reinforcing rounds are concerned, a definite season when these are in demand and after that has passed they are a dead line.

Pig iron is selling at $53.80 for 2.25 to 2.75 per cent. silicon.

FOUNDRY ACTIVITY IS GIVING SOME RELIEF IN MONTREAL FIELD

Special to CANADIAN MACHINERY.

MONTREAL, June 24.—Definite signs of industrial improvement are slow in coming but indications are beginning to point to a gradual betterment in many directions. The resumption of foundry activities in this district has given relief to many manufacturers, as threatened scarcity was beginning to affect the operations of plants getting outside castings. The modification of the tax budget may have something to do with the optimistic feeling, as manufacturers are better pleased with the changes that have been effected. There appears to be a slight break in railroad congestion, and this is more favorable to the consuming trade, and this condition will do much to infuse confidence into general industrial enterprise. The steel situation is still suffering from unbalanced supply and demand, but even here the outlook is encouraging. Old material movement is comparatively quiet, being a reflection of industrial curtailment, resulting from irregular producing supplies.

Hopeful of Early Improvement

Apart from the encouraging reports of increased steel output from the producing mills, the general situation remains unchanged. Deliveries are still irregular, as transportation facilities are inadequate to meet the requirements of the trade. Present conditions will prevail until railroad congestion is relieved and the freight now in transit has reached its destination, thus releasing many cars that are now tied up. The disorganization of railroad operation, during the strike and since, has meant the employment of many new men and reasonable time must elapse before normal operations can be resumed. Despite the rumors that have been heard of, large quantities of steel being held in reserve at some of the mills, visits by Canadian dealers fail to disclose any stocks of abnormal magnitude. It is true that some yards in the States have large supplies in the yards, but the bulk of this is awaiting shipment to previous purchasers, whose orders have been on the books for months. Existing conditions cannot prevent the accumulation of material at producing points and is not improbable that freer shipments will result in an easier market. Such a change would not only aid in the removal of finished product but would allow much needed raw materials to pass to the mills, and, in consequence, permit increased activity in the way of production. Some dealers here have been able to satisfy customers in the way of sheets and tubes, as incoming supply has been slightly improved, but the demand is still such as to prevent other than temporary warehouse stocks.

Uncertain Delivery Affects Trade

Machine tool activity is still gauged by the period of time that must elapse between the placing of the order and the receipt of the equipment. This factor of shipping is still so very uncertain that buying of tools is still deferred awaiting more definite assurance of delivery. In some cases dealers state that surprises have been given to customers in the way of prompt shipment, but when asked for an explanation the dealer himself is unable to give one, and could give no further reason than that it was due to the prevailing uncertainty. Dealers have reports of shipments that have been on the way for from six to eight weeks, and others where equipment has come through in a few days, even before the invoice. English goods are coming in regularly, and while delivery dates are never definite, the receipt of material from this source is invariably more certain than from the States. Large machine tool orders are seldom placed now, but small lots, widely distributed, retain the interest of the trade. Used equipment is still in demand but the week's sales have been lighter. Supplies are in good demand but affected by uncertain shipments.

Quiet Week in Scrap

Improvement in scrap activity is almost entirely confined to the slightly better demand for foundry scrap. This is probably due to the resumption of work in local shops following a brief period of idleness. The restricted activity in many lines, as a result of indefeinite and delayed deliveries of madefinite and delayed deliveries of materials and dealers report a quiet week with little prospect of early betterment. A slightly increased demand has been noted on scrap zinc and brass, but only of a temporary character. While dealers are not forcing a decline it is believed that the market is generally weaker The needs of the trade, apparently, are as insistent as ever, but owing to the prevailing uncertainty regarding deliveries many plants are forced to curtail production. Dealers state that normal conditions will probably be revived when the railroad situation becomes stabilized. Price quotations are unchanged but with a weak undertone.

MONTREAL NOTES

McLean Kennedy, Ltd., as agents for the Houston Line, announce the inauguration of a new steamship service between Montreal and the Far East. This service will commence with the sailing of the Clan Campbell about the middle of July.

The McClary Manufacturing Company have just about completd the four-storey addition to their Montreal factory. This section has been built on the south-east corner of the old building and will provide an additional 20,000 square feet of floor space.

The fortieth annual convention of the American Water Works Association is being held in Montreal this week. Over 800 delegates from all over Canada and the United States are in attendance at the Windsor Hotel, where the business meetings will be held.

An interesting exhibition is being held at the present time at McGill University. This display will represent the treasures of the Redpath Library, which contains many valuable documents and original editions of books and papers dealing with America in its infancy.

J. T. McCall, of Drummond and McCall, has just presented a scholarship to McGill University in honor of his son, James D. McCall, who was drowned in Lake Wayagamack last year. Young Mr. McCall entered McGill in 1911 and graduated in 1915, leaving shortly afterwards for France, where he served with distinction in the Royal Air Force.

The launch of the "Canadian Victor" from the yard of the Canadian Vickers, Ltd., on June 22, is the third that this company has placed in the water this spring. The first two were for Norwegian interests. Five other steel vessels are under construction at the present time, and it is expected that these will all be launched before the fall. Two of these are for Norwegian shipping companies and the remaining three are for the Canadian Government. The total tonnage that this company will construct this year will approximate 70,000 tons.

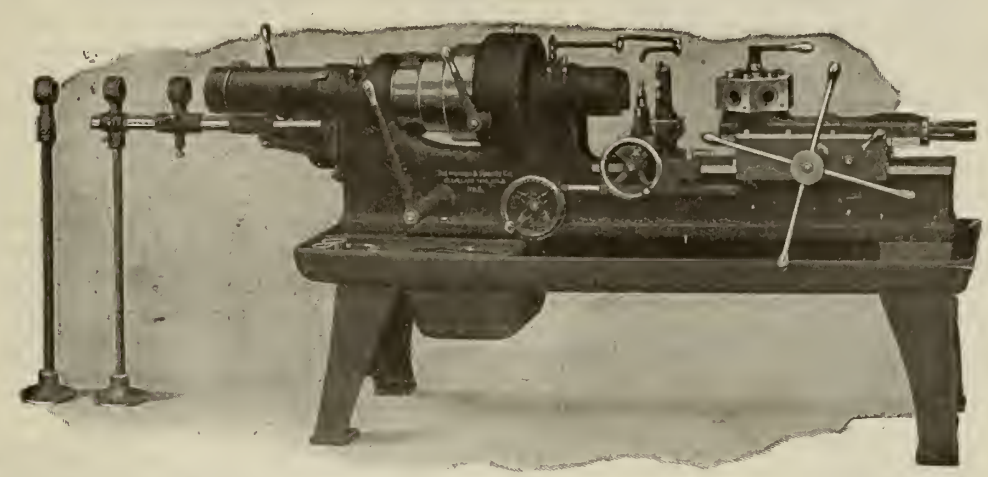
Several new coal discoveries have been made in southern Chile, says "Engineering." One of these, near La Union, is estimated to contain 40,000,000 tons, and a special railway is being built to the Rapalla Station. Another coal deposit has been found in the Department of Castro. The greater part of the coal field is on the beach in the northern part of Castro Bay. The coal from this region is different from that in other parts of Chile, and is not unlike cannel.

The burial took place at St. Catharines, Ont., of Captain John Dewey, a lifelong resident of St. Catharines, and a noted Canadian marine engineer. He died at the home of his daughter, Mrs. Thomas Welch, at Buffalo.

Warner & Swansey Screw Machines

For large output and close limits—If you are figuring on screw machine work you can depend on W. & S. machines being right for the job.

We can supply you from stock immediately.



The A. R. Williams Machinery Company, Limited

ST. JOHN, N.B.
WINNIPEG, VANCOUVER

If It's Machinery—"Write Williams"

64 Front Street West
TORONTO

Gray Iron and Semi Steel Castings of all Descriptions

From 5 lbs. up to 4 tons

Foundry capacity, 15 tons per day.

Difficult castings our specialty.

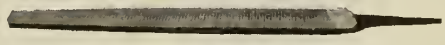
Mixtures regulated by chemical analysis and all castings sandblasted.

Estimates from blue prints submitted promptly.

If desired, we can make patterns to your drawings.

G. W. MacFarlane Engineering, Limited

Paris, Ontario



TO-DAY

is not too early,
or too late,
to start
the use
of

P X H **P.H. or Imperial Files** IMPERIAL

"They cut faster and wear longer."

Be File-Wise

Ingersoll File Company, Limited

John Morrow Screw and Nut Co., Ltd.
Sole Distributors,
Ingersoll, Ontario

INGERSOLL

If interested tear out this page and place with letters to be answered.

Another Steel Strike to Start on July 1?

Pittsburgh Thinks Both Labor Unions Are Striving to Lead Race in Calling Men Out of the Mills—Some Interesting Sidelights on What is Going on in the Pittsburgh District

Special to CANADIAN MACHINERY.

PITTSBURGH, June 24.—At this whiting the extent of the steel strike, July 1, cannot be forecast. The strike may not even include all of the sheet and tin plate mills that have hitherto been union, or it may be considerably more extensive. On account of the break, or partial break, between the Amalgamated Association and the Federation of Labor, with which it has been affiliated, both organizations may attempt a strike July 1. Before the Amalgamated Association broke with the sheet and tin mills at Atlantic City, June 14, the report was that the American Federation of Labor intended to call a steel strike for July 1, and then prosecute the work of organization, which has not gotten far since the last strike played out. The Amalgamated Association does not want the Federation to have anything to do with the iron and steel industry, claiming that by reason of its several decades of existence the Amalgamated Association has a prior right to attempt to control the industry.

How little understanding there is of present circumstances is illustrated by an editorial in the leading iron and steel trade paper of the United States, commending the Amalgamated Association for its wisdom and conservatism in breaking with the American Federation of Labor, interpreting this action as being due to the Amalgamated Association's principles being too lofty to countenance the Federation's desire in the recent iron and steel trade crisis that the Amalgamated Association break its scale agreements and go on strike. The real animus of the Amalgamated Association is to beat the Federation to an iron and steel strike.

The conference on the sheet and tin plate wage scales at Atlantic City was confined almost entirely to discussion of the amendment the Amalgamated Association proposed to the preamble. The association has controlled only the hot mill or tonnage labor, together with the tin house workers, if the sheet and tin plate plants it controlled at all. The preamble has always provided that should the association organize other departments during the scale year, which runs from July 1, scales could be presented, but in event of disagreement the matter should rest until the expiration of the scale year, the men for whom the scale was signed remaining at work meanwhile. The amendment proposed was that work should terminate upon disagreement in such a case at any time after July 31.

This meant, in substance, that the Amalgamated Association could at any time organize the picklers, or the open-hearth steel workers, or any others, and if the demands were not granted they could close the hot mills. With such power the Amalgamated Association up to the limit of its own strength. The plan evidently was to force by steps the could organize any departments it chose, organization of the entire iron and steel industry. Two of the union sheet mills, for instance, have blast furnaces, and thus there would be opportunity to organize the workers at those blast furnaces, the organization of other blast furnaces then being attempted.

Roughly speaking, the Amalgamated Association controls about 40 per cent. of the sheet and tin mills, the 60 per cent. non-union including all the Steel Corporation plants. Whether all the union sheet and tin mills will close July 1, is to be ascertained by waiting to see. According to the present outlook several of the manufacturers intend to make the effort to run. On the other hand, the Amalgamated Association will doubtless try to organize the non-union mills, and it is possible the American Federation of Labor will call a strike for July 1, and also attempt to organize the mills.

Impending labor troubles may help to explain the eagerness of the steel mills at this time to operate as fully as possible, despite the fact that they cannot ship all their current output, and at the same time have large stocks, while the consuming demand can hardly be as large as it was two or three months ago.

WHAT THE FOUNDRY AND MACHINE SHOP BUSINESS AMOUNTED TO IN 1918

The Dominion Bureau of Statistics has recently compiled a review indicating the status in 1918 of foundry and machine shops in Canada. The report covers the operations of 687 individual plants distributed by location in the following order: Ontario, 369; Quebec, 126; Nova Scotia, 23; New Brunswick, 13; Prince Edward Island, 4; Manitoba, 23; Saskatchewan, 25; Alberta, 15; British Columbia, 69.

This is an industry that is not peculiarly adapted to any one locality, but it rather tends to follow the growth of population and as each community develops it provides the opportunity for the enterprising machinist to step in and take care of local needs.

The capital invested in this industry in 1918 was $84,122,446, divided among the provinces as follows: Ontario, $56,880,631; Quebec, $14,276,674; British Columbia, $3,635,563; Manitoba, $2,781,536; New Brunswick, $2,623,056; Nova Scotia, $2,007,191; Alberta, $1,176,932; Saskatchewan, $508,423; Prince Edward Island, $232,440.

These industries distribute in salaries and wages, $28,986,306. They consume fuel to the value of $2,654,145, consisting of coal, coke, gasoline, fuel, oils, gas, natural and artificial.

Miscellaneous expenses, including rent of office, rent of power, insurance, taxes, advertising and travelling expenses, repairs to buildings and machinery amount to $8,553,509. Materials used cost $27,788,059, consisting principally of pig and scrap iron, bar and sheet iron, black and galvanized iron, malleable and wrought iron, castings, sheet plate and tool steels, steel bars, billets and other shapes, brass and bronze castings, tin sheet and pig copper.

The products of these industries reach in value $82,493,897, and take the form of iron, brass and copper castings, stoves of all kinds, furnaces, radiators, machinery, tools, tinware, car wheels, foundry supplies.

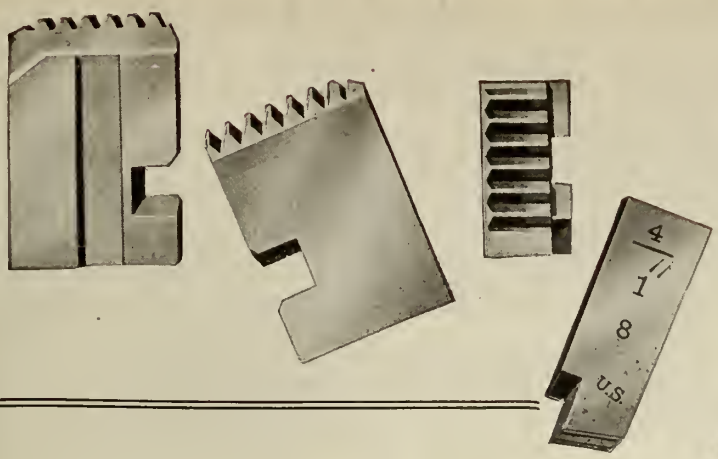
SEES BIG FUTURE FOR THE YARDS HERE

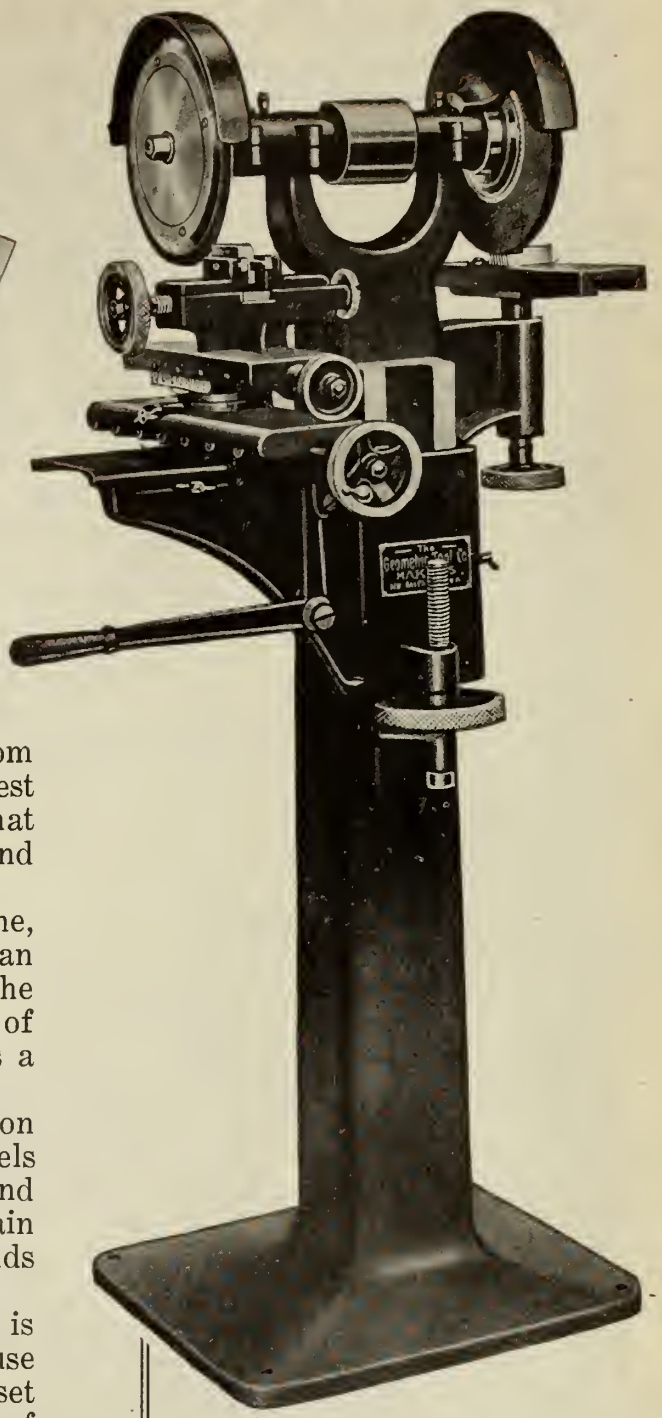
Sir James McKechnie Optimistic on Chances of Shipbuilding in Canada

In the group of gentlemen interested in the proposed merger who were to be seen at the Ritz-Carlton, Montreal, a prominent figure was Sir James McKechnie, K.B.E. Sir James is managing director of Vickers, Limited, at Barrow-in-Furness, England, and is considered one of the foremost engineers and marine architects in the world. To the Gazette representative, he stated:

"I have just returned from an inspection trip of the shipbuilding plants proposed to be absorbed in the British Empiro Steel Corporation. I am surprised at their magnitude, and also at the economical layout of the plants, and I have seen the most modern machinery in these plants that exists anywhere today, and for the first time in my life I am ready to admit that there is a great future for the shipbuilding industry in Canada.

"I have no hesitation in saying that the acquisition of the companies owning these plants is absolutely essential, in my opinion, to the existence of the British Empire Steel Corporation. It will only be following out the same lines as have been adopted by the United tSates Stetel Corporation and our big steel interests in England, where they have control of their shipping and shipbuilding plants."





Sharp Chasers Cut Clean Threads

Accurate, uniform threads result only from dies which are maintained in the highest state of cutting efficiency. This means that chasers must be kept sharp, and ground uniformly.

Even if just touched up from time to time, the chasers respond splendidly, with clean threads. And with this machine — the Geometric Chaser Grinder—the matter of keeping threading tools up to scratch is a comparatively simple matter.

Various makes of chasers can be ground on this adaptable machine. The two wheels permit the easy grinding of both milled and tapped chasers. In addition, the plain wheel lends itself readily to various kinds of tool grinding.

Uniform grinding of a set of chasers is purely a mechanical matter through the use of adjustments which can be accurately set to govern the grinding of an entire set of chasers.

The Catalogue describing this machine is a mine of information on chaser grinding. Write for it.

THE GEOMETRIC TOOL COMPANY

NEW HAVEN CONNECTICUT

Canadian Agents: Williams & Wilson, Ltd., Montreal; The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg, and St. John, N.B.; The Canadian Fairbanks-Morse Co., Ltd., Manitoba, Saskatchewan, Alberta.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$42 40
Lake Superior, charcoal, Chicago	57 00
Standard low phos., Philadelphia	50 00
Bessemer, Pittsburgh	43 00
Basic, Valley furnace	42 90
Toronto price:—	
Silicon, 2.25% to 2.75%	52 00
No. 2 Foundry, 1.75 to 2.25%	50 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 50
Steel bars, base, Toronto	5 50
Iron bars, base, Montreal	5 50
Steel bars, base, Montreal	5 50
Reinforcing bars, base	5 00
Steel hoops	7 00
Norway iron	11 00
Tire steel	5 75
Spring steel	10 00
Band steel, No. 10 gauge and 3-16 in. base	6 00
Chequered floor plate, 3-16 in.	8 40
Chequered floor plate, ¼ in.	8 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	4 00
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 67 to 5 50
Small shapes under 3″	3 62
	C.L. L.C.L.

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points		
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

	Gross. Montreal	Toronto
Lake copper	$25 00	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	66 00	65 00
Spelter	12 00	12 00
Lead	11 50	11 00
Antimony	14 50	14 00
Aluminum	34 00	36 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$ 7 25	$ 7 25
Plates, ¼ up	6 50	6 50

PIPE—WROUGHT

Price List No. 44—April, 1920.

STANDARD BUTTWELD S/C

	Steel Black	Steel Galv.	Gen. Wrot. Iron Black	Gen. Wrot. Iron Galv.
⅛ in.	$6 50	$ 8 50	....	....
¼ in.	5 13	7 26	$ 5 43	$ 7 56
⅜ in.	5 13	7 26	5 43	7 56
½ in.	6 84	8 42	7 27	8 84
¾ in.	8 45	10 58	9 03	11 16
1 in.	12 50	15 64	13 35	16 49
1¼ in.	16 91	21 16	18 06	22 31
1½ in.	20 21	25 30	21 59	26 68
2 in.	27 20	34 04	29 05	35 89
2½ in.	43 00	53 82	....	....
3 in.	56 23	70 38	....	....
3½ in.	71 30	88 32	....	....
4 in.	84 48	104 64	....	....

STANDARD LAPWELD S/C

	Steel Black	Steel Galv.	Gen. Wrot. Iron Black	Gen. Wrot. Iron Galv.
2 in.	$30 90	$37 74	$34 60	$41 44
2½ in.	45 34	56 16	51 19	62 01
3 in.	59 29	73 44	66 94	81 09
3½ in.	73 14	90 16	82 34	99 36
4 in.	86 66	106 82	97 56	117 72
4½ in.	0 98	1 23	1 24	1 49
5 in.	1 15	1 44	1 44	1 73
6½ in.	1 49	1 86	1 87	2 25
7 in.	1 94	2 43	2 42	2 90
8-L in.	2 04	2 55	2 54	3 05
8 in.	2 35	2 94	2 92	3 51
9 in.	2 81	3 52	3 50	4 21
10-L in.	2 61	3 26	3 25	3 90
10 in.	3 36	4 20	4 18	5 03

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4″ and under, 60%.

4½″ and larger, 50%.

4″ and under, running thread, 30%.

Standard couplings, 4-in. and under, 30%.

Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds. Montreal	Toronto
Copper, light	$15 00	$14 00
Copper, crucible	18 00	18 00
Copper, heavy	18 00	18 00
Copper wire	18 00	18 00
No. 1 machine composition	16 00	17 00
New brass cuttings	11 00	11 75
Red brass cuttings	14 00	15 75
Yellow brass turnings	8 50	9 50
Light brass	7 00	7 00
Medium brass	8 00	7 75
Scrap zinc	6 50	6 00
Heavy lead	7 50	7 75
Tea lead	4 50	5 00
Aluminum	19 00	20 00
	Per Ton	Gross
Heavy melting steel	18 00	18 00
Boiler plate	15 50	15 00
Axles (wrought iron)	22 00	20 00
Rails (scrap)	18 00	18 00
Malleable scrap	25 00	25 00
No. 1 machine east iron	32 00	33 00
Pipe, wrought	12 00	12 00
Car wheel	26 00	26 00
Steel axles	22 00	20 00
Mach. shop turnings	11 00	11 00
Stove plate	26 50	25 00
Cast boring	12 00	12 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜-in. and less	10
Carriage bolts, 7-16 and up	Net
Coach and lag screws	25
Stove bolts	55
Wrought washers	45
Elevator bolts	Net
Machine bolts, 7/16 and over	Net
Machine bolts, ⅜-in. and less	15
Blank bolts	Net
Bolt ends	Net
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square, blank	add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 50
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾″ and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	25 and 5
Sq. and hex. hd. cap screws	22½
Rd. and fil. hd. cap screws	plus 17½
Flat but. hd. cap screws	plus 30
Fin. and semi-fin. nuts up to 1-in.	20
Fin. and Semi-fin. nuts, over 1 in., up to 1½-in.	10
Fin. and Semi-fin. nuts over 1½ in., up to 2-in.	Net
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$60 00
Open-hearth billets	60 00
O.H. sheet bars	76 00
Forging billets	56 00-75 00
Wire rods	52 00-70 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 70
Cut nails	5 85
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 35½
British Manila rope	0 28
New Zealand hemp	0 28
Transmission rope, Manila	0 47
Cotton rope, ¼-in. and up	0 88

POLISHED DRILL ROD

Discount off list, Montreal and Toronto ..... net

ATKINS

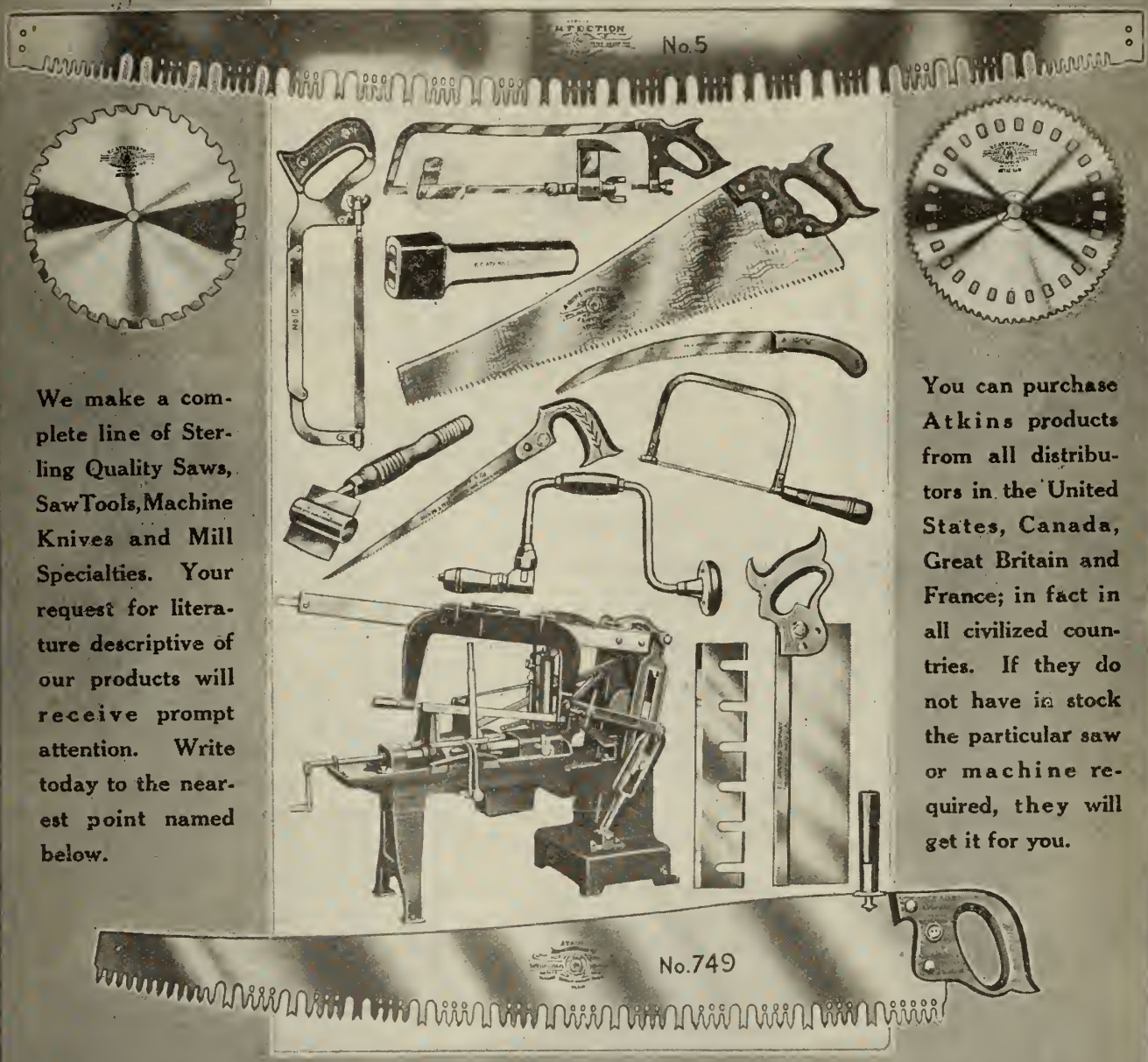
STERLING QUALITY

SAWS and TOOLS

A Perfect Saw for every Purpose

"Finest on Earth"

"Finest on Earth"



We make a complete line of Sterling Quality Saws, SawTools, Machine Knives and Mill Specialties. Your request for literature descriptive of our products will receive prompt attention. Write today to the nearest point named below.

You can purchase Atkins products from all distributors in the United States, Canada, Great Britain and France; in fact in all civilized countries. If they do not have in stock the particular saw or machine required, they will get it for you.

If you have difficulty in obtaining Atkins Saws and other products through your regular service, write

E. C. Atkins & Company

Established 1857

Canadian Factory: HAMILTON, ONTARIO *Branch:* VANCOUVER, B. C.

MISCELLANEOUS

Solder, strictly	$ 0 40
Solder, guaranteed	0 43
Babbitt metals	18 to 70
Soldering coppers, lb.	0 62
Lead wool, per lb.	0 16
Putty, 100-lb. drums	8 30
White lead, pure, cwt.	20 00
Red dry lead, 100-lb. kegs, per cwt.	16 50
Glue, English	0 40
Tarred slater's paper, roll	1 30
Gasoline, per gal., bulk	0 35
Benzine, per gal., bulk	0 35
Pure turp., single bbls., gal.	3 60
Linseed oil, raw, single bbls.	3 00
Linseed oil, boiled, single bbls.	3 03
Sandpaper, B. & A.	List plus 43
Emery cloth	List plus 37½
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin, "D," per lb.	0 14
Borax crystal and granular	0 14
Wood alcohol, per gal.	2 70
Whiting, plain, per 100 lbs.	2 75

CARBON DRILLS AND REAMERS

S.S. drills, wire sizes	32½
Can. carbon cutters, plus	20
Standard drills, all sizes	32½
3-fluted drills, plus	10
Jobbers' and letter sizes	32½
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	net
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	20 to 40
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At warehouse]

Rounds and squares	$7 base
Hexagons and flats	$7.75 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	60	75
Class B	27	37
Class C	18	27

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 8 50	$ 9 50
Sheets, Blue ann., No. 10	8 50	9 00
Canada plates, dull, 52 sheets	8 50	10 00
Can. plates, all bright	8 60	9 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	11 00	....
Fleur-de-Lis, 28 B.W.G.	10 50	....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28.	....	....
Premier, No. 28, U.S.	11 50	10 50
Premier, 10¾-oz.	11 50	10 90
Zinc sheets	16 50	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	29 50
1¾ in.	31 50	30 00
2 in.	35 00	30 00
2¼ in.	35 00	29 00
2½ in.	42 00	37 00
3 in.	50 00	48 00
3¼ in.	.. ..	48 50
3½ in.	63 00	51 50
4 in.	85 00	65 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	24½
Palacine	27½
Machine oil, per gal.	43½
Black oil, per gal.	18½
Cylinder oil, Capital	82
Cylinder oil, Acme	70
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	$2 60
Union thread cutting oil, antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil, bbls., net	13½

BELTING—No 1 OAK TANNED

Extra heavy, single and double	10%
Standard	10%
Cut leather lacing, No. 1	2 75
Leather in side	2 40

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 60
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	09
Pumice, ground	06
Emery glue	30
Tripoli composition	09
Crocus composition	12
Emery composition	10
Rouge, silver	60
Rouge, powder, nickel	45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE

XXX Extra	.24	Atlas	.20
Peerless	.22½	X Empire	.19½
Grand	.22½	Ideal	.19
Superior	.22½	X Press	.17½
X L C R	.21		

Colored

Lion	.17	Popular	.13
Standard	.15	Keen	.11
No. 1	.15		

Wool Packing

Arrow	.35	Anvil	.22
Axle	.28	Anchor	.17

Washed Wipers

Select White	.20	Dark colored	.09
Mixed colored	.10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades... 15%

ANODES

Nickel	.58 to .65
Copper	.38 to .45
Tin	.70 to .70
Zinc	.18 to .18

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6 x 4 base	45 00	44 00

LEAD SHEETS

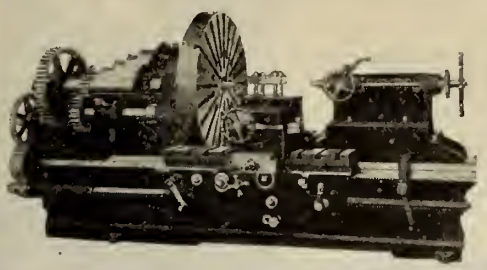
	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 75	$14 50
Sheets, 3½ lbs. sq. ft.	10 50	14 00
Sheets, 4 to 6 lbs. sq. ft.	10 25	13 50

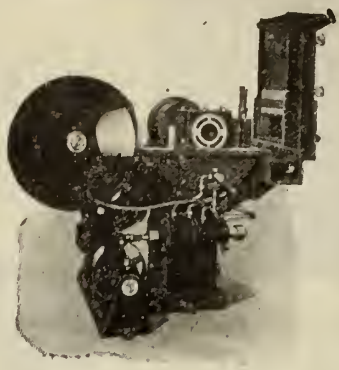
Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

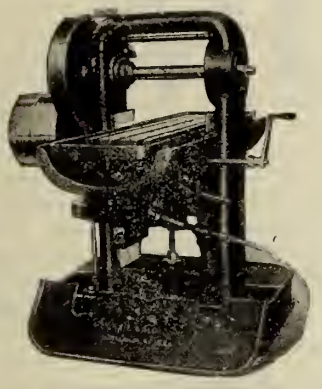
PLATING CHEMICALS

Acid, boracic	$ .23
Acid, hydrochloric	.03¼
Acid, nitric	.10
Acid, sulphuric	.03¼
Ammonia, aqua	.15
Ammonium, carbonate	.20
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.14
Copper, carbonate, annhy.	.41
Copper, sulphate	.16
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.08
Nickel carbonate	.32
Nickel sulphate	.19
Potassium sulphide (substitute)	.42
Silver chloride (per oz.)	1.25
Silver nitrate (per oz.)	1.20
Sodium bisulphate	.11
Sodium carbonate crystals	.06
Sodium cyanide, 127-130%	.38
Sodium hyposulphite per 100 lbs	8.00
Sodium phosphate	.18
Tin chloride	1.00
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated



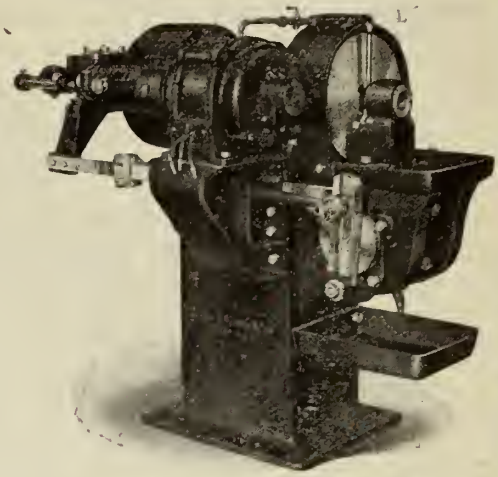


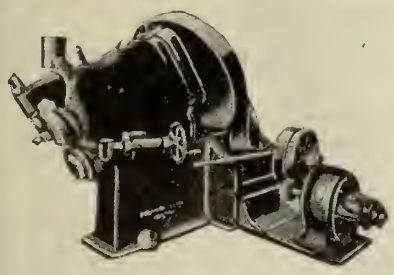


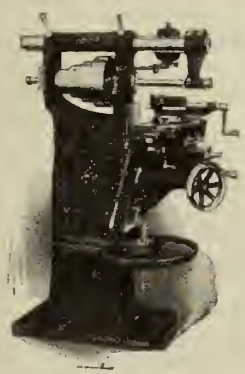
PARTIAL LIST OF MACHINERY IN TORONTO STOCK

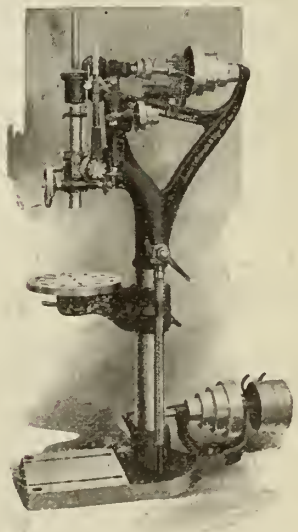
2 7 "A & B" Cataract Precision lathes.
1 18x8 Rae, D.B.G. & Q.C.G., engine lathe.
1 18x8 Milwaukee, D.B.G. & Q.C.F., engine lathe.
1 24x10 Milwaukee, D.G.B., Q.C.F., engine lathe.
1 36x18 Putnam engine lathe.
1 20x38x12 C.M.C., Gap engine lathe.
1 16" Edlund H.S. drill.
1 20" Barnes drill press.
2 20" Champion drill press.
1 No. 314 Baker, 3" capacity.
3 4-spindle Woodward H.S. drills.
1 16" Queen City shaper.
1 24" McGregor and Gourlay shaper.
1 24" Steptoe single pulley drive shaper.
1 30x36x12 London planer.
1 8x36 Fitchburg Plain Cylindrical grinder.
1 No. 3 Ryerson Owen Universal miller.
2 No. 3 Ford Smith plain miller.
4 Briggs Millers, 20 to 42" traverse.
1 Ryerson No. 3 Rotary Bevel Shear 1" capacity.
Cleveland, National, Acme & Brown & Sharpe Automatic and other machines for all purposes.

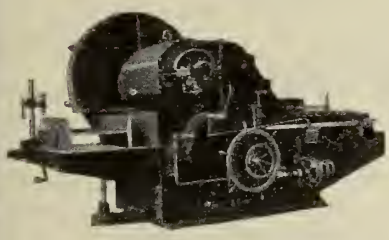
May we have your enquiries?

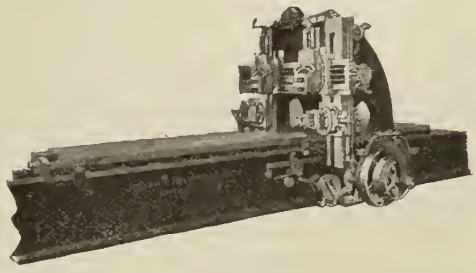












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INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS PERSONAL AND TRADE NOTES

TRADE GOSSIP

Meeting in Woodstock.—The stationary engineers of the province are holding their annual convention in Woodstock. Upwards of 500 delegates from all parts of Ontario and outside points attended. The big exhibit of power machinery and accessories opened in the market building on Wednesday. The delegates are to be the guests of the local motor club.

Strikers Return.—The machinists of the steel plant of the Dominion Steel Corporation, after a strike of two months' duration, have returned to work. The men are to get 68 cents an hour for a 10-hour day, time and a half for Saturday work, and double time for Sundays and overtime. They will only work 5 12-hour night shifts each week instead of 7 12-hour night shifts as at present. The settlement of the strike is a matter of relief to the entire community.

Gonzaba Launched.—An ocean-going steel cargo freighter, SS. Gonzaba, designed to carry 2,550 tons deadweight, was launched on Saturday at the Bathurst Street wharf by the Dominion Shipbuilding & Repair Co. The ship's principal dimensions are: Length over all, 261 feet; molded breadth, 39 ft. 6 in.; depth molded, 19 ft. 4 in. It is classed at Lloyd's 100 A1, and is equipped with triple expansion reciprocating engines, 950 horsepower, two Scotch marine boilers of 180 lbs. pressure.

HAMILTON MEN ARE PLANNING A TRIP

Manufacturers Will Go West With a Special "Made-in-Hamilton" Train Exhibit

At a meeting of the board of directors of the Hamilton Chamber of Commerce, C. W. Kirkpatrick, industrial commissioner, explained to the board a plan for a tour through the Western Provinces for a number of Hamilton manufacturers by special train which would carry with it an exhibit of Made-in-Hamilton goods. It was considered that a trip of this kind would be an excellent advertisement for Hamilton and would do a great deal to promote harmonious relations between the manufacturers and business men of the East and West. The board of directors heartily endorsed this plan, and will appoint a committee to take the matter up.

WHAT CANADA GETS FROM THE STATES

Figures Show What This Market is Worth For Machinery, Iron and Tin

Washington.—England is still the chief purchaser of American metal working machinery. Out of a total exportation of these machines of $3,613,-721, in April, 1920, $1,027,559 went to England. France was second with $780,-136; Canada third with $473,504, and Japan fourth with $358,241.

In our exportation of tin plate, terne plate and taggers' tin, Japan led all of our customers. Her receipts during April, 1920, were 18,635,111 lb., valued at $1,453,943, out of a total export of these commodities of 51,650,920 lb., worth $3,892,017. Canada was next with 9,113,504 lb., worth $653,789, and Brazil third, with 5,736,566 lb., worth $424,551. Then came China with 2,807,419 lb. at $218,938, and England fifth, with 2,085,-994 lb., at $184,545.

Belleville's Growth.—C. I. White, in his report to the Belleville City Council on the first year's work of the Industrial Commission, points out that seven industries have been secured for Belleville in that period: The Elliott Machinery Co., the Judge Jones Milling Co., the H. A. Wood Manufacturing Co., the Natural Tread Shoe Co., the Toronto Hat Manufacturing Co., the A. S. Richardson Co., and the Wood Harvesting Machine Co.

To Build Plant.—Plans for a $75,000 plant which the Dominion Oxygen Company, Ltd., proposes to erect on Erin Street, Winnipeg, were approved by the civic works committee. The company proposes to manufacture oxygen for welding purposes by taking it from the air. The gas container will be of about 50,000 cubic feet capacity, and the plant will be equipped with all safety appliances, it was stated. S. J. Rothwell and G. L. Lennox, solicitors for the company, appeared in support of the application for a permit to go ahead with construction.

To Aid Shipbuilders.—A resolution designed to assist shipbuilding yards in carrying out their contracts for vessels over 3,000 tons, has been placed on the order paper of the Commons in the name of Sir Henry Drayton, Minister of Finance. The resolution provides that the Minister of Finance may be authorized by the Governor-in-Council to endorse promissory notes drawn by the purchaser in favor of the shipbuilder for fifty per cent. of the purchase price where the remaining half of the cost has been provided for. The vessels will be mortgaged to His Majesty for the full amounts of the notes so endorsed and fully insured, and the vessels shall be registered in Canada and the register shall not be transferred until the mortgage has been cleared off.

DEVELOP THE STEEL INDUSTRY

Death of K. W. Blackwell at Montreal—Vice-President of Canadian Steel Foundries

The death occurred at his residence, 103 Crescent Street, Montreal, after a brief illness, of Mr. Kenneth William Blackwell, vice-president of the Canadian Steel Foundries, Limited.

Mr. Blackwell, son of the late Thomas E. Blackwell, was born in Devizes, Wiltshire, England, nearly seventy years ago, and came to Canada when a youth with his father, who was the first general manager of the Grand Trunk Railway. He was educated at Bishop's College School, Lennoxville, and was apprenticed as a mechanical engineer in the G. T. R. shops, Point St. Charles. He was later appointed mechanical superintendent of the G. T. R. for the division between Montreal and Toronto, with headquarters at Belleville. Subsequently he became mechanical superintendent of the Chicago and Grand Trunk Railway, and later joined the C. P. R. as mechanical superintendent.

In 1882 he went into the manufacturing business under the name of K. W. Blackwell, manufacturing railway car springs, etc. This business later became a joint stock company of which Mr. Blackwell was president, the firm subsequently becoming Montreal Steel Works, Limited, of which Mr. Blackwell was president and managing director. The company was absorbed by the Canadian Car and Foundry Company under the name of Canadian Steel Foundries, Limited, Mr. Blackwell being vice-president up till the time of his death.

When we work hard with our body all day our backs ache and our muscles ache. This is all right, for nature has given us sweet refreshing slumber to drive away the aches and pains so that on the morrow we are ready for the fray.

It's better to wear out than to rust out.

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FORGED drills are built on scientific principles with a view to MAXIMUM PRODUCTION. They are made from hammered bars of high speed steel (not less than 18% tungsten content).

The drills are forged at plant No. 3 and are hot TWISTED (the grain of the steel runs with the twist). They withstand the torsional strain under most exacting duty and give more holes with less re-grinding.

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Throw out the germ-laden Drinking Cup
Give your men a clean drink

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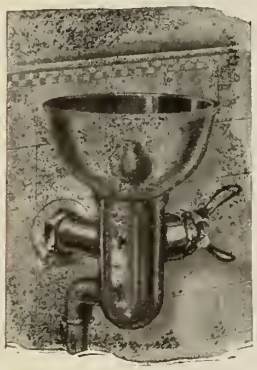

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Machine Tools
FOR SHIPBUILDERS & IRON & STEEL WORKS
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CARBON IN STEELS

Continued from page 593

edges are cold. The edges are then quickly rubbed with an old file or a piece of firebrick or emery cloth tacked upon a block of wood. This is done so that the color can be easily seen—the color travelling down toward the shank or point. When the desired color reaches the cutting edge, the tool is plunged into cold water and the job is done. Appended is a list of tempering colors, each one representing a lower degree of hardness than the one preceding it.

List of Tempering Colors Used by Blacksmith

Straw color is the hardest. Brown the next. Now comes light purple, dark purple, deep blue and pale blue.

Straw color is suitable for cold chisels where light blows are struck, or for other work where great hardness is required. Where heavy blows are delivered, it is best to temper the chisel to a brown color. Screwdrivers should be colored a light purple and springs or other articles that require to have great toughness with a reasonable amount of hardness should be tempered to a deep blue color.

There is another kind of steel on the market called "high-speed" steel. This is a most remarkable metal and is the best tool steel for roughing down work that the writer has ever used, it being of such toughness and hardness that very heavy cuts can be taken; so heavy, in fact, that the cutting edge gets red-hot and it operates for a long time in that condition before requiring regrinding. The writer has also tried this class of steel for turning rolls. With the exception of chilled rolls, which the steel would not cut at all, it proved to be very fine on all other classes of rolls, enabling the work to be completed in far quicker time than the best crucible tool steel would allow. The crucible steel tools seemed to be better suited for turning chilled rolls, and also the ones containing manganese, the carbon element being the ingredient required for turning chilled work. Singularly enough, the high-speed variety of steel contains very little carbon in comparison with the crucible or open-hearth metal; it depending for its hardness and toughness upon the addition of chromium, cobalt, molybdenum, tungsten, nickel, vanadium and other rare metals which impart to it the extraordinary characteristics of cutting metal when the point of the tool is red hot, the chip in this case coming off with a deep blue color. Each manufacturer has his pet formula for manufacturing this kind of tool steel, they using some or all of the above ingredients. High-speed steel is very expensive and on account of this fact, all shops do not use it, but the demand is increasing every year, the late war making very heavy demands on it. High-speed steel cuts the overhead cost of manufacturing down to a minimum by allowing a far greater output to be secured from machines in a day's work.

This class of steel requires different treatment in hardening, it being necessary to heat it to a "white heat," which latter would positively ruin the best crucible or any of the usual kinds of tool-cutting steels. The best plan for cooling high-speed is to do the work in an air-blast, although oil can be used. I find it will not hold its cutting edge for as long a time as when the air-blast is used as a cooling medium. This steel, unlike crucible steel, does not need tempering after hardening, as it gives the best service when left hard.

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See first issue of each month.
Eclipse Counterbore Co., Ltd.
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TRADE GOSSIP

Incorporation has been granted to Copper Products, Limited. The capital is limited to $3,000,000, and the head office is located at Montreal.

Dominion Novelty Co. has been given incorporation at Ottawa, to manufacture, buy, sell, etc., automatic weighing machines, etc. The head office of the company is at Hampton, N.B., and the capital $50,000.

Incorporation has been granted to the Hutchins Car Roofing Co., Ltd., with head office in Montreal, to carry on business as iron and steel founders, etc., and handle all materials that enter into the construction of car roofs, etc. Capital is placed at $500,000.

Incorporation has been granted at Ottawa to the Corundo Steel Co., Ltd., to do business as manufacturers, smelters and dealers in iron, steel and other metals. The capital is placed at $50,000 and the head office of the said company will be at Montreal, Que.

Foundry in Operation.—The grey iron foundry recently completed by the Dominion Steel Products Co., Limited, Brantford, Ont., poured its first heat on June 15th, 1920, and is now proceeding with the fulfilment of orders for various classes of castings, among which are large orders for all classes of rolls for rolling mills, rubber working mills, flour mills, calender stacks and looms. This foundry can make castings up to the weight of thirty tons.

IF FOR MANUFACTURE THEN ONLY ONE TAX

Important Ruling Received at Montreal In Regard to Raw Material

Montreal.—Word was received by the secretary of the Canadian Manufacturers' Association that goods imported for use in manufacture in Canada would not be subject to the double sales tax, amounting to two per cent., but only to the importers' sale tax of one per cent. The information comes direct from George S. Taylor, Deputy Minister of Inland Revenue. This ruling has particular importance for Canadian railways, steamship companies and utilities companies, which import enormous quantities of material.

Motor Accessories & Supplies, Ltd., Kitchener, Ont., has been incorporated with a capital stock of $40,000 by Henry Sweitzer, Armand A. Schreiter, Arthur L. Sauder and others to manufacture automobile supplies, electric machines, fixtures, etc.

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Machine Tool Makers.
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Oil Tempered Steel Springs
—for every purpose and the best for each use.
Special styles of all kind to order.
THE CLEVELAND WIRE SPRING COMPANY
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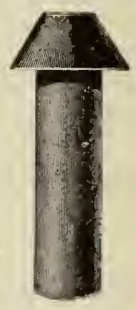
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WANTED — MAN TO SET UP AND TAKE charge of Gleason straight tooth gear cutters. Must be able to handle men. Salary commensurate with ability and experience. Apply Employment Manager, McKinnon Industries Ltd., St. Catharines, Ont. (c26m)

DIE SINKER WANTED—FIRST-CLASS MAN only. Best working conditions and top wages. Apply Employment Manager, McKinnon Industries Limited, St. Catharines, Ont. (c26m)

SALESMAN FOR MACHINE TOOLS SUPplies. Must be a high grade man of engineering knowledge, and good address; for such there are excellent prospects. Address giving full particulars in confidence. Jas. Buckley Co., St. Nicholas Bldg., Montreal. (ctfm)

Foreman wanted to take charge of a department manufacturing small high-grade machines. Must be a thorough machinist and capable of handling men to get production with first-class workmanship. State experience, age and salary expected in first letter. References required. Apply Box 689, Canadian Machinery, Toronto.

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50 Bars 2½" Round Cold Rolled Steel.

New stock in perfect condition

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FROG AND SWITCH PLANER, SIZE 36" x 36" x 18', overhauled and first-class. Heavy. One Head on Rail, weight 35,000 lbs. Apply "Winnipeg," c/o Canadian Machinery. (c1m)

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BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

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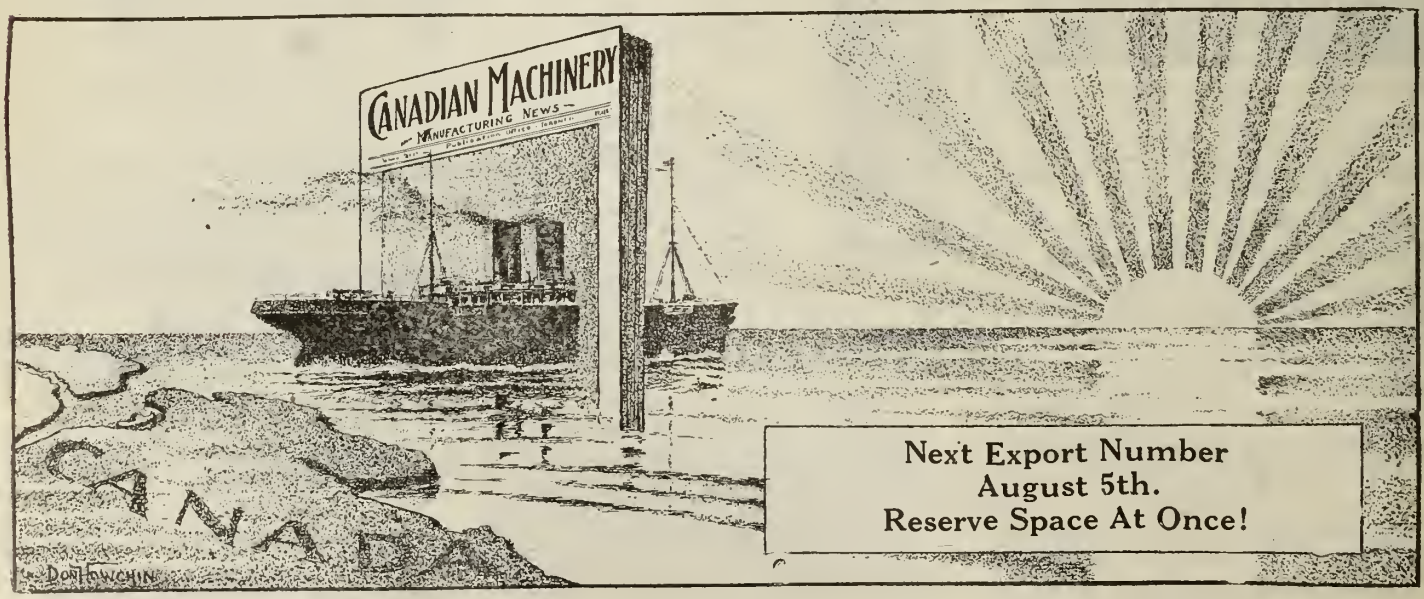

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CLASSIFIED ADVERTISING SECTION
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It has been adopted as standard by many firms that found it a long way better than guess work.

CANADIAN MACHINERY would like to see this Chart in every shop in the Dominion. Mail the coupon below for your copy to-day.

Shows at a glance Correct Clearance and Rake Angles for Cutting Tools

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Please send me/us free, one of your tool grinding charts.

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ONE of the largest and best equipped forge plants anywhere is at your call for drop forgings of any kind, particularly in large quantities.

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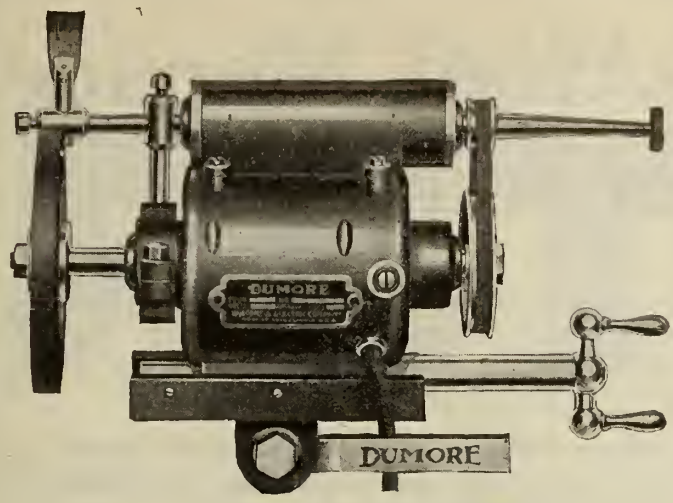

The Parts of This Well Known Machine are Die Cast

Die Cast Parts Promote Economy

Do you require machine parts in large numbers ? If so you should decide to have the parts **die-cast.** By this method you can save a lot of expense. The making of die-cast parts is a quantity production proposition which spells **economy.** Die Cast parts require no machining; they come to you ready to assemble and they are clean and accurate.

Send us your blue prints for estimates.

DIE CASTING CHAT NO. 13.—Everyone knows of the above grinder, but do they know that every part of this grinder is a die-casting? Of course, we mean with the exception of the spindles, handles, and other parts which must be steel; but this example illustrates just to what an extent die castings can be used.

It pays to find out if a die casting can be used in your product as it means a real saving to you.

Largest Makers of Die Castings in Canada

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TURBO UNITS

25 CYCLES

Generator				Turbine		Pressure.
K.W.	Volts	R.P.M.	Faker	K.W.		
500	370/400	1500	Westinghouse Parsons	500		150 lb.
750	440	1500	Westinghouse	750		
750	380	1500	Westinghouse Parsons	750		
850	380	1500	Westinghouse Parsons	150		150 lb.
1000	240	1500		1000		
1000	6600		Westinghouse	1000		
2000	2200	750	General Elec. Curtis	2000		150 lb.
2500	2400		Westinghouse	2500		150 lb.
2500	2200	1500	Westinghouse Parsons	2500		150 lb.
2500	2400	1500	Westinghouse	2500		150 lb.
3500	6600		General Elec.	3500		
6000	6600	1500	General Elec. Curtis	6000		170 lb.
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No. 4—B. & S. Plain Miller
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No. 3—Cincinnati Universal Miller
5—No. 0 Steptoe Hand Millers
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15" x 6' New Sidney D.B.G. Quick-Change Lathe, swing 17"
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17" x 8' New National Quick-Change Lathe
3—17" x 8' New Sidney D.B.G. Quick-Change Lathe, swing 19"
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18" x 24" New Rahn Larmon Lathe, D.B.G. Quick-Change
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33" x 14' Putnam, arranged for Motor Drive
6' Western Radial Drill
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30-ton Watson & Stillman Hydraulic Press

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If interested tear out this page and place with letters to be answered.

Is There an Alien Menace in Canada?

IN THE years of war, people were quick to grasp the possibilities of danger that lie in Alien sympathies. But people quickly forget, and therein lies the danger for it is in the insidious breaking down of the ties of loyalty, that goes on in the piping times of peace, that makes the menace of the days of war.

In "The Stranger in Our Midst" the simple story of a school teacher's experience in foreign settlements in the West there lies a reproach and a warning, a reproach in that such things can be, and a warning that they may not happen again.

This is only one of the many stories and articles that make the June 15th issue of MacLean's Magazine of outstanding interest.

These are some other points of interest:

FICTION

"The Little Warrior"—Pelham Grenville Wodehouse's inimitable story.

"The Parts Men Play"—Arthur Beverly Baxter.

"The Sunset Homesteader"—Will E. Ingersoll.

"The Beetle and the Butterfly"—C. W. Stephens.

ARTICLES

"What Must Be Done?"—Mrs. Murphy's suggestions of a remedy for the drug menace.

"We Must Reform Dress"—Marian Keith.

"Gentlemen of the Fourth Estate"—The story of men who begin life in newspaper offices.

The Best From Everywhere

In the Review of Reviews department will be found the best articles from all magazines and periodicals the world over. Look at these titles and authors:

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"How the English Came to Be"—by Rudyard Kipling.

"Eight Billions Wasted"—by Thomas V. Merle.

"Mankind Needs Change of Heart"—by Sir Philip Gibbs.

"Give Labor a Square Deal"—by Charles M. Schwab.

"The Slow Conquest of America"—by Forrest Crissey.

"Know Your Own Car"—by Alexander C. Johnson.

"Sending Pictures by Telegraph"—by Milton W. Stoddard.

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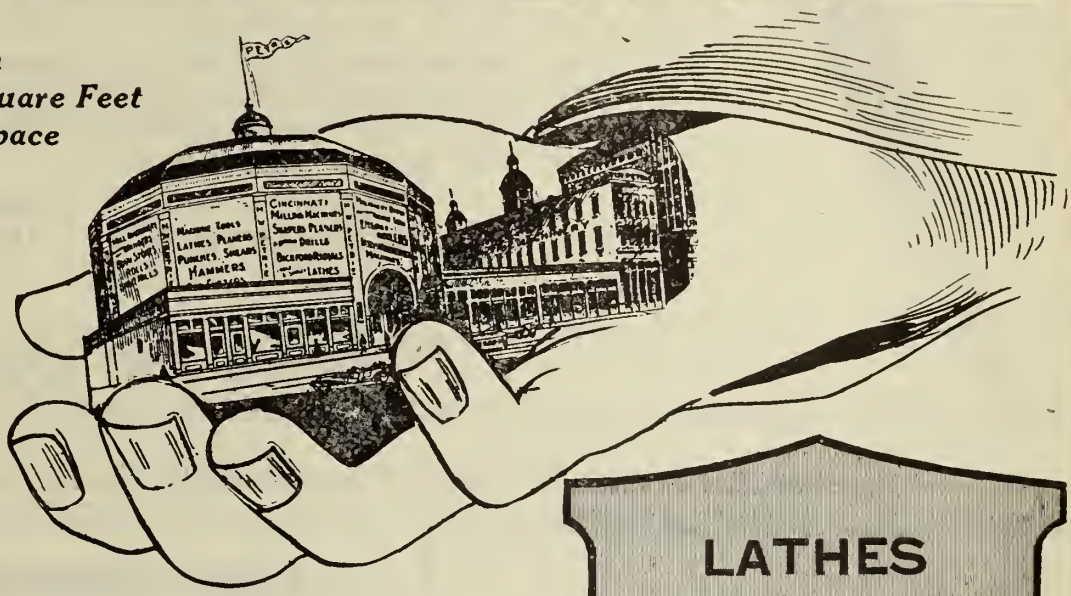

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LATHES
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Everything in Machinery and Supplies

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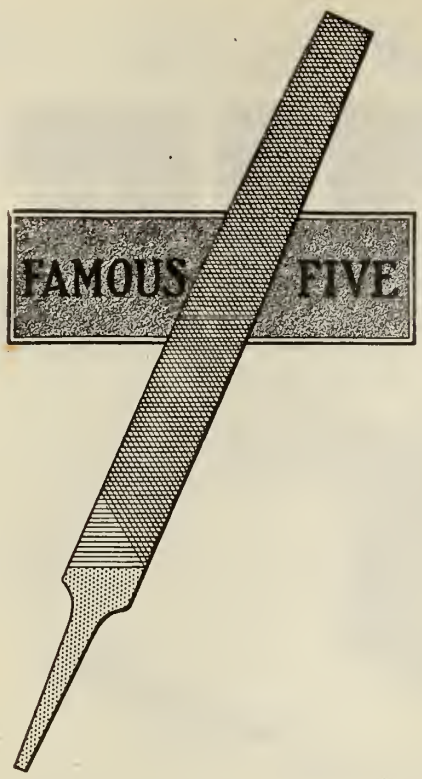

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A SCIENTIFICALLY CORRECT CUTTING TOOL

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32″ x 54″ x 26′0″ McCabe double spindle engine lathe.
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16″ x 8′0″ Hendley lathe.
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20″ x 38″ x 14′0″ C.M.C. engine lathe.

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No. 2 LeBlond universal milling machine.
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No. 12 Pratt & Whitney Milling machine.
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20″ and 24″ Gould & Eberhardt.
16″ C.M.C.
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6′0″ Ridgway heavy duty radial.
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600-lb. steam hammer.
12″ Betts slotter.
No. 26 Williams & White bulldozer.

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We have the following tools out of the plant of The Canada Cement Company, available at very attractive prices:
26″ x 12′0″ C.M.C. Bertram and Bridgeford lathes.
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22″ x 8′0″ and 10′0″ Davenport engine lathes.
Pulleys, Hangers, Clutches, Conveyor Chain, etc.

WRITE FOR PRICES

The above tools are offered refitted and complete.

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Main 5200 — 320-28 St. James Street, Montreal

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showing a Trahern Coolant Pump attached to end of shaft on a J. N. La Pointe Broaching Machine.
A TRAHERN will reverse automatically with the machine, throwing a heavy, uniform flow of water, oil or compound. When properly installed, guaranteed not to lose prime. Run at low speed giving long life.
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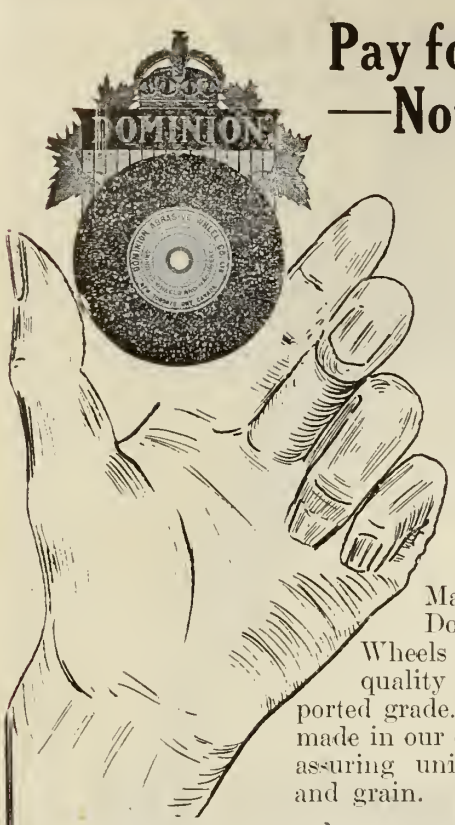

Some manufacturers are inclined to purchase imported grinding wheels believing that the same quality is not obtainable in Canadian goods. Perhaps this was so at one time. But times have changed.

Made in Canada, Dominion Grinding Wheels are now equal in quality to the best imported grade. The abrasives are made in our own furnaces, thus assuring uniformity in grade and grain.

Try Dominion Wheels once and you will acquire the habit of buying at home.

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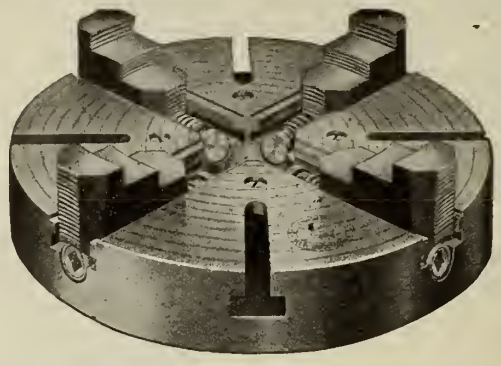
ALL STEEL
INDEPENDENT CHUCKS

are not an experiment—they have come to stay. They are a necessity with the modern machinery and high-speed steel cutting tools.



THE UNION STEEL BODY CHUCKS
are well designed and have all the elements of strength and durability for which they are designed. We make other types in steel also, including the Geared Scroll Chucks and the Geared Scroll Combination—all designed for heavy work and hard usage.

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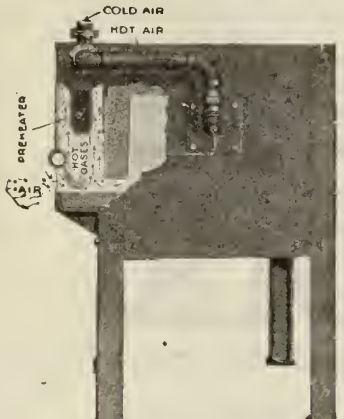
Makers of a complete line of chucks

Overcome the Summer "Slump"

When its too hot to work—production drops and overhead rises. Men will not put forth their best efforts when suffering from oppressive heat.



(*Patented*)
Section showing deflection of hot gases, with induced air toward the furnace, and the preheating of air for combustion.

A forging is the result of a working combination of machine, furnace and man. The man is the weak link in the operation; when he's idle, expensive equipment is idle.

The fatigue of furnace operators is due largely to gases and heat. In the

ROCKWELL ECONOMIZER FORGE

the novel construction of shield deflects the hot gases and—

See illustration, write for Bulletin 34-T, and learn of the many other advantages that make this forge an all-year-round economizer.

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"FURNACE AND FUEL TO SUIT THE WORK"

Canadian Representative:
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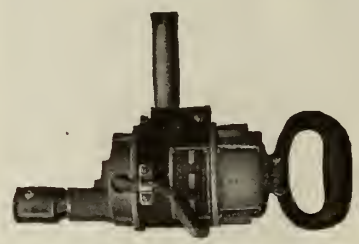
U. S. Electric Drills and Grinders

Save Time, Labor and Money



They can be attached to any lamp socket.

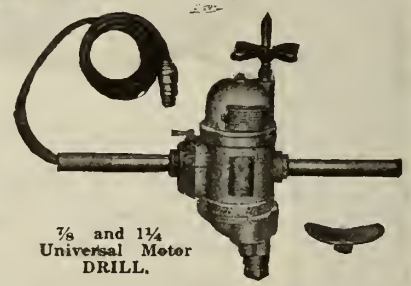
For drilling in metal they are superior to any other kind of portable drill. Cost 50% less to run than air drills.

3 SIZES
3-16 in., W.G.T., 6 lbs.
¼ in., W.G.T. 9 lbs.
⅜ in., W.G.T. 12 lbs.

All motors wound for 110 or 220 volts.

Direct or alternating current.

Try a few of our Electric Drills and Grinders and you'll send us an order for more. Our guarantee protects you.



⅜ and 1¼ Universal Motor DRILL.

For Sale By
The Canadian Fairbanks-Morse Co., Limited
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High-class Drills with IRRESISTIBLE PIERCING FUNCTIONS that stand the WEAR and TEAR — in other words, the DRILLS that are EFFICIENT and ECONOMICAL — are the DRILLS with the "DORMER" Brand.

We are manufacturing SPECIALISTS—Carry large STOCKS — Give PROMPT deliveries, and rely upon our products for REPEATS.

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Industrial Electric Trucks
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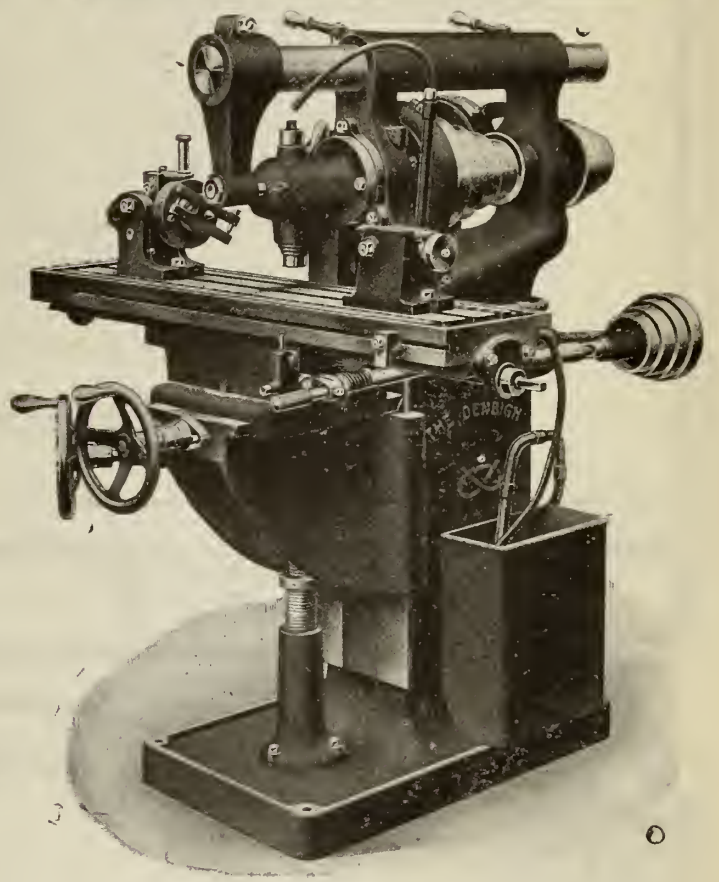
The **DENBIGH** Famous MANUFACTURING MILLERS



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This extensive experience has resulted in machines perfect in design and construction. We are now in a position to place them on the market at a very low price.

Nine types and sizes—to suit any miller requirement—**and the delivery is right.**

John M. Terry & Company
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Cables: Athenian, Cannon, London.

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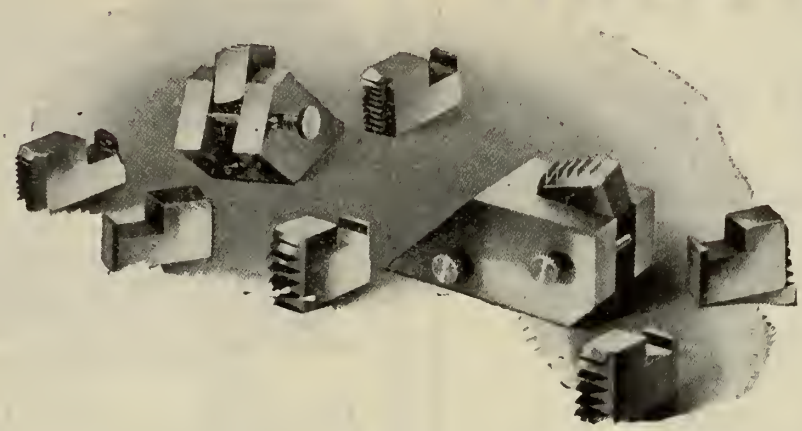
Chasers for HARTNESS Dies are easily ground

These Jigs



And any small Grinder will grind Hartness Chasers quickly and correctly.

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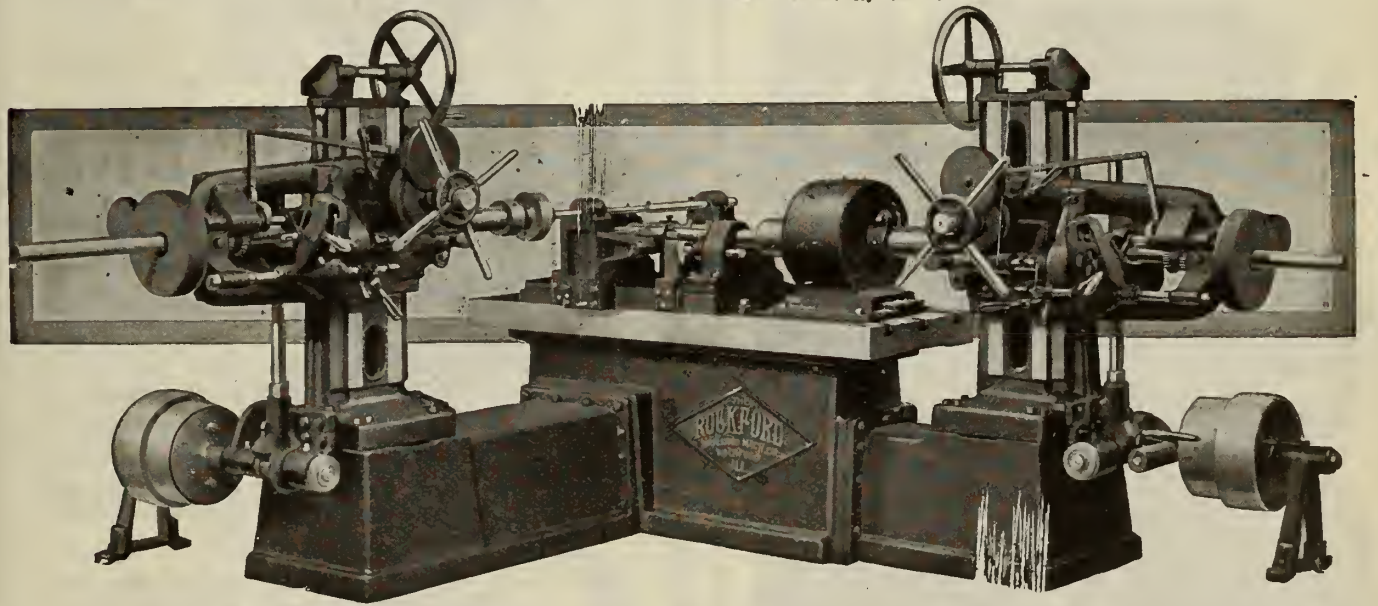

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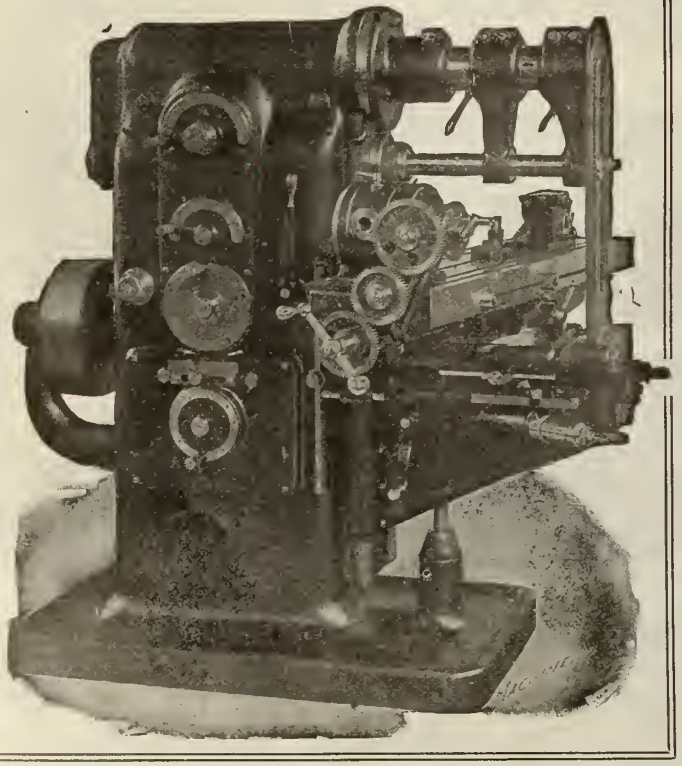

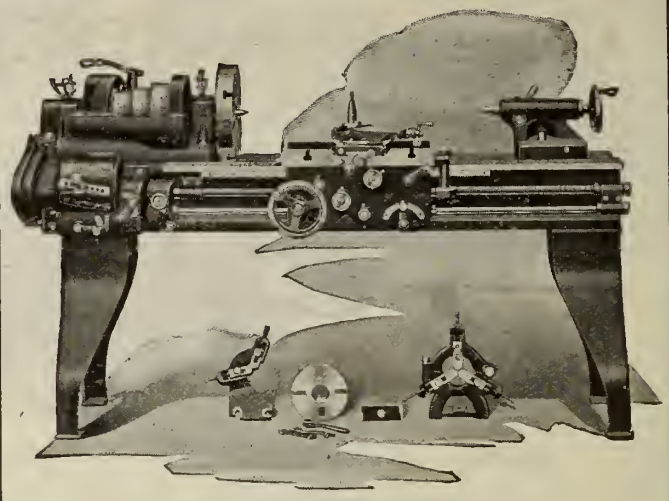

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You can use them to great advantage on any work in your shop that's suitable for a machine tool of this kind. The operating is easy and the labor cost comparatively low.

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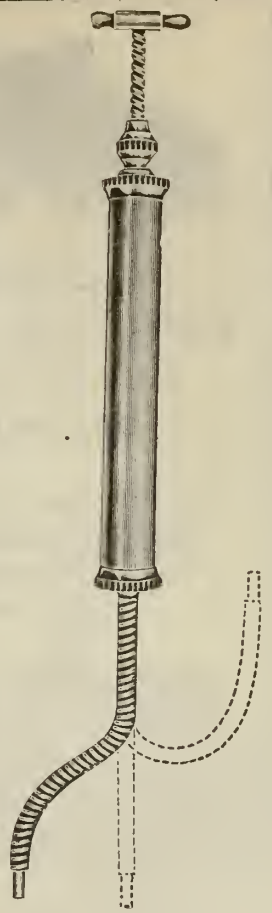

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It was the often-heard story of time saved, of costs lowered, of all threads clean and smooth. And it was pleasant to hear.

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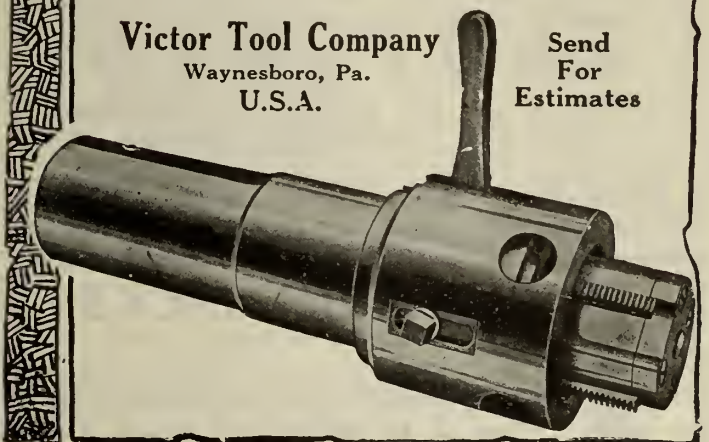

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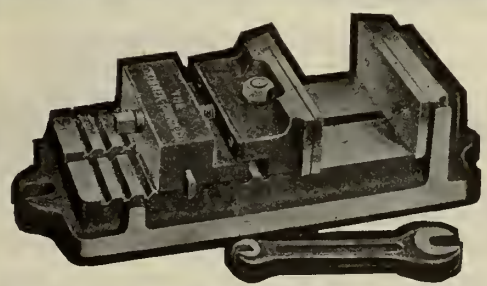

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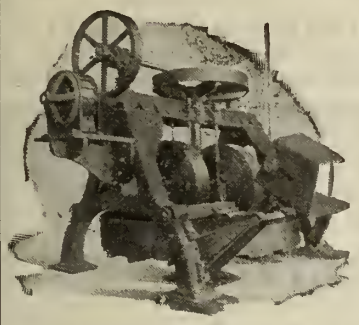

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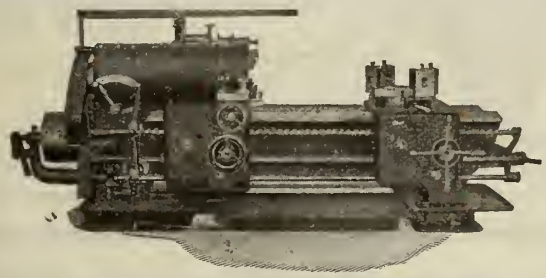

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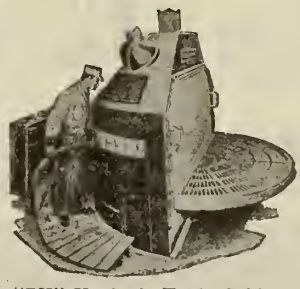

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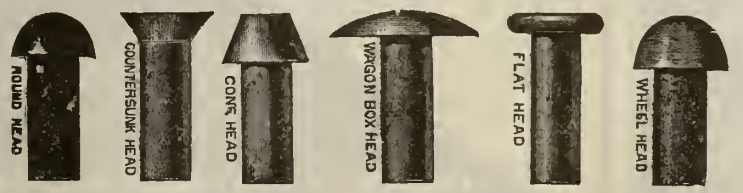

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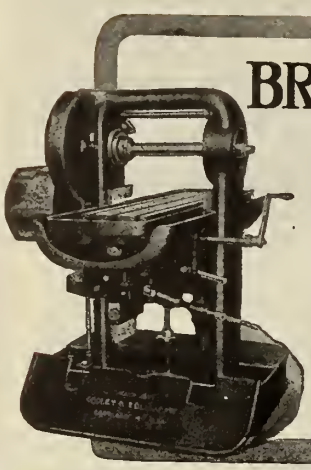

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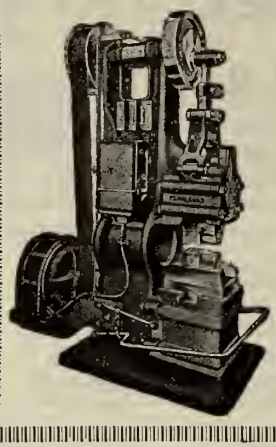

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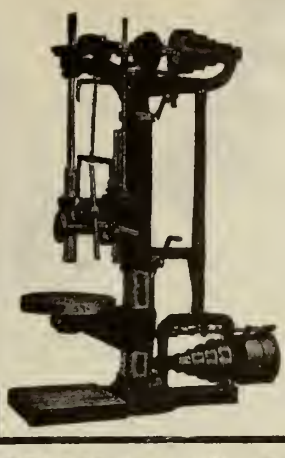

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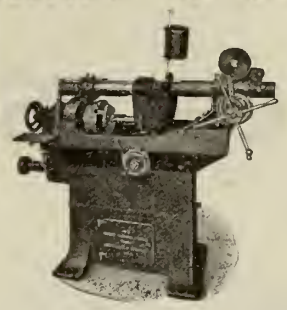

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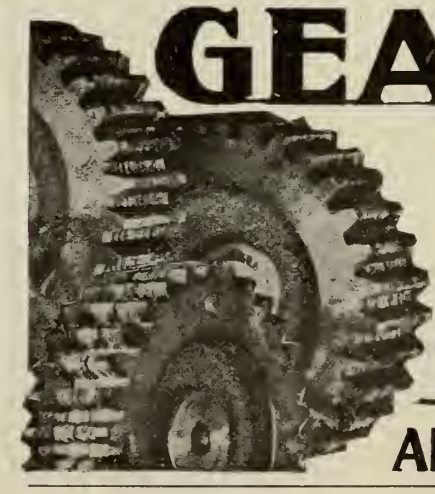

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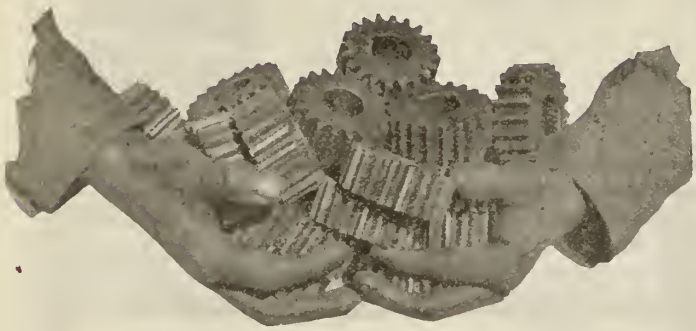

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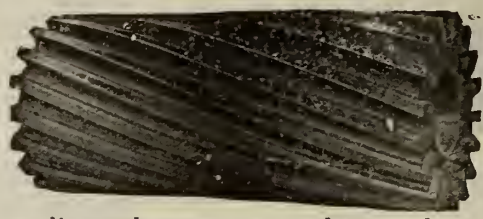

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Firth & Sons, Thos., Montreal, Que.
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Rice Lewis & Son, Toronto, Ont.
Tallman Brass & Metal Co., Hamilton.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

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Canada Machinery Corp., Galt, Ont.
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Canadian Fairbanks-Morse Co., Montreal
Can. S K F Co., Toronto, Ont.
Chapman Double Ball Bearing Company, Toronto
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., John, Ingersoll
Williams Mchy Co., A. R., Toronto, Ont.

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Gray Ball Bearing Co., Ltd., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Petrie, Ltd., H. W., Toronto.
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Victoria Foundry Co., Ottawa, Ont.

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Northern Electric Co., Ltd., Montreal Que

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Lyman Tube & Supply Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Summer & Co., New York, N.Y.
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Franklin Mfg. Co., Syracuse, N.Y.

BEARINGS, GRAPHITE BRONZE
Lyman Tube & Supply Co., Montreal, Que.

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Dunlop Tire & Rubber Goods Co., Ltd., Toronto,
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Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
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Whitney Mfg. Co., Hartford, Conn.
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Graton & Knight Mfg., Worcester, Mass.
International Mchy. Spls., Ltd., Montreal.
Jones & Glassco, Montreal, Que.
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Can. Con. Rubber Co., Ltd., Montreal.
Gutta Percha & Rubber, Ltd., Toronto.

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Summer & Co., New York, N.Y.

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Sumner & Co., New York, N. Y.
John Tullis & Son, Glasgow, Scotland.

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Bertram & Sons Co., John, Dundas
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Can. Blower & Forge Co., Kitchener.
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Garlock-Walker Mach. Co., Toronto.
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National Mach. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont

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Swedish Steel & Importing Co., Ltd., Montreal.
Algoma Steel Corp., Sault Ste. Marie
Kayser-Ellison & Co., Ltd., Montreal
Marshall, Son & Bunney, Toronto.
United States Steel Corp., Canton, Ohio.

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Kayser-Ellison & Co., Ltd., Montreal

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Dennis Wire & Iron Works, London, Ont
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Toronto Iron Works, Ltd., Toronto, Ont.
Willis's Hamilton Co., Peterboro, Ont.

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United States Steel Corp., Canton, Ohio.

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Can. Blower & Forge Co., Kitchener, Ont
Garlock-Walker Machinery Co., Toronto
MacGovern & Co., Montreal, Que.
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BOILER TUBES
Lyman Tube & Supply Co., Montreal, Que

BOILER BREECHINGS
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St Lawrence Welding Co, Ltd., Montreal
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Greenfield Tap & Die Corp., Greenfield, Mass.
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BOILERS
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MacGovern & Co., Montreal, Que.

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Rice, Lewis & Son, Toronto, Ont.
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Williams & Co.,, J. H. Brooklyn, N.Y.

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Gait Machine Screw Co., Ltd., Galt, Ont.

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Can. Winkley Co., Ltd., Windsor, Ont.
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Morrow Screw & Nut Co., John, Ingersoll.

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Bertram & Sons Co., John, Dundas, Ont
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto
Gardner & Son, Robt., Montreal.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Universal Mach, Co., Bowling Green, O.
Williams Machinery Co., A. R., Toronto

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Jardine & Co., Ltd., B., Hespeler
Landis Machine Co., W aynesboro, Pa.
National Acme Co., Cleveland, Ohio.
Victor Tool Co., Waynesboro, Pa.

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Canadian Fairbanks-Morse Co., Montreal
Can. Ingersoll-Rand Co., Sherbrooke Que
Garlock-Walker Mach. Co., Toronto.

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Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto
Oliver Mach'y Co., Grand Rapids, Mich.
Gisholt Machine Co., Madison, Wis.
Hoefer Mfg., Co., Freeport, Ill.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Rockford Drilling Mche. Co, Rockford, Ill

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Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Foss Mch. & S'ply Co., Geo. F., Montreal
Knight Metal Products, Toronto.
Oliver Mach. Co., Grand Rapids, Mich.
Niles-Bement-Pond Co., New York.

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Petrie, Ltd., H. W., Toronto.
Pratt-O-Lite Co., Inc., Toronto, Ont.
Wood Turret Machine Co., Brazil, Ind.
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Brown's Copper and Brass Rolling Mills, New Toronto.

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MacKinnon Steel Co., Sherbrooke, Que.

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Tallman Brass and Metal Co., Hamilton.

BRONZE COPPER
Canada Metal Co., Toronto.

BRUSHES, CARBON
Lyman Tube & Supply Co., Montreal, Que.

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Foss Mchy. & S'ply Co., Geo. F. Montreal
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.

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Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
St Lawrence Welding Co, Ltd , Montreal

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Can. Link-Belt Co., Toronto, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
St Lawrence Welding Co, Ltd., Montreal

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Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Ltd, Walkerville.

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Williams Mchy Co., A. R., Toronto, Ont.

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St Lawrence Welding Co, Ltd., Montreal

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Brown & Sharpe Mfg. Co., Providence, R.I.
Pangborn Corporation, Hagerstown, Md.

CABINETS, SAND BLAST
Pangborn Corporation, Hagerstown, Md.

CABLE, ELECTRIC
International Machinery & Supply Co., Ltd., Montreal, Que.

CABLES, TRANSMISSION AND TELEPHONES
Northern Electric Co., Ltd., Montreal.

CALKS, BOOT
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Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Can.

CANNERS' CONVEYORS
Can. Link-Belt Co., Toronto, Ont.

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L'Air Liquide Society, Toronto, Ont.
Union Carbide Co., of Canada, Limited, Weland, nt.

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Swedish Crucible Steel Co., Windsor.

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Jones & Glasseo, Montreal.

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Can. Fairbanks-Morse Co., Ltd, Montreal
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

CASES, FILING
Economy Drawing Table Co., Adrian, Mich.

CASTINGS, ALUMINUM, BRASS BRONZE, COPPER, AND GUN METAL
Algoma Steel Corp., Sault Ste. Marie.
Franklin Mfg. Co., Syracuse, N.Y.
Canada Metal Co., Ltd., Toronto, Ont.

CASTINGS, DIE CAST
Canada Metal Co., Ltd., Toronto, Ont.
Franklin Mfg. Co., Syracuse, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Tallman Brass & Metals Ltd., Hamilton, Ont.

CASTINGS, STEEL—ALL KINDS
Canada Electric Castings, Ltd., Orillia, Ont.
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Electric Steel & Metals Co., Welland.
Meeta Machine Co., Pittsburgh, Pa.

CASTINGS, ELECTRIC AND ALLOY STEEL
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Dominion Foundries & Steel Ltd., Hamilton, Ont.

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John Morrow Screw & Nut Co., Ingersoll
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Tallman Brass & Metal Co., Hamilton.

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Brown & Sharpe Mfg. Co., Providence, R.I.

CASTINGS, BRASS AND IRON
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CASTINGS, GRAY IRON
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Hull Iron & Steel Foundries, Ltd., Hull
International Malleable Iron Co., Guelph
Kennedy & Sons, Ltd., Wm., Owen Sound.
Katie Foundry, Ltd., Galt, Ont.
Hamilton Co., Wm., Peterboro.
McFarlane Engineering Ltd., G. W., Paris, Ont.

CASTINGS, PLUMBERS'
Katie Foundry, Galt, Ont.

CASTINGS, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville

CASTINGS, HARDWARE
Katie Foundry, Galt, Ont.

CASTINGS, STEEL CHROME AND MANGANESE STEEL
Thos. Davidson Mfg. Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hull Iron & Steel Foundries, Ltd., Hull.
Kennedy & Sons, Ltd, Owen Sound.

CASTINGS, MALLEABLE
International Malleable Iron Co., Guelph

CASTINGS, NICKEL STEEL
Hull Iron & Steel Foundries, Ltd., Hull.

CEMENT MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal.
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CENTERING MACHINES
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Butterfield & Co., Inc., Rock Island, Que.
Gardner, Robt. & Son, Montreal.
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Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co., of Canada, Galt, Ont.

CHAIN, WELDED COIL
Morris Crane & Hoist Co., Herbert, Niagara Falls. Ont.

CHAIN BLOCKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford Chain Block & Mfg. Co., Phila., Pa.
Garlock-Walker Machy. Co., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & HoistCo., Herbert, Niagara Falls, Ont.
Oliver Engineering Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Jones & Glasseo, Montreal, Que.

CHAINS, AGRICULTURAL
Canadian Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.

CHAINS, AUTOMOBILE ENGINE
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.

CHAINS, BICYCLE, DRIVE AND BLOCK
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAINS, FOR ELEVATORS AND CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAIN, MALLEABLE, DETACHABLE AND RIVETED
Can. Link-Belt Co., Toronto, Ont.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAINS, POWER TRANSMISSION
Canadian Link-Belt Co., Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, New York.
Glasgow, N.S.

CHAINS, SPROCKET WHEEL
Can. Link-Belt Co., Ltd., Toronto, Ont.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAIN DRIVES
Can. Link-Belt Co., Toronto, Ont.
Coventry Chain Co., Coventry, England.
Jones & Glasseo, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHASERS
National Acme Co., Cleveland, Ohio.
Taylor, J. A. M., 518 Stair Bldg., Toronto, Ont.

CHEMISTS
Toronto Testing Lab'tory, Ltd., Toronto

CHUCKS, AERO, AUTOMATIC
Garvin Machine Co., New York.

CHUCKS, CENTERING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKS, COLLET, AIR
Elliott & Whitehall Mach. & Tool Co. Galt, Ont.
Smalley-General Co., Inc., Bay City, Mich.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, LATHE AND UNIVERSAL
Aikenhead Hardware Co., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt., & Son, Montreal.
Garlock-Walker Mach'y Co., Toronto.
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Chicago, Ill.
Jacobs Mfg. Co., Hartford, Conn.
Ker & Goodwin Machine Co., Ltd.
Knight Metal Products, Toronto.
Modern Tool Co., Erie, Pa.
Rice Lewis & Son, Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Aikenhead Hardware Co., Toronto, Ont
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McCrosky Tool Corp., Meadville, Pa., U. S. A.

CHUCKS, FRICTION AND TAP
Victor Tool Co., Waynesboro, Pa.

CHUCKS, MAGNETIC
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

CHUCKS, RING WHEEL
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.

CHUCKS, WHEEL, CAR
Hoggson & Pettis Mfg. Co., New Haven Conn.

CHUCKING MACHINES
Barber Mchy. Co., Ltd., Toronto, Ont
Brown & Sharpe Mfg. Co., Providence, R.I.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Windsor, Vt.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Wood Turret Mach. Co., Brazil, Ind.
Williams Mchy Co., A. R., Toronto, Ont.

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Williams & Co., J. H., Brooklyn, N.Y.

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Elk Fire Brick Co., Can., Ltd., Hamilton, Ont.

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Oakley Chemical Co., New York, N.Y.

CLEANING COMPOUND
Oakley Chemical Co., New York.

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CLOCKS, WATCHMAN, PORTABLE
Gisholt Machine Co., Madison, Wis.

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Crane, Ltd., Montreal, Que.

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Wright Mfg. Co., Lisbon, Ohio.

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Bernard Industrial Co., A., Fortierville, Q.
Can. Link-Belt Co., Toronto, Ont.
Carlyle Johnson Mach. Co., Manchester, Conn.
Positive Clutch & Pulley Wks., Aurora, Ont.
Jones & Glasseo, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.

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Canadian Mead-Morrison Co., Limited, Montreal, Que.

COAL HANDLING MACHINERY
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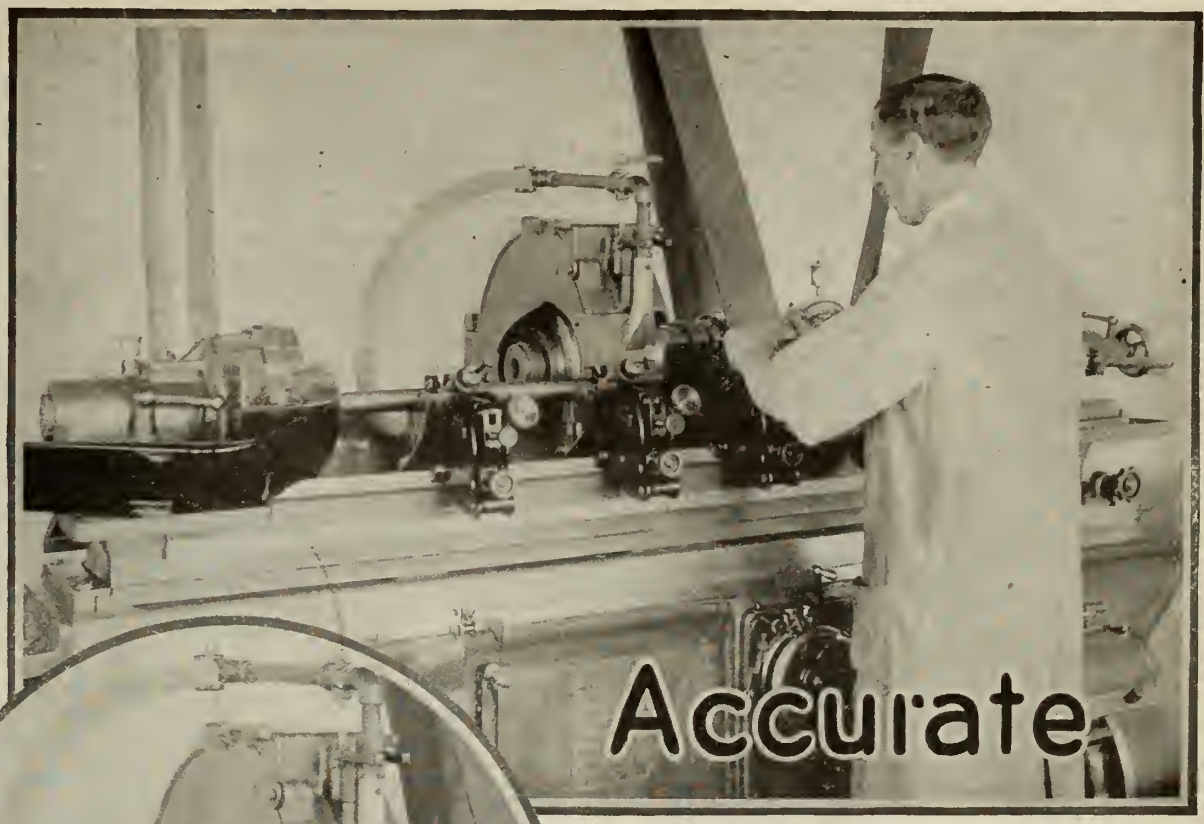
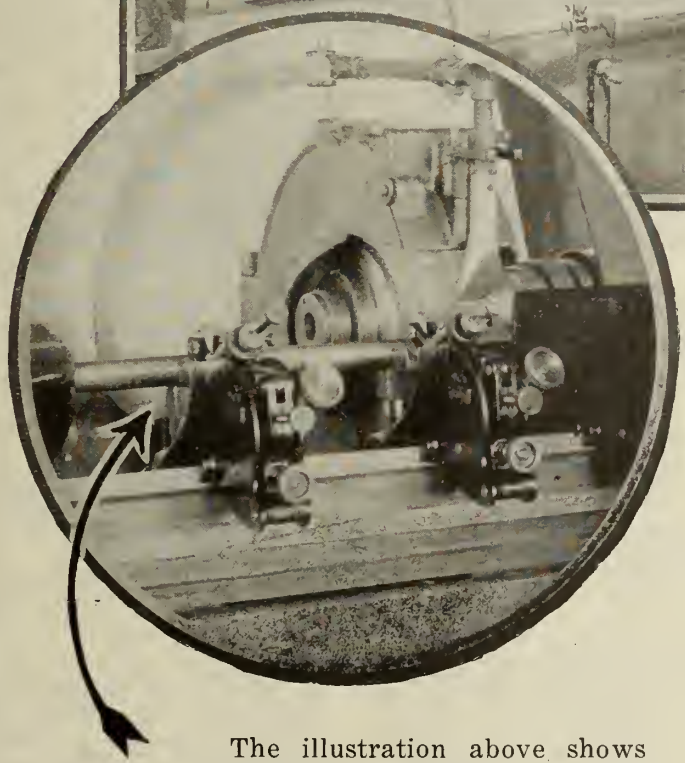
Can. Link-Belt Co., Toronto, Ont.
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Nova Scotia Steel & Coal Co., New





The illustration above shows the Combination, Plain and Universal Back Rests as used on our Nos. 14 and 16 Plain Grinding Machines. The work is shown being supported by both shoes. Adjustments on these rests are simply and easily made. A clamping screw is provided to prevent the vibration of the Machine disturbing the adjusting screw. These rests may also be used as plain back rests or as regular universal back rests.

On Extra Heavy Work

Or long slender pieces, accuracy in grinding is dependent upon the use of suitable work rests.

On the large size

BROWN & SHARPE PLAIN GRINDING MACHINES

combination plain and universal back rests are furnished. The rests support the work at the front and under sides. When thus properly supported the operator is able to take heavier cuts at faster speeds and feeds, and the "sizing power" of the wheel is greatly increased.

These are essential factors where high production and accuracy are to be maintained.

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BROWN & SHARPE MFG. CO.

PROVIDENCE, R.I., U.S.A.

If interested tear out this page and place with letters to be answered.

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Williams & Co., J. H., Brooklyn, N.Y.

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Sturtevant Co., B. F., Galt, Ont.

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COMPOSITION INGOT
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CONDUITS
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CONTRACTORS' HOISTS
Canadian Mead-Morrison Co., Limited, Montreal, Que.

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CONVERTERS, ROTARY
MacGovern & Co., Montreal, Que.
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Canadian Mead-Morrison Co., Limited, Montreal, Que.

COOLERS, WITH DRINKING FOUNTAINS
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Bertram & Sons Co., John, Dundas, Ont.
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Niles-Bement-Pond Co., New York.
Can. Blower & Forge Co., Kitchener.

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Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.

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COUNTERBORES, INVERTED, INTERCHANGEABLE
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Baird Machine Co., Bridgeport, Conn.
Ford-Smith Machine Co., Hamilton, Ont.
Foster Machine Co., Elkhart, Ind.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams Mchy Co., A. R., Toronto, Ont.

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Can. Link-Belt Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Int. Machinery & Supply Co., Ltd., Montreal, Que.

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Hanna & Co., M. A., Cleveland, O.

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Independent Pneumatic Tool Co., Chicago

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Northern Crane Works, Walkerville.

ELECTRIC
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CUPS, OIL
Can. Winkley Co., Ltd., Windsor, Ont.

COVERS, OIL HOLE
Can. Winkley Co., Ltd., Windsor, Ont.

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Northern Crane Works, Walkerville.

CRANE RUNWAYS
MacKinnon Steel Co., Sherbrooke, Que.

CRANES, JIB
Brown Hoisting Machinery Co., Cleveland, Ohio.

CRANES, LOCOMOTIVE
Brown Hoisting Machinery Co., Cleveland, Ohio.

CRANES, GOLIATH, PNEUMATIC AND PORTABLE
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Morris Crane and Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Petrie, Ltd., H. W., Toronto.

CRANES, PILLAR
Brown Hoisting Machinery Co., Cleveland, Ohio.

CRANES, TRAVELLING, ELECTRIC AND HAND POWER
Brown Hoisting Machinery Co., Cleveland, Ohio.
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Curtis Pneumatic Machy. Co., St. Louis
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Hepburn, John T., Ltd., Toronto.
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MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Niles-Bement-Pond Co., New York.
Northern Crane Works, Walkerville.
Oliver Engineering Co., Montreal.

CRANK SHAFTS
Canada Found's & Forgings Ltd., Welland
Williams & Co., J. H., Brooklyn, N.Y.

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Aikenhead Hardware Co., Toronto, Ont.
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Can. Blower & Forge Co., Kitchener.
Northern Crane Works, Walkerville.

CURB PUMPS FOR OIL, GASOLINE
Bowser Co., Ltd., S. F., Toronto, Ont.

CURRENT TRANSFORMERS
Volta Manufacturing Co., Welland, Ont.

CUT-OFF COUPLINGS, FRICTION
Petrie, Ltd., H. W., Toronto.

CUTTERS, BOLT
See Bolt Cutters.

CUTTERS, GEARS
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Fellows Gear Shaper Co., Springfield, Vt.

CUTTERS, FLUE
Cleveland Pneumatic Tool Co., Toronto.

CUTTER HEADS
Oliver Machinery Co. Grand Rapids, Mich

CUTTERS, PIPE (See Pipe Cutters)

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Illinois Tool Works, Chicago, Ill.
Ingersoll Mache. Co., Ingersoll, Ont.
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Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Whitney Mfg. Co., Hartford, Conn.
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Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Foss Mchy & S'ply Co., Geo. F., Montreal
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield, Mass
Hurlburt, Rogers Machy. Co., South Sudbury, Mass.
Hall & Sons, John H., Brantford, Ont.
Kennedy & Sons, Wm., Owen Sound.
Lyman Tube & Supply Co., Montreal, Que.
Niles-Bement-Pond Co., New York, N.Y.
Prest-O-Lite Co., Inc., Toronto, Ont.
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Ford-Smith Machine Co., Hamilton, Ont.
Smalley General Co., Inc., Bay City, Mich

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DEHUMIDIFYING
B. F. Sturtevant Co, Galt, Ont.

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Hepburn Co., Ltd., J. T., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

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Furniss, Clarke & Co., Montreal, Que.

DIAMOND TOOLS
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Furniss, Clarke & Co., Montreal, Que.
Joyce-Koebel Co., Inc., New York City.
Wheel Trueing Tool Co., Detroit.
Petrie, Ltd., H. W., Toronto.

DIAMONDS, CARBON AND BORTZ
Wheel Trueing Tool Co., Detroit.

DIAMONDS, BLACK AND ROUGH
Joyce, Koebel & Co., Inc., New York.
Wheel Trueing Tool Co., Windsor, Ont.

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Fisher Motor Co., Ltd., Orillia, Ont.
Tallman Brass & Metals Ltd., Hamilton, Ont.

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Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt. & Son, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Jones & Lamson, Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.
Marshall, Son & Bunney, Toronto.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Rickert-Shafer Co., Erie, Pa.
Stoll Co., Inc., D. H., Buffalo, N.Y.
Wells Brothers of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

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Kimber & Hillier Mfg., Co., St. Catharines, Ont.

DIES, DROP FORGE.
Kimber & Hillier Mfg., Co., St. Catharines, Ont.

DIES, METAL STAMPING
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Elliott & Whitehall, Galt, Ont.

DIES, PIPE THREADING
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Crescent Mche, Co., Ltd., Montreal, P.Q.
Landis Machine Co., Waynesboro, Pa.

DIES, THREADING
Butterfield & Co., Inc., Rock Island, Que.
Crescent Machine Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

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Becker Milling Machine Co., Boston
Garvin Machine Co., New York.
Kimber & Hillier Mfg., Co., St. Catharines, Ont.
Pratt & Whitney Co., Dundas, Ont.
Walcott Lathe Co., Jackson, Mich

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Butterfield & Co., Rock Island, Que.
Firth & Sons, Thos., Montreal, Que.
Landis Machine Co., Waynesboro, Pa.
Wells Brothers Co. of Canada, Galt.

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Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Canada, Galt, Ont.

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Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Wells Brothers Co. of Can., Galt, Ont.
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Armstrong-Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
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Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.

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Butterfield & Co., Inc., Rock Island, Que.
Wells Bros. Co. of Can., Galt, Ont.

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Brown, Boggs & Co., Hamilton, Canada
Globe Engineering Co., Hamilton, Ont.
Stoll Co., D. H., Buffalo, N.Y.

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A. B. Jardine & Co., Ltd., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
National-Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros., Co., of Can., Galt, Ont

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Graton & Knight Mfg. Co., Worcester, Mass.
Swedish Steel & Importing Co., Montreal

DIRECT CONNECTED UNITS
MacGovern & Co., Montreal, Que.

DRAFT, MECHANICAL
Butterfield & Co., Rock Island, Que.
Can. Blower & Forge Co., Kitchener.
A. B. Jardine & Co., Hespeler, Ont.
Pratt & Whitney Co., Dundas, Ont.
Sturtevant Co., B. F., Galt, Ont.

DRAINAGE FITTINGS
Crane, Ltd., Montreal, Que.

DRAWING INSTRUMENTS
Hughes, Owens Co., Ltd., Montreal, Que.

DRAWING OFFICE SUPPLIES
Hughes, Owens Co., Ltd., Montreal, Que.

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Atkins & Co., E. C., Hamilton, Ont.
Can. Desmond-Stephan Mfg. Co., Hamilton
Dominion Abrasive Co., Ltd., Mimico, Ont
Petrie, Ltd., H. W., Toronto.
Wheel Trueing Tool Co., Windsor, Ont.

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Aurora Tool Works, Aurora, Ind.
Barber Mchy. Co., Ltd., Toronto, Ont.
W. F. & John Barnes Co., Rockford.
Can. Blower & Forge Co., Kitchener.
Canada Machinery Corp., Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
U. S. Mach. Tool Co., Cincinnati, Ohio.
A. R. Williams Machinery Co., Toronto.

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Atkins & Co., Ltd., Wm., Sheffield, Eng
Kayser-Ellison & Co., Ltd., Montreal.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
Marshall, Son & Bunney, Toronto.
Swedish Steel & Importing Co., Ltd., Montreal.

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Barnes, W. F. & John, Co., Rockford, Ill.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bilton Mach. Tool Co., Bridgeport, Conn
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Silver Mfg. Co., Salem, Ohio.

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John Bertram & Sons Co., Dundas.
Bilton Mach. Tool Co., Bridgeport, Conn
Can. Blower & Forge Co., Kitchener, Ont
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Mach. Co., Toronto.
Garvin Machine Co., New York.
Hoefer Mfg., Co., Freeport, Ill.
Henry & Wright Mfg. Co., Hartford, Conn
A. B. Jardine & Co., Hespeler, Ont.
Landis Tool Co., Waynesboro, Pa.
Nat. Automatic Tool Co., Richmond, Ind.
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Niles-Bement-Pond Co., New York.
Williams Mchy Co., A. R., Toronto, Ont.

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Canadian Machinery Corp., Galt, Ont.
Geo. F. Foss Mch. & S'ply Co., Montreal
Garlock-Walker Mach. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
United States Mach. Tool Co., Cincinnati
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Garlock-Walker Mach. Co., Toronto, Ont
Can. Blower & Forge Co., Kitchener.
Canada Mach. Corp., Galt, Ont.
Garvin Machine Co., New York.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mach. Co., Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
A. B. Jardine & Co., Hespeler, Ont.
Knight Metal Products, Toronto.
Landis Tool Co., Waynesboro, Pa.
R. McDougall Co., Galt.
Nat. Automatic Tool Co., Richmond, Ind
Rockford Drilling Mach. Co., Rockford, Ill
Niles-Bement-Pond Co., New York.
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DRILLING POSTS
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Can. Fairbanks-Morse Co., Montreal.
Geo. F. Foss Mch. & S'ply Co., Montreal
Garlock-Walker Machinery Co., Toronto.
Pratt & Whitney Co., Dundas, Ont.
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U.S. Electrical Tool Co., Cincinnati, O.

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Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.
Whitman & Barnes Mfg. Co., Akron, O.
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Wilt Twist Drill Co. of Can., Walkerville

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Cleveland Twist Drill Co., Cleveland.
Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Machine Co., New Bedford, Mass.
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Rice Lewis & Son, Toronto, Ont.
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Cincinnati Electrical Tool Co., Cincinnati
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Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Pilot Steel & Tool Co., Montreal, Que.
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Butterfield & Co., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Canadian Fairbanks-Morse Co., Montreal
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Geo. F. Foss Mch. & S'ply Co. Montreal
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
W. F. & John Barnes Co., Rockford, Ill
Osborne, Samuel, Montreal, P.Q.
Pratt & Whitney Co., Dundas, Ont.
Petrie, H. W. Toronto.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal
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Wilt Twist Drill Co. of Can., Walkerville
Wilkinson & Kompass, Hamilton, Ont.
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Cleveland Pneumatic Tool Co., Toronto.
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Niles-Bement-Pond Co., New York.
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Canadian Fairbanks-Morse Co., Montreal.
Cincinnati Electrical Tool Co., Cincinnati.
Cleveland Twist Drill Co., Cleveland.
Garlock-Walker Mchy. Co., Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilt Twist Drill Co. of Can., Walkerville.

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The Foss Mchy. & Supply Co., Montreal.
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Morse Twist Drill & Mch. Co., New Bedford, Mass.
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Lyman Tube & Supply Co., Montreal, Que.
Northern Electric Co., Ltd., Montreal Que

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Volta Manufacturing Co., Welland, Ont.

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Goad Engineering Co., Toronto, Ont.

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Petrie, Ltd., H. W., Toronto.

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Oliver Machinery Co., Grand Rapids, Mich

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Ford-Smith Machine Co., Hamilton, Ont.

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Atkins & Co., E. C., Hamilton, Ont.

EMERY PAPER
Atkins & Co., E. C., Hamilton, Ont.

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Brantford Emery Wheel Co., Brantford, Canada.
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Garvin Machine Co., New York.
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Canada Emery Wheels Co., Hamilton.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Wilkinson & Kompass, Hamilton, Ont.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.

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Dominion Abrasive Co., Ltd., Mimico, Ont.
Wheel Trueing Tool Co., Windsor Ont.

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MacGovern & Co., Montreal, Que.
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EYE PROTECTORS
Standard Optical Co., Geneva, N.Y.

FACTORY GATES
Page Steel & Wire Co., Adrian, Mich.

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FACTORY SITES
City of St. Johns, Quebec.

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Can. Blower & Forge Co., Kitchener, Ont.
Sturtevant Co., B. F., Galt, Ont.

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Vanadium-Alloys Steel Co. Pittsburgh Pa

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Atkins & Co., Wm., Sheffield, Eng.
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Marshall, Son & Bunney, Toronto, Ont.
Nicholson File Co., Port Hope, Ont.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
Whitman & Barnes Mfg. Co., Akron, O
Wilkinson & Kompass, Hamilton, Ont.

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General Combustion Co., Ltd., Montreal, Que.

FIRE CLAY
Elk Fire Brick Co., Can., Ltd., Hamil
General Combustion Co., Ltd., Montreal, Que.

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Toronto Tool Co., Toronto, Ont.

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Can. Electric Co., Ltd., Montreal Que

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Can. Ingersoll-Rand Co., Ltd., Sherbrooke.
William Hamilton Co., Peterboro, Ont.

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Can. Blower & Forge Co., Kitchener.
A. B. Jardine & Co., Ltd., Hespeler, Ont
Rice Lewis & Son, Toronto, Ont.
Sturtevant Co., B. F., Galt, Ont.

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FORGES, OIL
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.

FORGINGS
Mesta Machine Co., Pittsburgh, Pa
Can. Found. & Forgings, Ltd., Welland
Nova Scotia Steel & Coal Co., New Glasgow, N.S.

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Williams & Co., J. H., Brooklyn, N.Y

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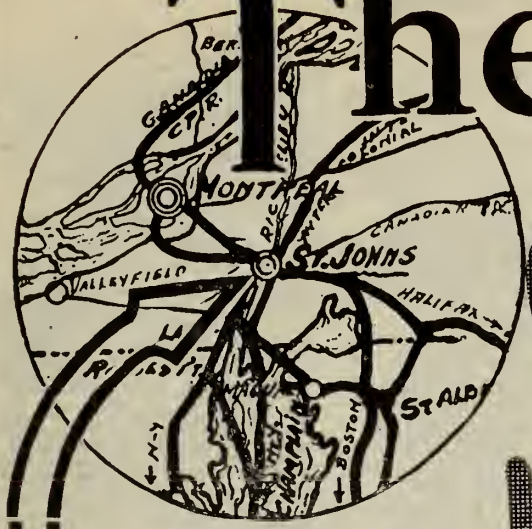
Brown, Boggs Co., Ltd., Hamilton, Ont
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machy. Co., Toronto, Ont
National Machy. Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
Chicago Flexible Shaft Co., Chicago, Ill



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Merits your careful investigation as a location for your new factory

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For more specific information write

The Secretary of the City Council

St. Johns, Quebec, Canada

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Williams & Co., J. H., Brooklyn, N.Y.

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W. S. Rockwell Co., New York, N.Y.
Petrie, Ltd., H. W., Toronto.

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Toronto Iron Works, Ltd., Toronto.

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General Combustion Co., Ltd., Montreal.

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Electric Furnace Construction Co., Philadelpria, Pa.
Hamilton & Hansell, Inc., New York City

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Gen. Combustion Co. of Can., Ltd., Montreal.
W. S. Rockwell Co., New York, N.Y.

FURNACES — HIGH-SPEED STEEL
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British Smelting & Refining Co., Ltd. Montreal, Que.

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Armstrong Bros. Tool Co., Chicago.

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GASOLINE TANKS
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GASOLINE PUMPS, SELF-MEASURING
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.

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Elliott & Whitehall Mach. & Tool Co., Galt, Ont.

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Taylor Instrument Co., Rochester, N.Y.

GAUGES, HYDRAULIC
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Wells Bros. of Can., Galt, Ont.

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Taylor Instrument Co., Rochester, N.Y.

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Brown Engineering Corp., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Crescent Mchy. Co., Ltd., Montreal, Que.
Garvin Machine Co., New York.
C. E. Johanson, Inc., Toronto, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Hartford, Conn.
Taylor, J. A. M., 518 Stair Bldg., Toronto
Toronto Tool Works, Toronto, Ont.
Wells Brothers Co. of Canada, Galt, Ont.

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Can. Found. & Steel, Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Williams & Co., J. H., Brooklyn, N.Y.

GEAR BLANKS, CAST
Katie Foundry, Galt, Ont.

GEAR BLANKS, RAWHIDE
Lyman Tube & Supply Co., Montreal, Que.

GEAR BOXES, REDUCTION
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GEAR SHAPERS AND CUTTERS
Fellows Gear & Shaper Co., Springfield, V.

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Bilton Mach. Tool Co., Bridgeport, Conn.
Fellows Gear & Shaper Co., Springfield, V.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd, H. W., Toronto.
A. R. Williams Machy. Co., Toronto.

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Gisholt Machine Co., Madison, Wis.

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Morse Chain Co., Ithaca, New York.
Can. Link-Belt Co., Ltd., Toronto, Ont.

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Can. Link-Belt Co., Ltd., Toronto, Ont.

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Diamond State Fibre Co., Bridgeport, Pa.
Dom. Steel Products Co., Ltd., Brantford.
Dominion Bridge Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Elliott & Whitehall, Galt, Ont.
Gardner, Robt., & Son, Montreal.
Hamilton Gear & Machine Co., Toronto.
Hull Iron & Steel Found., Ltd., Hull, Q.
Jones & Glassco, Montreal.
Wm. Kennedy & Sons, Ltd., Owen Sound, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia.
Victoria Foundry Co., Ottawa.

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Grant Gear Works, Boston, Mass.
Hamilton Gear & Machine Co., Toronto.
Hamilton Co., Ltd., Wm., Peterborough,
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia.
A. R. Williams Machy. Co., Toronto.

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GEARS, SILENT CHAIN
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, SPRING
Morse Chain Co., Ithaca, New York.

GEARS, SPUN, BENCH, SPIRAL
Brown & Sharpe Mfg. Co., Providence, R.I.

GENERAL MACHINE WORK
Elliott & Whitehall, Galt, Ont.

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GENERATORS, MOTOR
MacGovern & Co., Montreal.
Northern Elec. Co., Ltd., Montreal, P.Q.
Sturtevant Co., B. F., Galt, Ont.

GENERATORS, STEAM TURBO
Can. Link-Belt Co., Ltd., Toronto, Ont.

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Brown's Copper and Brass Rolling Mills New Toronto.

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Streng, Kennard & Nutt Co., Cleveland.

GLUE HEATERS
Oliver Machinery Co., Grand Rapids, Mich

GLASSES, SAFETY
Streng, Kennard & Nutt Co., Cleveland.
Willson & Co., Inc., T. A., Reading, Pa.

GRAPHITE
Aikenhead Hardware, Ltd., Toronto.
Rice Lewis & Son, Toronto.

GOGGLES
Consolidated Optical Co., Toronto.
Standard Optical Co., Geneva, N.Y.

GRAB BUCKETS—CLAMSHELL and ORANGE PEEL
Canadian Link-Belt Co., Ltd., Toronto, Ont.
Canadian Mead-Morrison Co., Limited, Montreal, Que.

GRAVITY CARRIERS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.
Morris Crane & Hoist Co., Ltd., Herbert
Niagara Falls, Ont.

GREASE CUPS, PRESSED STEEL, BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES (See Lubricants)

GRINDERS, AUTOMATIC KNIFE
Canada Machinery Corp., Galt, Ont.
Foss Mchry. & S'ply Co., G. F., Montreal
Garlock-Walker Machinery Co., Toronto.

GRINDERS, BENCH
Superior Machinery Co., London, Ont.

GRINDERS, CENTRE COLUMN, PEDESTAL AND BENCH
Can. Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Haskins & Co., R. C., Chicago, Ill.
Wisconsin Electric Co., Inc., Racine, Wis.
Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto.
Katie Foundry, Galt, Ont.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford.
Niles-Bement-Pond Co., New York, N.Y.
Perfect Machine Co., Galt, Ont.
United States Elec. Tool Co., Cincinnati.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, CUTTER
Brown & Sharpe Mfg. Co., Providence, R.I
Cincinnati Milling Mach. Co., Cincinnati.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Globe Engineering Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield, M.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Norton Co., Worcester, Mass.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, DIE AND CHASER
Haskins & Co., R. C., Chicago, Ill.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
National-Acme Co., Cleveland, Ohio.

GRINDERS, DISK
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., E. C., Hamilton, Ont.
Ford-Smith Mach. Co, Hamilton.
Gardner Machine Co., Beloit, Wis.
Heald Machine Co., Worcester, Mass.

GRINDERS, FLEXIBLE CASTING
Manhattan Machine & Tool Co., Grand Rapids, Mich.

GRINDERS, DRILL
Aikenhead Hardware Co., Toronto.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield,
Petrie, Ltd., H. W. Toronto.
United States Elec. Tool Co., Cincinnati.
Wells Bros. of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, CYLINDER, INTERNAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I
Foss Mchy. & S'ply Co., G. F., Montreal.
Greenfield Machine Co., Greenfield, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, PORTABLE, ELECTRIC HAND, TOOL POST, FLOOR AND BENCH
Baird Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Ford-Smith Mach. Co., Hamilton, Ont.
Haskins & Co., R. C., Chicago, Ill.
Grant Mfg. & Mach. Co., Bridgeport, Con
Garlock-Walker Machinery Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Independent Pneumatic Tool Co., Chicago
Petrie, Ltd., H. W., Toronto.
United States Elec. Tool Co., Cincinnati
Wisconsin Electric Co., Inc., Racine, Wis.
Williams Mchy Co., A. R., Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.

GRINDERS, MANUFACTURING
Barber Mchy. Co., Ltd., Toronto, Ont.
Universal Grinding Mach. Co., Fitchburg, Mass.

GRINDERS, HOLE, HOLE AND AND DEEP HOLE
Barber Mchy. Co., Ltd., Toronto, Ont.
Bryant Chucking Grinder Co., Springfield, Vermont.
Heald Machine Co., Worcester, Mass.

GRINDERS, PLAIN CYLINDRICAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Fitchburg Grinding Mach. Co., Fitchburg, Mass.

GRINDERS, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal.
Cleveland Pneumatic Tool Co., Toronto.
Garlock-Walker Machinery Co., Toronto.
Heald Machine Co., Worcester, Mass.
Independent Pneumatic Tool Co., Chicago
MacGovern & Co., Montreal, Que.

GRINDERS, PROFILE
Cleveland Milling Machine Co., Cleveland.

GRINDERS, ROTARY SURFACE
Brown & Sharpe Mfg. Co., Providence, R.I
Bristol Machine Tool Co., Bristol, Conn.
Manhattan Machine & Tool Co., Grand Rapids, Mich.

GRINDERS, TOOL AND HOLDER
Armstrong Bros. Tool Co., Chicago.
W. F. & John Barnes Co., Rockford, Ill.
Blount & Co., J. G., Everet, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I
Ford-Smith Machine Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield.
National-Acme Co., Cleveland, Ohio.
Tabor Mfg. Co., Philadelphia, Pa.
Wells Bros. of Canada, Galt, Ont.

GRINDERS, UNIVERSAL, PLAIN
Barber Mchy. Co., Ltd., Toronto, Ont.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Modern Tool Co., Erie, Pa.
Norton Co., Worcester, Mass.
Williams Mchy Co, Ltd., A. R., Montreal

GRINDERS, VERTICAL, SURFACE
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Co., Montreal.
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Norton Co., Worcester, Mass.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDING DISCS
Wausau Abrasives Co., Chicago, Ill.

GRINDING AND POLISHING MACHINES, PORTABLE, PNEUMATIC AND SPRING FRAME
Can. Fairbanks-Morse Co., Montreal.
Cincinnati Elec. Tool Co., Cincinnati, O.
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal.
Garvin Machine Co., New York.
Garlock-Walker Machy. Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Haskins & Co., R. C., Chicago, Ill.
Hall & Sons, John H., Brantford, Ont.
Niles-Bement-Pond Co., New York, N.Y.
Norton Co., Worcester, Mass.
Petrie, Ltd, H. W., Toronto.
Wisconsin Electric Co., Racine, Wis.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDING MACHINES, CAR WHEEL, CUTTER, CYLINDRICAL, CRANKSHAFT
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I
Norton Co., Worcester, Mass.

GRINDING WHEELS
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Brantford Emery Wheel Co., Brantford.
Can. Fairbanks-Morse Co., Montreal.
Carborundum Co., Niagara Falls, N.Y.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Mchy. & S'ply Co. G. F., Montreal.
Norton Co., Worcester, Mass.

GRINDING WHEEL DRESSER
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.

GUARDS, WINDOW AND MACHINE
Canada Machinery Corp., Galt, Ont.
Canada Wire & Iron Goods Co., Hamilton
Dennis Wire & Iron Works, London, Ont.
B. Greening Wire Co., Hamilton, Ont.
Page Steel & Wire Co., Adrian, Mich.

GUTTERS AND SKYLIGHTS
H. H. Robertson, Ltd., Sarnia, Ont.

HACK SAW BLADES
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Wks., Buffalo.
Ford-Smith Machine Co., Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Plewes, Ltd., Winnipeg, Man.
Pilot Steel & Tool Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Racine Tool & Machine Co., Racine, Wis.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
L. S. Starrett Co., Athol, Mass.
Standard Machy. & Supplies, Montreal.
Victor Saw Works, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.
Williams Mchy Co., A. R., Toronto, Ont.

HANDLES, BALANCE, CRANK AND MACHINE
Williams & Co., J. H., Brooklyn, N.Y.

HANGERS, SHAFT
Can. Link-Belt Co., Ltd., Toronto, Ont.

HACK SAW FRAMES
Aikenhead Hardware Co., Toronto.
Atkins & Co., E. C., Hamilton, Ont.
Can. Fairbanks-Morse Co., Montreal.
Ford-Smith Machine Co., Hamilton, Ont.
Garvin Machine Co., New York City.
Victor Saw Works, Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.

HACK SAWS, POWER
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Wks., Buffalo.
Foss Mchy. & S'ply Co., G. F., Montreal.
Ford-Smith Machine Co., Hamilton.
Perfect Machine Co., Galt, Ont.
Starrett Co., L. S., Athol, Mass.
Victor Saw Works, Hamilton, Ont.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Can. Billings & Spencer, Ltd., Welland.
Canada Machinery Corp., Galt, Ont.
High Speed Hammer Co., Rochester, N.Y.
Jardine & Co., A. B., Hespeler, Ont.
Niles-Bement-Pond Co., New York, N.Y.
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
United Hammer Co., Boston, Mass.
Williams Mchy Co, Ltd., A. R., Montreal

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Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
West Tire Setter Co., Rochester, N.Y.
Williams Mchy Co, Ltd., A. R., Montreal

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Can. Ingersoll-Rand Co., Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Nazel Eng. & Mach. Wks., Philadelphia

HAMMERS, MARKING
Matthews & Co., Jas. H., Pittsburgh, Pa.

HAMMERS, NAIL MACHINE
Rice Lewis & Son, Toronto, Ont.
United Hammer Co., Boston, Mass.

HAMMERS, POWER
Nazel Eng. & Mach. Wks., Philadelphia

HAMMERS, STEAM
Canada Machinery Corp., Galt, Ont.
Niles-Bement-Pond Co., New York.

HAND PLANERS
Oliver Mchry. Co., Grand Rapids, Mich.

HAND PLANING AND JOINTING MACHINERY
Oliver Engineering Co., Montreal, P.Q

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Graton & Knight Mfg. Co., Montreal

HANDLES, FIBRE
Diamond State Fibre Co., Bridgeport, Pa.

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Brown & Sharpe Mfg. Co., Providence, R.I
Canadian Link-Belt Co., Ltd., Toronto, Ont.

HANGERS, SHAFT
Algoma Steel Corp., Sault Ste. Marie.
Chapman Double Ball Bearing Co., Toronto.
Gray Ball Bearing Co., Ltd., Toronto.
Baird Machine Co., Bridgeport, Conn.
Can. S K F Co., Toronto, Ont.
Gardner & Son, Robt., Montreal.
Jones & Glassco, Montreal.
Williams Mchy Co, Ltd., A. R., Montreal

HARDNESS TESTING INSTRUMENTS
Shore Instrument & Mfg. Co., New York.

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Hoefer Mfg. Co., Freeport, Ill.

HEATING AND VENTILATING ENGINEERS
Can. Blower & Forge Co., Kitchener, Ont.
Sturtevant Co., B. F., Galt, Ont.

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Shore Instrument & Mfg. Co., New York

HELMETS, SANDBLAST, AMMONIA
Strong, Kennard & Nutt Co., Cleveland

HIGH SPEED STEEL
See Steel.

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Baird Machine Co., Bridgeport, Conn.

HINGES
Butterfield & Co., Inc., Rock Island, Que.
London Bolt & Hinge Wks., London, Ont.

HOBS
Greenfield Tap & Die Co., Greenfield, Mass
Pratt & Whitney Co., Dundas, Ont.
Taylor, J. A. M., 318 Stair Bldg., Toronto
Wells Bros. of Canada Galt, Ont.

HOISTING MACHINERY
Canadian Mead-Morrison Co., Limited, Montreal, Que.

HOISTS, AIR
Can. Ingersoll-Rand Co., Ltd., Sherbrooke
Morris Crane & Hoist Co., Herbert. Niagara Falls, Ont.

HOISTS, CHAIN AND PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Ford Chain Block & Mfg., Philadelphia.
Independent Pneumatic Tool Co., Chicago
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert. Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

HOISTS, ELEC., STATIONARY, MONO RAIL
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
A. Leatty & Sons, Ltd., Welland, Can
Oliver Engineering Co., Montreal.
Volta Mfg. Co., Welland, Ont.

HOISTS, ELECTRICAL
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Montreal, Que.
Electric Steels & Metals Ltd., Welland
Kennedy & Sons, Owen Sound, Ont.
Morris Crane & Hoist Co., Herbert Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

HOLDERS, ADJUSTABLE LENGTH
Eclipse Counterbore Co., Ltd., Walkerville, Ont.

HOLDERS, STEEL DIE FOR MARKING
Matthews & Co., Jas. H., Pittsburgh, Pa.

HOLDERS, ELECTRIC
Electric Steels & Metals, Ltd., Welland

HOOKS, BELT LACING
Clipper Belt Lacer Co., Grand Rapids.

HOPPERS
MacKinnon Steel Co., Ltd., Sherbrooke.
Dominion Bridge Co., Montreal, Que.
William Hamilton Co., Peterboro, Ont.
Toronto Iron Works, Ltd., Toronto, Ont.

HOSE, FIRE PROTECTION
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal

HOSE, PNEUMATIC
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Gutta Percha & Rubber, Ltd., Toronto.
Independent Pneumatic Tool Co., Chicago.
Quaker City Rubber Co., Philadelphia, Pa.
Wells Bros. Co. of Canada, Galt, Ont.

HOSE, ALL KINDS
Goodyear Tire & Rubber Co., of Canada, Ltd., Toronto.
Gutta Percha & Rubber, Ltd., Toronto.
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.

HOSE, SAND BLAST
Pangborn Corporation, Hagerstown, Md.
Goodyear Tire & Rubber Co. of Can., Ltd. Toronto
Quaker City Rubber Co., Philadelphia, Pa.
Intern'l. Machine Tool Co., Indianapolis.

HOSE, STEAM, SUCTION AND WATER
Gutta Percha & Rubber, Ltd., Toronto.
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.

HUMIDIFIERS
Sturtevant Co., B. F., Galt, Ont.

HYDRAULIC ACCUMULATORS
Dom. Steel Products Co., Ltd., Brantford.

HYDRAULIC MACHINERY
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
West Tire Setter Co., Rochester, N.Y.
Victoria Foundry Co., Ottawa.

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Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

HYDROMETERS, HYGROMETERS, HYGRODEIKS
Taylor Instrument Co., Rochester, N.Y.

INDICATORS, SPEED
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol, Mass.

INDEX CENTRES
Brown & Sharpe Mfg. Co., Providence, R.I.
Dickow, Fred. C., Chicago, Ill.
Ford-Smith Machine Co., Hamilton, Ont.
Garvin Machine Co., New York.
Petrie, Ltd., H. W., Toronto.

INDICATING INSTRUMENTS
Taylor Instrument Co., Rochester, N.Y.

INDICATING SCALES
Can. Kron Scale Co., Montreal.

INDUSTRIAL SITES
City of St. Johns, Quebec.

INGOTS, BRASS, BRONZE, GUN METAL, PHOSPHOR
Thomas Moore & Son, Montreal.

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INSULATING COMPOUNDS
Robertson Co., Ltd., H. H., Sarnia, Ont.

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Hanna & Co., M. A. Cleveland, O.

IRON, WROUGHT, ROLLED, PIG
Swedish Steel & Impt. Co., Ltd., Montreal

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Can. Fairbanks-Morse Co., Montreal.
Dominion Engineering Co.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Norton, A. O., Coaticook, Que.
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Canadian Fairbanks-Morse Co., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Northern Crane Works, Walkerville.

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Cushman Chuck Co., Hartford, Conn.
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Skinner Chuck Co., New Britain, Conn.

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Crescent Mach. Co., Ltd., Montreal, P.Q.
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Gisholt Machine Co., Madison, Wis.
Globe Engineering Co., Ltd., Hamilton.
Homer & Wilson, Hamilton, Ont.
Jones & Lamson, Springfield, Vt.
Toronto Tool Co., Toronto, Ont.

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Canada Foundries & Forgings, Welland.
Dominion Foundries & Steel Ltd., Hamilton, Ont.

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Garvin Machine Co., New York.
Morton Mfg. Co., Muskegon Heights, M.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.

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Whitney Mfg. Co., Hartford, Conn.
Williams & Co., J. H., Brooklyn, N.Y.

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General Combustion Co., Ltd., Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Sturtevant Co., B. F., Galt, Ont.

KNIVES, MACHINE
Atkins & Co., E. C., Hamilton, Ont.

LABELS AND TAGS
Matthews & Co., Jas. H., Pittsburgh, Pa.

LABORATORIES, INSPECTION AND TESTING (see Chemists)

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Northern Crane Works, Walkerville.

LACING MACHINES
Clipper Belt Lacer Co., Grand Rapids, M.

LAG SCREW GIMLET POINTERS
National Machy. Co., Tiffin, Ohio.

LATH
Robertson. Ltd.. H. H., Sarnia, Ont.

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Acme Machine Tool Co., Cincinnati, Ohio.
Petrie, Ltd., H. W., Toronto.
Wood Turret Machine Co., Brazil, Ind.

LATHE CHUCKS (See Chucks)

LATHE DOGS AND ATTACHMENTS
Armstrong Bros. Tool Co., Chicago.
Hendey Machine Co., Torrington, Conn.
Williams & Co., J. H., Brooklyn, N.Y.

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Gisholt Machine Co., Madison, Wis.
Wood Turret Machine Co., Brazil, Ind.

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Barber Mchy. Co., Ltd., Toronto, Ont.
Betts Mach. Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.

LATHES, BORING
Barber Mchy. Co., Ltd., Toronto, Ont.
Bridgeford Mach. Tool Works, Rochester.
Canada Machinery Corp., Galt, Ont.
Lodge & Shipley, Cincinnati, O.
Petrie, Ltd., H. W., Toronto.

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W. F. & John Barnes Co., Rockford.
J. G. Blount & Co., Everett, Mass.
Canadian Fairbanks-Morse Co., Montreal.
Geo. F. Foss Machy. & Supply Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Hardinge Bros., Chicago, Ill.
Pratt & Whitney Co., Dundas, Ont.
Seneca Falls Mfg Co., Seneca Falls, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Acme Machine Tool Co., Cincinnati, Ohio.
Hardinge Bros., Chicago, Ill.
Wood Turret Machine Co., Brazil, Ind.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

LATHES, ENGINE
Acme Machine Tool Co., Cincinnati, O.
Barber Mchy. Co., Ltd., Toronto, Ont.
John Bertram & Sons, Co., Dundas.
Canada Machy. Corp., Galt, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cisco Machine Tool Co., Cincinnati, O.
G. F. Foss, Mchy. & S'ply Co., Montreal
Garlock-Walker Machinery Co. Toronto.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
Kennedy & Sons, Wm., Owen Sound, Ont.
Lehman Mach. Co., St. Louis, Mo.
R. McDougall Co., Galt.
Niles-Bement-Pond Co., New York.
Perfect Machine Co., Galt, Ont.
Rae Mach. Tool Co., Hamilton.
Smalley-General Co., Inc., Bay City, Mich.
Standard Equipment & Tool Wks. Montreal, P.Q.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Sidney Tool Co., Sidney, Ohio
Walcott Lathe Co., Jackson, Mich.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.
A. R. Williams Machy. Co., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Seneca Falls Mfg. Co., Seneca Falls, N.Y.

LATHES, HORIZONTAL
Intern'l. Mchy. Supplies Ltd., Montreal.
Wood Turret Machine Co., Brazil, Ind.

LATHES, JOURNAL TRUEING
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.

LATHE MANDRELS, HARDENED AND GROUND
Elliott & Whitehall, Galt, Ont.

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J. G. Blount Co., Everett, Mass.
Can. Machinery Corp., Galt.
Wood Turret Machine Co., Brazil, Ind.
G. F. Foss Mchy. & S'ply Co., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.

LATHES, POLISHING
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

LATHES, SCREW CUTTING
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas, Ont.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Cisco Machine Tool Co., Cincinnati, O.
Foss Mchy. & Sply Co., G. F., Montreal
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Toronto, Ont.
Hardinge Bros., Inc., Chicago, Ill.
Hepburn Ltd., John T., Toronto, Ont.
Lehman Machine Co., St. Louis, Mo.
Niles-Bement-Pond Co, New York.
Rae Mach. Tool Co., Hamilton.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.
Williams Machy. Co., A. R., Toronto.
Wood Turret Machine Co., Brazil, Ind.

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Cisco Machine & Tool Co., Cincinnati, O.
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Knight Metal Products, Toronto.
Lehman Machine Co., St. Louis, Mo.
Rae Mach. Tool Co., Hamilton.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.

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Atkins & Co., E. C., Hamilton, Ont.

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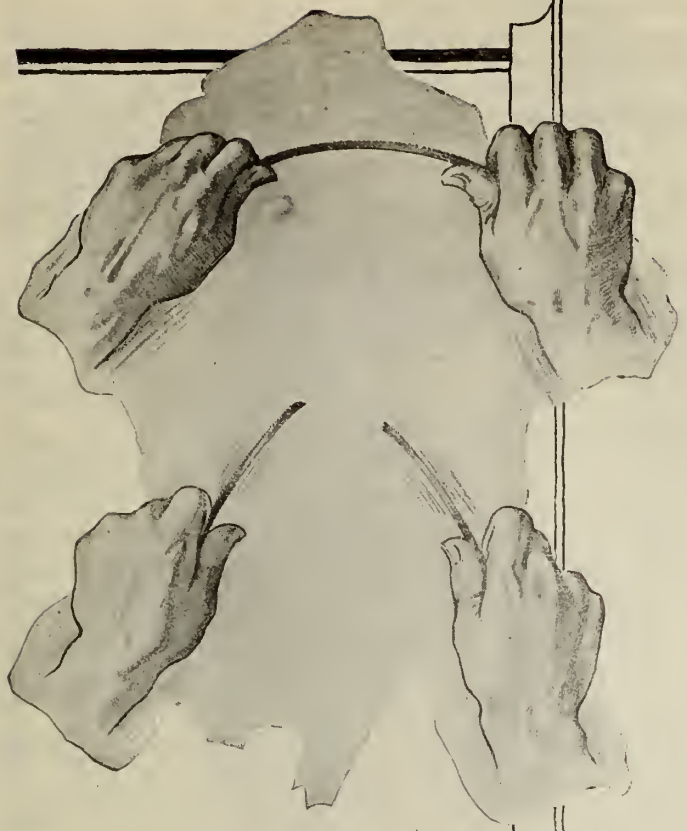

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Taft-Peirce Mfg. Co., Woonsocket, R.I.

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Standard Equipment & Tool Wks., Montreal, P.Q.

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Marshall, Son & Bunney, Toronto.
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Wilt Twist Drill Co., Walkerville, Ont.

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Smalley Gen. Co., Inc., Bay City, U.S.A.
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Knight Metal Products, Toronto.
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Cleveland Milling Machine Co., Cleveland.
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Garlock-Walker Machy. Co., Toronto, Ont.
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Knight Metal Products, Toronto.
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Williams Mchy Co., A. R., Toronto, Ont.

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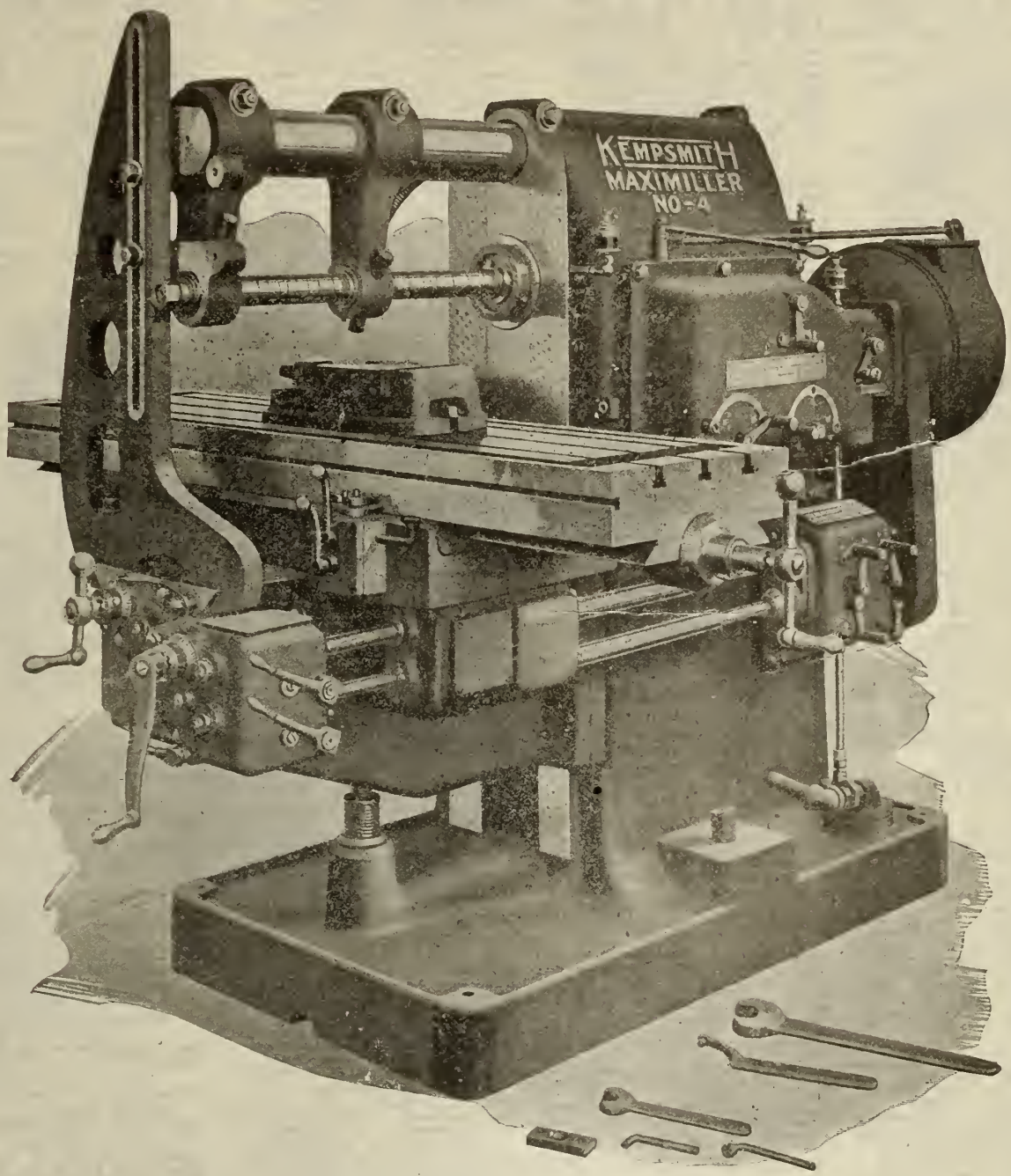

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Cleveland Pneumatic Tool Co., Can., Toronto
Curtis Pneumatic Machy. Co., St. Louis.
Garlock-Walker Machy. Co., Toronto.
Int. Mach. & Supply Co., Ltd., Montreal.
Independent Pneumatic Tool Co., Chicago.

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MacKinnon Steel Co., Sherbrooke, Que.

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Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto.

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Wells Bros. of Canada, Galt, Ont.

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H. H. Barton & Son Co., Philadelphia.

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Elec. Steel & Metals, Welland, Ont.

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Hoskins & Co., R. C., Chicago, Ill.

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Toledo Machine & Tool Co., Toledo.
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Bliss Co., E. W., Brooklyn, N.Y.
Toledo Machine & Tool Co., Toledo.
Stoll Co., D. H., Buffalo, N.Y.

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Smalley-General Co., Inc., Bay City, Mich.

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Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
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Ford-Smith Machine Co., Hamilton, Ont.
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Garlock-Walker Machinery Co., Toronto.
Darling Bros., Ltd., Montreal, Que.
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Metalwood Mfg. Co., Detroit, Mich.
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Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
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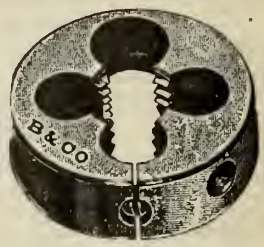

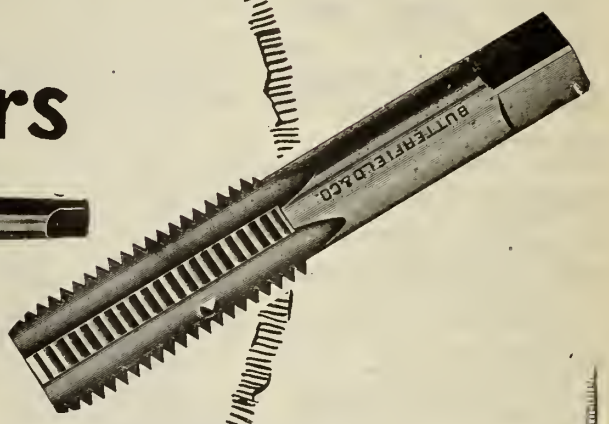

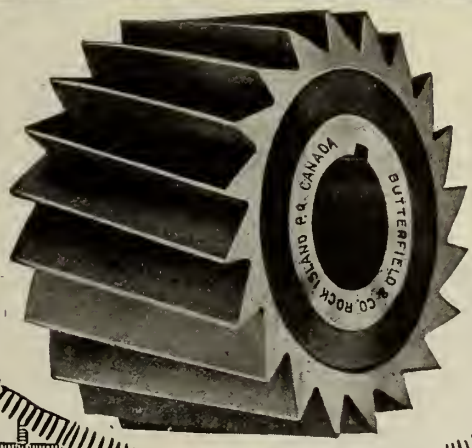

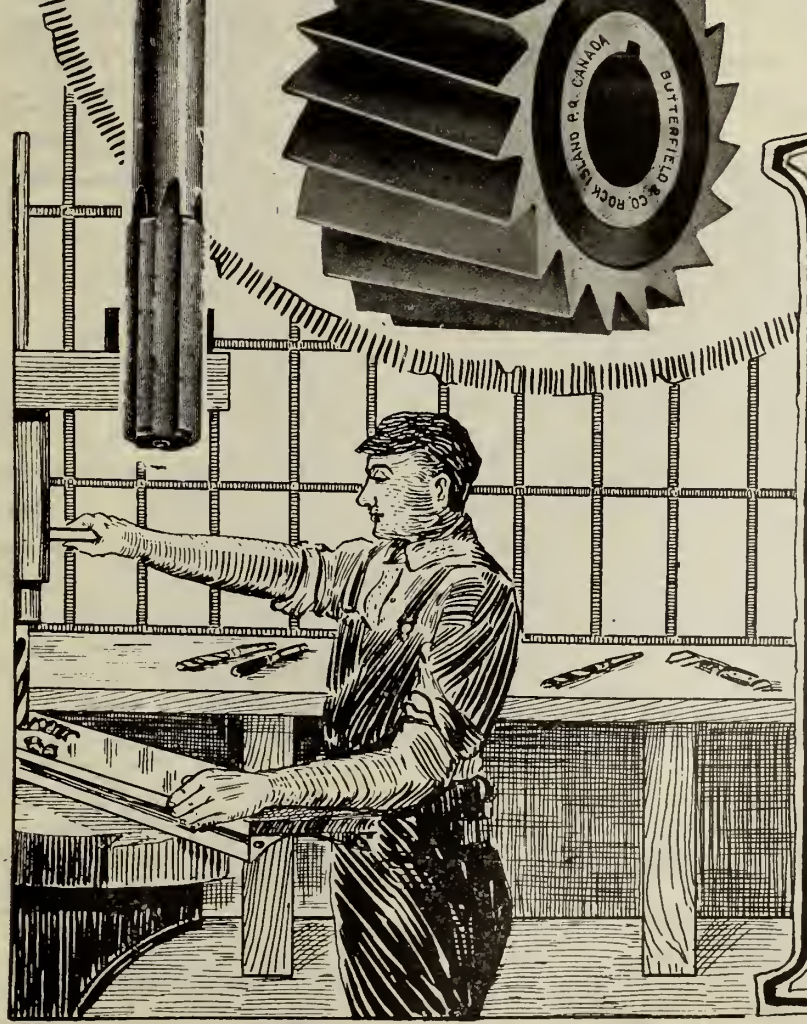

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Geo. F. Foss Mchy. & Sply. Co., Montreal
Robt. Gardner & Son, Montreal.
Garlock-Walker Mach'y. Co., Toronto.
Hendey Machine Co., Torrington, Conn.
Milwaukee Shaper Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto.
Rae Mach. Tool Co., Hamilton.
Standard Equipment & Tool Wks., Montreal.
Walcott Lathe Co., Jackson, Mich.
Williams Mchy Co., A. R., Toronto, Ont.

SHAPERS, GEAR
Fellows Gear & Shaper Co., Springfield, V
Knigh Metal Products, Toronto.

SHAFTING
Algoma Steel Corp., Sault Ste. Marie, O.
Can. Fairbanks-Morse Co., Montreal.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Jones & Glassco, Montreal.
Niles-Bement-Pond Co., New York.
Can. Drawn Steel Co., Hamilton.
Peckovers, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas.
Rice, Lewis & Son, Toronto.
A. R. Williams Machy. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

SHARPENING STONES
Norton Co, Worcester, Mass.
Rice, Lewis & Son, Toronto.

SHEARING MACHINES, ANGLE IRON, BAR AND GATE
John Bertram & Sons Co., Dundas.
Bertrams Ltd., Edinburgh, Scotland.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
A. B. Jardine & Co., Hespeler, Ont.
Long & Allstatter Co., Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo, O.

SHEARS, POWER
John Bertram & Sons Co., Dundas.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton.
Can Blower & Forge Co, Kitchener.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Long & Allstatler, Hamilton, Ohio.
A. B. Jardine & Co., Hespeler, Ont.
National Machy. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
H. D. Stoll Co., Inc., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Williams, White & Co., Moline, Ill.
Williams Mchy Co., A. R., Toronto, Ont.

SHEARS, ROTARY
The Quickwork Co., St Mary's, Ohio.

SHEARS, PNEUMATIC
Toledo Machine & Tool Co., Toledo, Ohio

SHEARS, PLATE CUTTING, SLITTING
Dom. Steel Products Co., Ltd., Brantford.
Quickwork Co., St. Mary's, Ohio.

SHEARS, SPLITTING
Dom. Steel Products Co., Ltd., Brantford.

SHEARS, IRREGULAR AND CIRCLE CUTTING
The Quickwork Co., St. Mary's, Ohio.
D. H. Stoll Co., Inc., Buffalo, N.Y

SHEARS, SERPENTINE
The Quickwork Co., St. Mary's, Ohio.

SHEARS, SQUARING
Brown, Boggs & Co., Hamilton, Ont.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEET METAL WORKING MACHINERY
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEET METAL WORKING TOOLS
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Barber Mchy. Co., Ltd., Toronto, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton.
Peck, Stow & Wilcox Co., Southington, C.
Petrie, Ltd., H. W., Toronto.
D. H. Stoll Co., Inc., Buffalo, N.Y.

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British Smelting & Refining Co., Ltd., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal

SHEETS, BLACK AUTO AND GALVANIZED
Peckovers, Ltd., Toronto, Ont.

SHEETS, NICKEL, RESIST, ALLOY
Can. Driver-Harris Co., Ltd., Walkerville.

SHELVING, STEEL
Dennis Wire & Iron Works, London.

SHIPYARD MACHINERY, SHOP FURNITURE
Dennis Wire & Iron Works, London.

SIDE TOOLS
Armstrong Bros. Tool Co., Chicago.
J. H. Williams & Co., Brooklyn, N.Y.

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Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.

SLEDGES
Aikenhead Hardware Co., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont

SLEDGES, CAST IRON
Katie Foundry, Galt, Ont.

SLICING CLAMPS
Peck, Stow & Wilcox Co., Southington Conn.

SLINGS, CHAINS
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

SLOTTERS
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
National-Acme Co., Cleveland, Ohio.
Niles-Bement-Pond Co., New York.

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William Hamilton Co., Peterboro, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

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Kearney & Trecker Co., Milwaukee, Wis.
J. Morrow Screw & Nut Co., Ingersoll, Ont.

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Brown & Sharpe Mfg. Co., Providence.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Keystone Mfg. Co., Buffalo, N.Y.
Modern Tool Co., Erie, Pa.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

SOIL PIPE FITTINGS, CAST IRON
Katie Foundry, Galt, Ont.

SOLDERING IRONS
Aikenhead Hardware Co., Toronto, Ont.
Brown, Boggs & Co., Hamilton, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.

SOLDER
British Smelting & Refining Co., Ltd., Montreal, Que.
Aikenhead Hardware Co., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Tallman Brass & Metal Co., Hamilton.

SPELTER
British Smelting & Refining Co., Ltd., Montreal, Que.

SPEED REDUCING GEARS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.

SPRINGS, MACHINERY
Barnes, Wallace Co., Bristol, Conn.
Can. Steel Foundries, Ltd., Montreal.
Cleveland Wire Spring Co., Cleveland.
Dunbar Bros. Co., Bristol, Conn.
Garlock-Walker Machinery Co., Toronto.

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Baird Machine Co., Bridgeport, Conn.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram, John, & Sons Co., Dundas.
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada.
Brown Engineering Corp., Toronto, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Globe Engineering Co., Ltd., Hamilton.
John H. Hall & Sons, Brantford.
Hamilton Co., Ltd., Wm., Peterborough,
A. B. Jardine & Co., Hespeler, Ont.
Katie Foundry, Galt, Ont.
Ker & Goodwin Machine Co., Ltd., Brantford, Ont.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
National-Acme Co., Cleveland, Ohio.
Mesta Machine Co., Pittsburgh, Pa.
Rae Mach. Tool Co., Hamilton.
Stoll Co., D. H., Buffalo, N.Y.
Victoria Foundry Co., Ottawa, Ont.
William R. Perrin, Ltd., Toronto.

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Crescent Machine Co., Ltd., Montreal, Que.
McClean Machine & Tool Co., Ltd., Hamilton, Ont.
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SPRINGS STEEL
Barnes Co., Wallace, Bristol, Conn.

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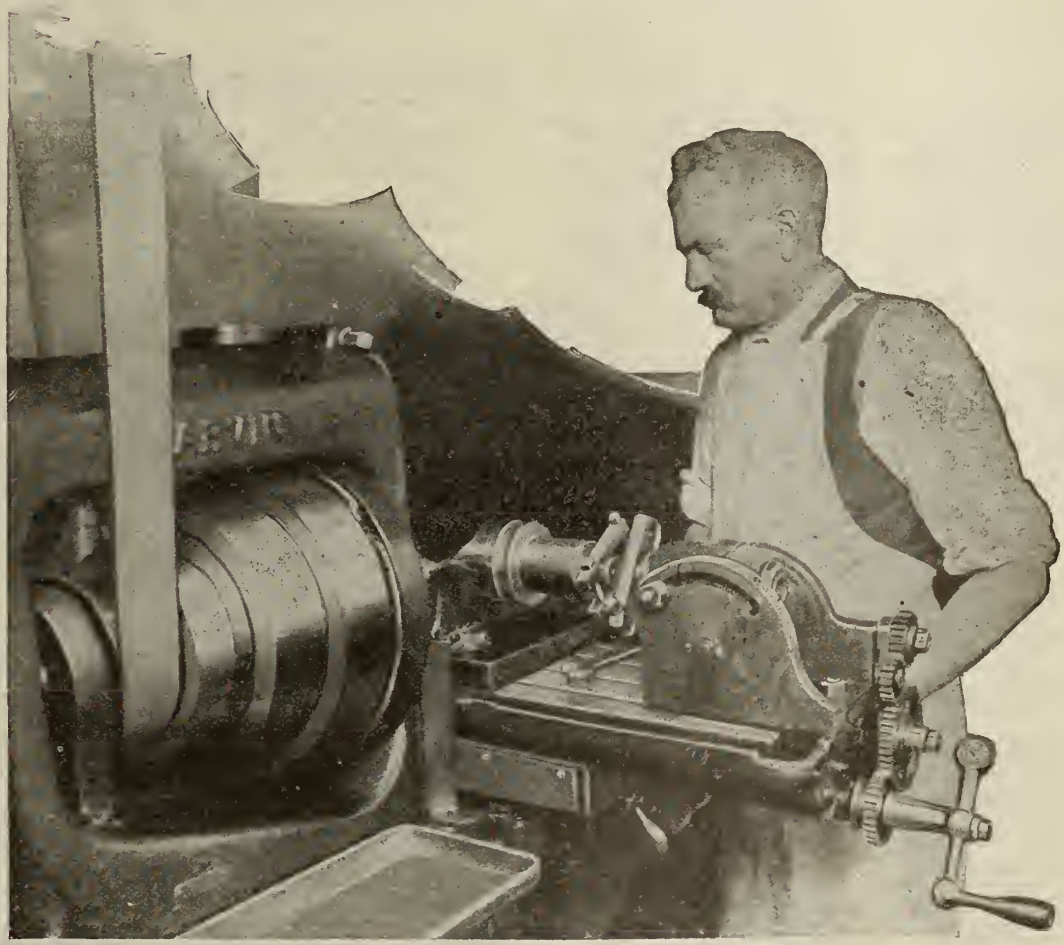

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Firth & Sons, Thos., Montreal, Que.
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Marshall, Son & Bunney, Toronto.
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Samuel Osborne (Can.), Ltd., Montreal.
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United States Steel Corp., Canton, Ohio.

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Atkins & Co., Ltd., Wm. Sheffield, Eng.
Marshall, Son & Bunney, Toronto.
United States Steel Corp., Canton, Ohio.

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Kayser-Ellison & Co., Ltd., Montreal.
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Atkins & Co., Ltd., Wm., Sheffield, Eng.
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United States Steel Corp., Canton, Ohio.

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Kennedy & Sons, Wm., Owen Sound.
Electric Steel & Metals Co., Welland.
Nova Scotia Steel & Coal Co., Windsor.
Swedish Crucible Steel Co., Windsor.

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United States Steel Corp., Canton, Ohio.

STEEL, COLD ROLLED
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Can. Drawn Steel Co., Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co. Ltd., Montreal.
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United States Steel Corp., Canton, Ohio.

STEEL FJAB
Lincoln Electric Co., of Canada, Ltd., Toronto, Ont.

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Atkins & Co., Ltd., Wm., Sheffield, Eng.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
United States Steel Corp., Canton, Ohio.

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Firth & Sons, Thos., Montreal, Que.
Illingworth Steel Co., J., New York.
Kayser Ellison & Co., Sheffield, Eng.
Latrobe Electric Steel Co., Latrobe, Pa.
Marshall, Son & Bunney, Toronto, Ont.
Osborne, Samuel, Montreal, P.Q.
Piewes, Ltd, Winnipeg, Man.
Pilot Steel & Tool Co., Montreal, Que.
Ralph B. Norton, Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co., Ltd., Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.

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Joliette Steel Co., Montreal, Que.

STEEL, OPEN HEARTH
Illingworth Steel Co., John, New York.
United States Steel Corp., Canton, Ohio.

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Baines & David, Toronto.
Can. Fairbanks-Morse Co., Montreal.
Drury Co., H. A., Montreal, Que.
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Firth & Sons, Thos., Montreal, Que.
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Kayser-Ellison & Co., Ltd., Montreal.
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Lyman Tube & Supply Co., Ltd., Montreal
Marshall, Son & Bunney, Toronto, Ont.
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Pilot Steel & Tool Co., Montreal, Que.
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Marshall, Son & Bunney, Toronto.
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Bertrams, Ltd., Edinburgh, Scotland.

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Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.

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Elec. Steel & Metals, Welland, Ont.
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Whitney Mfg. Co., Hartford, Conn.

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Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit
Pilot Steel & Tool Co., Montreal, Que.
Victor Tool Co., Waynesboro, Pa.

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Greenfield Tap & Die Corp., Greenfield Mass.
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TAPS, MACHINE SCREW
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Greenfield Tap & Die Corp., Greenfield
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Foss Mchy. & Sply. Co., G. F., Montreal.
Geometric Tool Co., New Haven.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Mach. Co., Ingersoll, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Morse Twist Drill & Mchy. Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit.
Pratt & Whitney Co., Dundas, Ont.
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Landis Machine Co., Waynesboro, Pa.
National-Acme Co., Cleveland, Ohio.
National Machy. Co., Tiffin, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt, Ont.

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Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Landis Machine Co., Waynesboro, Pa.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. of Canada, Galt, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

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Cleveland Twist Drill Co., Cleveland.
Deloro Smelting & Refining Co., Ltd. Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

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Williams & Co., J. H., Brooklyn, N.Y.

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Rice Lewis & Son Toronto, Ont.

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Kelly Reamer Co., Cleveland, O.
Petrie, Ltd., H. W., Toronto.

TOOLS, ELECTRIC
Independent Pneumatic Tool Co., Chicago.
Williams Machy. Co., A. R., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.
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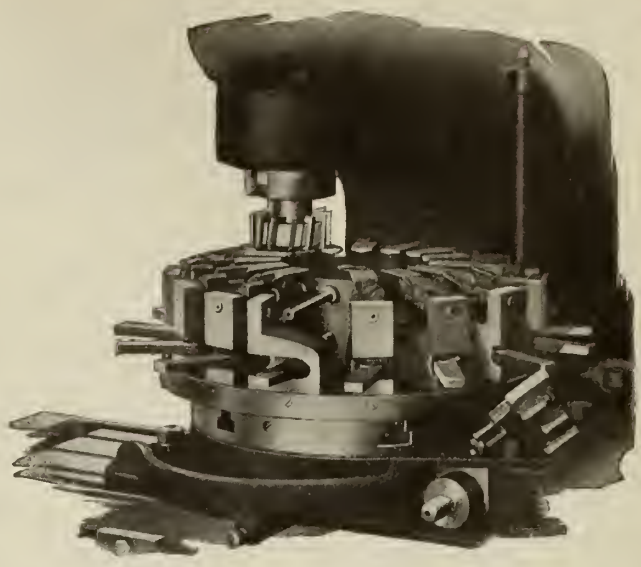

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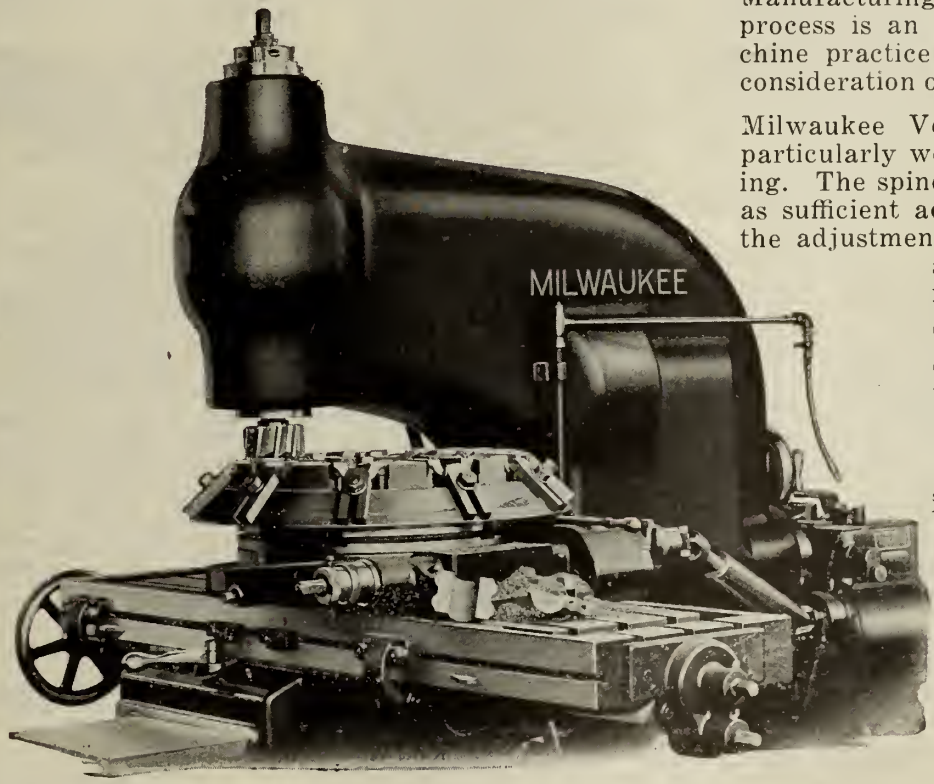

Manufacturing milling by the continuous process is an advanced step in milling machine practice and is worthy of the serious consideration of the management of any shop.

Milwaukee Vertical Milling Machines are particularly well adapted to continuous milling. The spindle is adjustable for wear only as sufficient adjustment can be obtained by the adjustment of the knee alone, the same as it is in the horizontal type milling machines.

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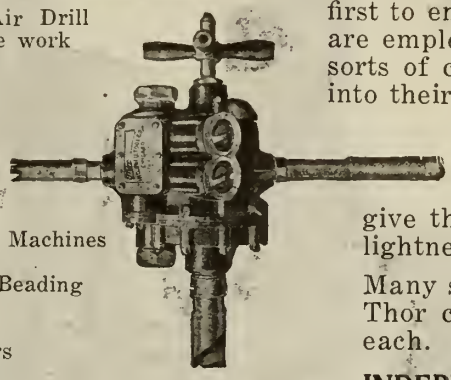

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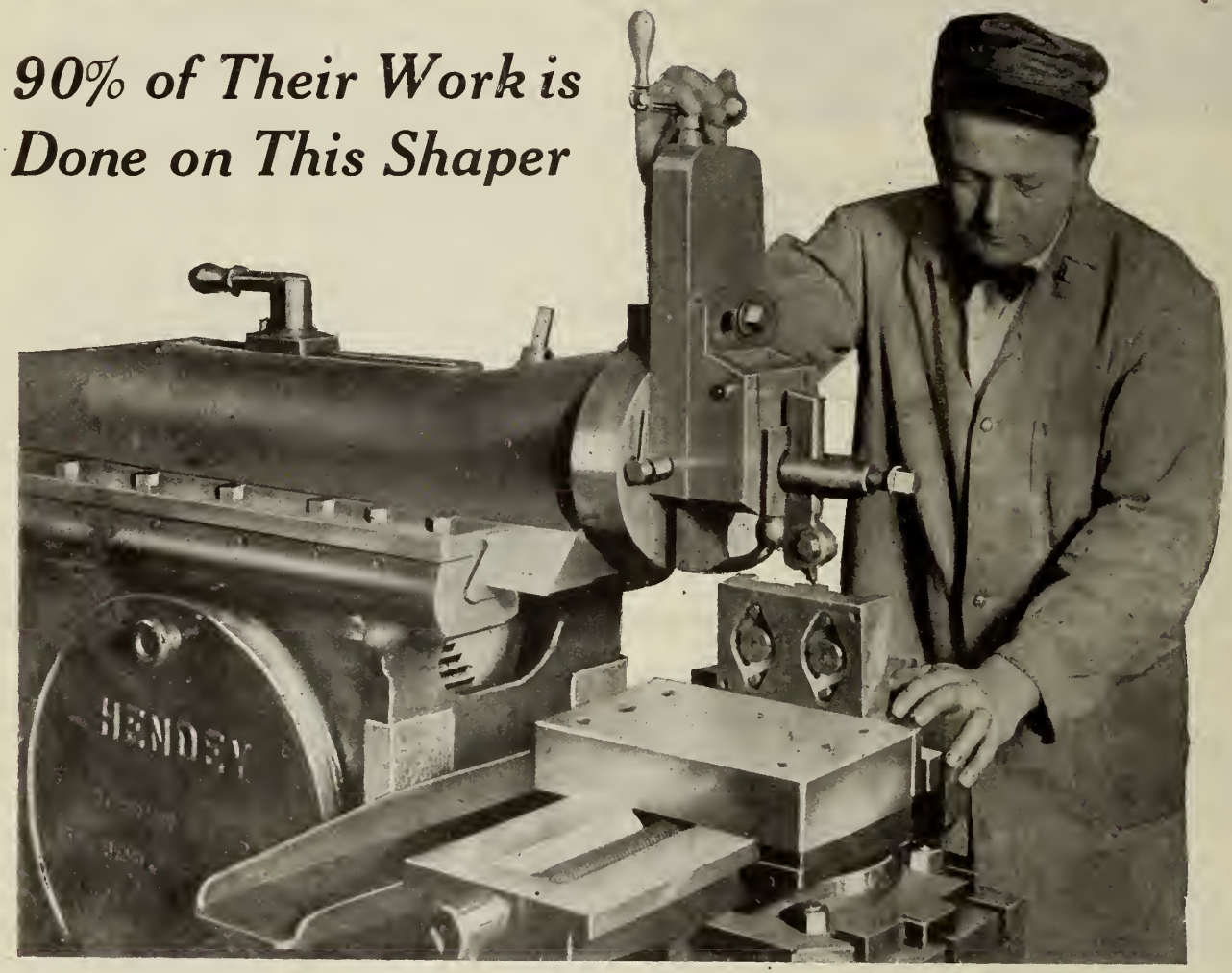

The Hendey Shaper is used on 90 per cent. of the work of the Modern Machine & Tool Works—and its high grade tool room work, too! The limits of accuracy required, within one-thousandth inch, are easily obtained on the Hendey.

This Machine is our 20-inch Crank Shaper

The frame and base are cast in one piece. The cross feed mechanism is operated entirely at the end of the cross rail in all its adjustments. The amount of feed is controlled by a dial with an indicator and can be varied while the machine is in operation.

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of the "Mueller" Radials, one-piece, patented column, reinforced with four internal webs; and the long bearing of the arm of this column assures accuracy at the extreme traverse of the spindle even when the arm is at the top of the column. Combination positive, and friction feed, low or high speed friction reverse, unusual operating convenience and other advantages, combine to make it both popular and profitable on a wide range of operations.

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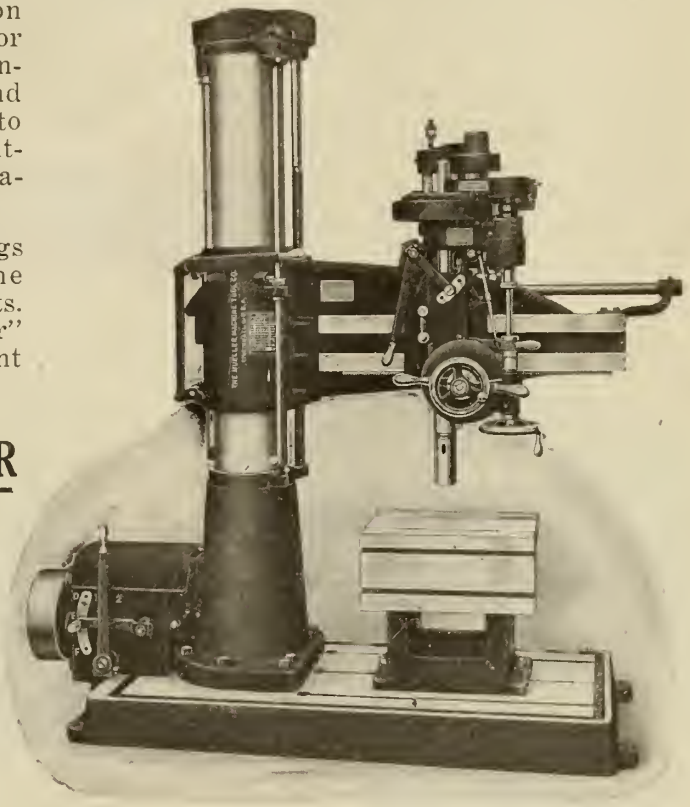

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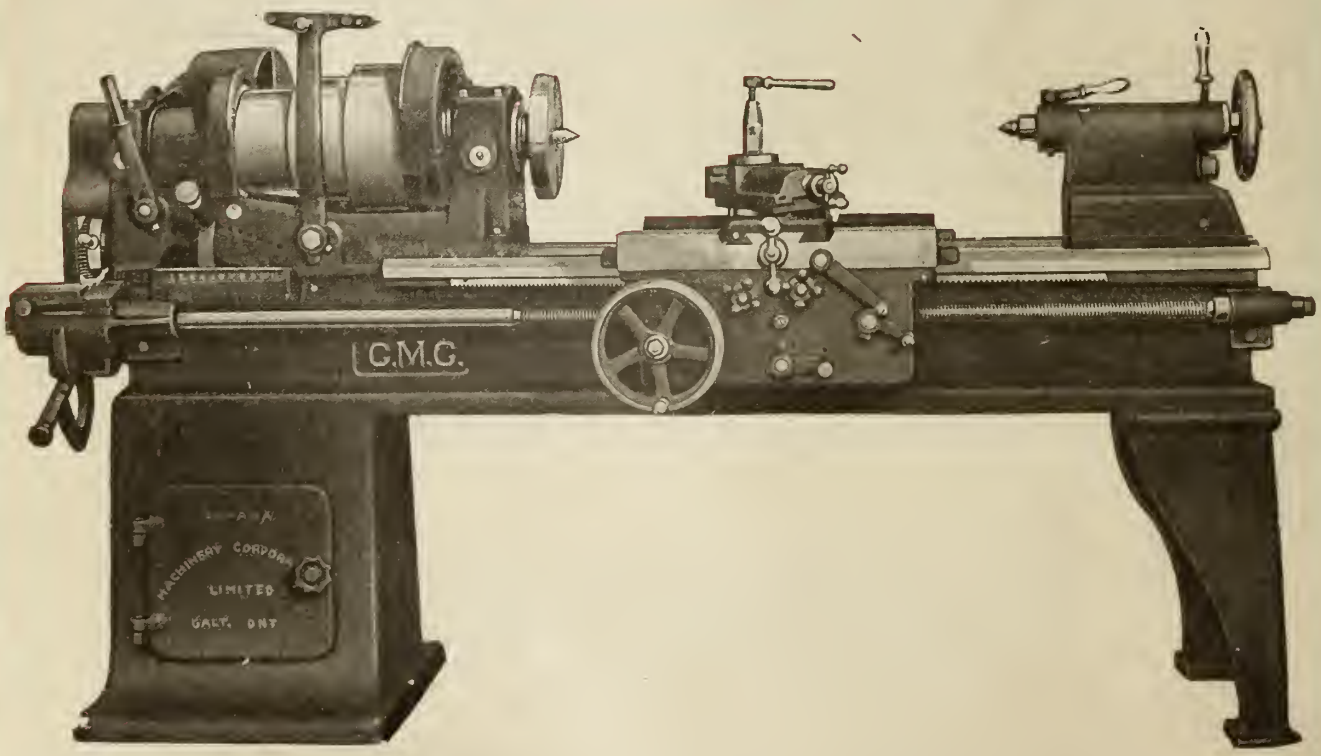

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